

Introduction to Weeds and Weed Management

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Proper weed management is critical to maintain crop yield potential, harvestability, economic return. A full discussion on weed management, including classification, management techniques, herbicides, and herbicide-resistance is in the Virginia Cooperative Extension Agronomy Handbook.

Table 5.1 - Selected Glyphosate (Group 9) Products and Premixes for Agronomic Use

Currently, numerous products contain glyphosate. Most of them are labeled for “burndown”/preemergence and/or spot applications. The majority, but not necessarily all, of the products below are labeled for over-the-top application in Roundup Ready crops (namely, RR corn and RR soybean). Refer to the product label for additional information on crop use, formulation, application rates, and other use restrictions. Other glyphosate-containing products may be available in your area. Contact your local dealer for more details.

Product and Amount of Glyphosate/Gallon ¹	Company	Product Rate (fl oz) Equivalent to:				Formulation	
		0.375 lb ae	0.56 lb ae	0.75 lb ae	1.13 lb ae	Salt ²	Adjuvant Load ³
5 lb ae/6 lb ai							
Refuge	Syngenta	10	14	19	29	Potassium	none
Roundup Powermax 3	Bayer CropScience	10	14	19	29	Potassium	fully loaded
4.5 lb ae/5.5 lb ai							
Abundit Edge	Corteva	11	16	22	32	Potassium	fully loaded
Bullzeye HL-K	Growmark	11	16	22	32	Potassium	fully loaded
Credit K6	Nufarm	11	16	22	32	Potassium	fully loaded
Credit Xtreme	Nufarm	11	16	22	32	IPA + Potassium	fully loaded
Duplicator 6 (5.4 ai)	Drexel	11	16	22	32	diammonium	partial
Gly Star K-Plus	Albaugh/AgriStar	11	16	22	32	Potassium	partial
Honcho K6	Bayer CropScience	11	16	22	32	Potassium	fully loaded
Mad Dog K6	Loveland	11	16	22	32	Potassium	fully loaded
Roundup PowerMax	Bayer CropScience	11	16	22	32	Potassium	fully loaded
Roundup WeatherMax	Bayer CropScience	11	16	22	32	Potassium	fully loaded

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Table 5.1 - Selected Glyphosate (Group 9) Products and Premixes for Agronomic Use (cont.)

Product and Amount of Glyphosate/Gallon ¹	Company	Product Rate (fl oz) Equivalent to:				Formulation	
		0.375 lb ae	0.56 lb ae	0.75 lb ae	1.13 lb ae	Salt ²	Adjuvant Load ³
4 lb ae/5 lb ai							
Accord XRT II	Corteva	12	18	24	36	DMA	fully loaded
Buccaneer 5	Tenkoz	12	18	24	36	IPA	partial
Buccaneer 5 Extra (5.4 ai)	Tenkoz	12	18	24	36	IPA	partial
Cornerstone 5 Plus	WinField	12	18	24	36	IPA	partial
Credit 5.4 Extra	Nurfarm	12	18	24	36	IPA	fully loaded
Durango DMA/Duramax	Corteva	12	18	24	36	DMA	fully loaded
Gly Star 5 Extra	Albaugh/AgriStar	12	18	24	36	IPA	partial
Helosate 5	Helm Agro	12	18	24	36	IPA	partial
Mad Dog 5.4	Loveland	12	18	24	36	IPA	partial
Tomahawk 5 (5.4 ai)	WinField	12	18	24	36	potassium	partial
Sunphosate 5 Max	Wynca	12	18	24	36	IPA	partial
3 lb ae/4 lb ai							
Buccaneer	Tenkoz	16	24	32	48	IPA	partial
Buccaneer Plus	Tenkoz	16	24	32	48	IPA	partial
Cornerstone Plus	WinField	16	24	32	48	IPA	partial
Credit 41 Extra	Nufarm	16	24	32	48	IPA	fully loaded
Envy	Innvictis	16	24	32	48	IPA	partial
Envy Intense	Innvictis	16	24	32	48	IPA	partial
Four Power Plus	Loveland	16	24	32	48	IPA	fully loaded
Gly Star Original	Albaugh/AgriStar	16	24	32	48	IPA	partial
Gly Star Plus	Albaugh/AgriStar	16	24	32	48	IPA	partial
Glyphogan	Adama	16	24	32	48	IPA	partial
Glyphogan Plus	Adama	16	24	32	48	IPA	fully loaded
Helosate Plus Advanced	Helm Agro	16	24	32	48	IPA	fully loaded
Hoss Ultra	Helena	16	24	32	48	IPA	fully loaded
Imitator DA	Drexel	16	24	32	48	diammonium	
Imitator Plus	Drexel	16	24	32	48	IPA	partial
Mad Dog	Loveland	16	24	32	48	IPA	partial
Mad Dog Plus	Loveland	16	24	32	48	IPA	fully loaded
Makaze	Loveland	16	24	32	48	IPA	fully loaded
Rascal	WinField	16	24	32	48	IPA	partial
Razor	Nufarm	16	24	32	48	IPA	partial
Showdown	Helena	16	24	32	48	IPA + monoammonium	partial
Sunphosate 41%	Wynca USA	16	24	32	48	IPA	fully loaded

Table 5.1 - Selected Glyphosate (Group 9) Products and Premixes for Agronomic Use (cont.)

Product and Amount of Glyphosate/Gallon ¹	Company	Product Rate (fl oz) Equivalent to:				Formulation	
		0.375 lb ae	0.56 lb ae	0.75 lb ae	1.13 lb ae	Salt ²	Adjuvant Load ³
Tomahawk 4	Winfield	16	24	32	48	IPA	partial

¹ Glyphosate products can be formulated to have different concentrations of glyphosate acid per gallon of product. To improve handling, performance, and concentration, the glyphosate acid is formulated as a salt compound. Acid equivalent (ae) is only the weight of the glyphosate acid, which is herbicidally active. Active ingredient (ai) is the weight of the glyphosate acid plus the salt. It is best to refer to ae when comparing glyphosate products and rates.

² Glyphosate can be formulated as different salts: isopropylamine (IPA), monoammonium, diammonium, dimethylamine (DMA), or potassium.

³ Some glyphosate products contain all the necessary adjuvants (i.e., fully loaded). Others contain only a limited amount and additional surfactants must be added to the tank before application. All brands of glyphosate recommend adding ammonium sulfate (AMS), if using hard water as a carrier or under other challenging conditions. If using AMS, always add it to the spray solution before glyphosate. Refer to product label for more information.

Table 5.2 - Common Herbicide Safeners Used as Commercial Products

Safener	Approximate date of introduction	Herbicide(s)	Crop	Other
1,8-naphthalic anhydride (NA)	1971	EPTC and butylate	Corn	Seed treatment
benoxacor	1985	metolachlor	Corn	Premixed with herbicide
cloquintocet-methyl	2006	pinoxaden	Wheat, cereals	Premixed with herbicide
cyposulfamide	2009	numerous (Groups 4 and 27)	Corn	Premixed with herbicide
dichlormid	1972	EPTC, butylate, acetochlor	Corn	Premixed with herbicide
fenchlorazole-ethyl	1992	fenoxaprop	Wheat, cereals	Premixed with herbicide
fluxofenim	1986	alachlor, metolachlor	Sorghum	Seed treatment
furilazole	1991	acetochlor	Corn	Premixed with herbicide
isoxadifen	2001	numerous (Groups 2 and 4)	Corn	Premixed with herbicide
mefenpyr-diethyl	1989	pyrosulfotole	Wheat	Premixed with herbicide

Table 5.3 - Selected Generic (or Post-Patent) Alternative Herbicides for Agronomic Uses

Active ingredient(s)	Trade name	Manufacturer	Labeled crops*	Alternative to:
acetochlor	Arrest	Sharda	Corn	Harness
	Arrest Plus			
	Asset-S Plus			
	Essensa			
atrazine	Atrazine 4L	Sipcam	Corn, sorghum	Aatrex
	Atrazine 90 DF	Winfield		
bentazon	Bashazon	Sharda	Corn, sorghum,	Basagran
	Broadlook	UPL	soybean	

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Table 5.3 - Selected Generic (or Post-Patent) Alternative Herbicides for Agronomic Uses (cont.)

Active ingredient(s)	Trade name	Manufacturer	Labeled crops*	Alternative to:			
acetochlor + atrazine	Acellus	Growmark	Corn	Harness Xtra, Degree Xtra, Keystone (NXT)			
	ATZ*/Xcelerate ATZ 5.6L						
	Cadence ATZ* NXT	Loveland					
	Confidence Xtra*	WinField Solution					
	Electra*	Sharda					
	Etcetra						
	Fearless Xtra*	Helm Agro					
	Overtime ATZ* NXT	Helena					
acetochlor + fomesafen	Tremor ATZ*	WinField	Soybean				
	Volley ATZ* (NXT)	Tenkoz					
	Forrest	Sharda					
	Recite	Sharda					
	acetochlor + flumetsulam + clopyralid	Definite			Sharda	Corn	SureStart, SureStart II, Tripleflex
		Smackdown			Loveland		
		Staunch II			Tenkoz		
		Threesidual/Trisidual			WinField		
acifluorfen	True Set II	Atticus	Soybean	Ultra Blazer			
	Acifin 2L	SummitAgro					
	Avalanche Ultra	WinField					
	Derecho	Atticus					
	Levity	Innvictis					
	Sharda Acifluorfen	Sharda					
bromoxynil	Uproar	WinField	Corn, sorghum, small grains				
	Deadbolt	Willbur-Ellis					
carfentrazone-ethyl	Maestro 2EC, 4EC	Nufarm	Corn, soybean, cotton, sorghum, small grains	Aim			
	Longbow	Nufarm					
chlorimuron	Antik	Atticus	Soybean	Classic			
	Curio	NuFarm					
chlorimuron + metribuzin	Sheridan 25 WG	Helm Agro	Soybean	Canopy*			
	Cloak	NuFarm					
	Metrixx Plus	Sharda					
chlorimuron + metribuzin	Resist	Tenkoz	Soybean	Canopy*			
	Cloak	Nufarm					
	Metrixx Plus	Sharda					
	Resist	Tenkoz					

Table 5.3 - Selected Generic (or Post-Patent) Alternative Herbicides for Agronomic Uses (cont.)

Active ingredient(s)	Trade name	Manufacturer	Labeled crops*	Alternative to:
chlorimuron + tribenuron	Cloak EX	NuFarm	Soybean	Canopy EX
	FallOut	Corteva		
clethodim	Arrow 2EC	Adama	Soybean, alfalfa	Select, Select Max, Prism
	Avatar*	Innvictis		
	Ceridan 2 EC	Atticus		
	Clense*/Section*	WinField		
	Dakota	Rotam North Amer.		
	Envoy Plus	Valent		
	Intensity	Loveland		
	Shadow*/Trizenta*	UPL		
	TapOut	Helena		
	Vaquero	Willbur-Ellis		
clopyralid	Bite	Sharda	Corn, pasture, small grains	Stinger
	Clean Slate	Nufarm		
	Savant	Innvictis		
	Sonora	Alligare		
	Spur	Albaugh/Agri-Star		
	Stigmata	Atticus		
clopyralid + flumetsulam	Jacket	Sharda	Corn	
cloransulam	Ankur	Sharda	Soybean	FirstRate
	FrontRunner	Atticus		
	Traject 4 dimeSC	SummitAgro		
	Willowood Cloran DF	Generic Crop Science		
carfentrazone-ethyl	Longbow	Nufarm	Corn, Soybean, Cotton, Sorghum, small grains	Aim
	Antik	Atticus		
dicamba	Topeka	Rotam	Corn, small grains, sorghum	Clarity
	Detonate	Tenkoz		
	Clarifier	Winfield		
	Clash	Nufarm		
	Sterling Blue	Winfield		
dimethenamid + atrazine	Commit ATZ*	WinField	Corn, sorghum	Guardman Max
	Sortie ATZ*	Helena		

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Table 5.3 - Selected Generic (or Post-Patent) Alternative Herbicides for Agronomic Uses (cont.)

Active ingredient(s)	Trade name	Manufacturer	Labeled crops*	Alternative to:
flumioxazin	Flumigard	Alligare	Soybean (or alfalfa, depending on label)	Valor*, Chateau
	Outflank	Adama		
	Panther*/Tuscany*	NuFarm		
	Varsity*	Innvictis		
	Zaltus SX	Atticus		
fluroxypyr	Comet	NuFarm	Corn, small grains, pastures	Starane
	Fancy/Flurox	Sharda		
	Flagstaff	Alligare		
	Stark Ultra	Atticus		
	Stave	Invictis		
fomesafen	Agent 1.88	WinField	Soybean	Reflex, Flexstar
	Andros*	Rotam North Amer.		
	Battle Star	Albaugh/Agri-Star		
	Foma*	Drexel		
	Forsyte 1.88 SL	Atticus		
	Rumble	Adama		
	Shafen/Shafen Star	Sharda		
	Sinister	Helena		
	TopGun/Top Gun Flex	Loveland		
Vamos	Invictis			
fomesafen + imazethapyr	Camo	Albaugh	Soybean	—
	Torment	Adama		
fomesafen + S-metolachlor	MetalliS PFX	Atticus	Soybean	Prefix
	Sharp	Sharda		
	Quake	Tenkoz		

Table 5.3 - Selected Generic (or Post-Patent) Alternative Herbicides for Agronomic Uses (cont.)

Active ingredient(s)	Trade name	Manufacturer	Labeled crops*	Alternative to:
glufosinate	Autonomy	Tenkoz	LibertyLink	Liberty
	Cheetah*	NuFarm	Corn, soybean, others	
	Fever	Innvictis		
	Forfeit 280	Loveland		
	Inflame 280	Atticus		
	Interline	UPL		
	Lifeline	UPL		
	Opportunity	Sharda		
	Para Shot	Sharda		
	Reckon 280 SL	Solera		
	Refer	SummitAgro		
	Scout	Valent		
	Surmise	Albaugh/Agri Star		
	Total*	WinField		
halosulfuron	Halomax 75	Aceto	Corn, sorghum	Permit, Sandea
	Herbivore	WinField		
	Profine 75	Aceto		
	Promote/Stadia	Atticus		
	Proventix 75 WDG	Innvictis		
imazethapyr	Imazethapyr 2 SL	ADAMA	Soybean, alfalfa	Pursuit
	Pemex	Atticus		
	Praxis	Sharda		
	Thunder	Albaugh/Agri-Star		
imazethapyr + glyphosate	Extreme	Helm Agro	Soybean	Extreme
	Praxis Plus	Sharda		
	ThunderMaster	Albaugh/Agri-Star		
lactofen	Boa	Sharda	Soybean	Cobra
	Phoeniz	UPL		

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Table 5.3 - Selected Generic (or Post-Patent) Alternative Herbicides for Agronomic Uses (cont.)

Active ingredient(s)	Trade name	Manufacturer	Labeled crops*	Alternative to:
mesotrione	Argos	Helm Agro	Corn, sorghum	Callisto
	Bellum	Rotam		
	Bridle/Incinerate	WinField		
	Cavallo 4 SC	Atticus		
	Incinerate	WinField		
	MesoStar	Sharda		
	Mesotrione	Albaugh/AgriStar		
	MesoTryOne	Drexel		
	Motif	UPL		
	Quartz	Sicam		
	Sotrion	Growmark		
	Undercover	Innvictis		
mesotrione + acetochlor	Optero	Rotam	Corn, sorghum	
mesotrione + metolachlor	Evinco	Rotam	Corn, sorghum	
	Stalwart 2W	Sipcam		
	Coyote	UPL		
mesotrione + metolachlor + atrazine	Ravine	Altitude Crop Innov.	Corn, sorghum	
	Rixa/Vilify	Rotam		
	Stalwart 3W	Sipcam Agro		
	TrizMax	Drexel		
	TriZar	Drexel		
mesotrione + S-metolachlor + atrazine	Entrax EZ	Growmark	Corn, sorghum	Lexar, Lumax
	Omni Xar	Helena		
mesotrione + metolachlor + glyphosate	Me-O-Sate	Drexel	Corn	
mesotrione + rimsulfuron	Equip	Rotam	Corn	
metolachlor	Helmet	Helm Agro	Corn, soybean, sorghum	
	Metalica	Sharda		
	Me-Too-Lachlor*	Drexel		
	Meto Star	Sharda		
	Parallel*	ADAMA		
	Stalwart*	Sipcam		
	Visor*	Innvictis		

Table 5.3 - Selected Generic (or Post-Patent) Alternative Herbicides for Agronomic Uses (cont.)

Active ingredient(s)	Trade name	Manufacturer	Labeled crops*	Alternative to:
metolachlor + atrazine	Parallel Plus	ADAMA	Corn, sorghum	
	Payback ATZ	Real Farm		
	Stalwart Xtra*	Sipcam		
	Triangle	Tenkoz		
	Trizmet II	Drexel		
	Visor ATZ	Innvictis		
metolachlor + imazethapyr	Pummel	ADAMA	Soybean	—
metolachlor + metribuzin	Galvan	Innvictis	Soybean	Boundary
	Headwin	Sharda		
	Ledger	Tenkoz		
	Me-Too-Lachlor	MTZ		
	Stalwart MTZ	Sipcam		
	Tailwind	ADAMA		
metribuzin	Derive 75*	Innvictis	Soybean, corn, alfalfa	formerly Sencor
	Dimetric*	WinField		
	Glory	ADAMA		
	Mauler	Valent		
	Metribuzin 75*	Loveland		
	Metriclude*	Winfield		
	Metricor*	UPL		
	Metrixx*	Sharda		
	Me-Try-Buzin*	Drexel		
	Omni Metribuzin	Helena		
	Rancor*	Atticus		
metsulfuron-methyl	Ally XP	FMC	Pasture	Cimarron* (DuPont no longer sells the single ai product for pastures)
	Clean Pasture DF	Control Solutions		
	MSM 60	Alligare		
	Patriot	NuFarm		
	Plotter/Romestol	Rotam North Amer.		
	Rometsol	Rotam		
	Tide MSM 60	Tide Int.		
nicosulfuron	Primero*	Rotam North Amer.	Corn	Accent Q

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Table 5.3 - Selected Generic (or Post-Patent) Alternative Herbicides for Agronomic Uses (cont.)

Active ingredient(s)	Trade name	Manufacturer	Labeled crops*	Alternative to:
paraquat	Bonedry	Sinon	All	Gramoxone
	Devour	Innvictis		
	Helmquat	Helm		
	Para-Shot 3.0	Sharda		
	Paraquat	Axill Solutions/RedEagle		
	Paraquat 3SL	Willowood		
	Paraquat concentrate	Solera Source Dynamics		
	Parazone 3 SL	ADAMA/AMVAC		
	Purgatory 3 SL	Atticus		
	Quik-Quat	Drexel		
pendimethalin	Acumen	Tenkoz	Corn, soybean	Prowl 3.3EC, (Prowl H ₂ O)
	AquaPen 3.8/ Pin-dee 3.3 EC	Drexel		
	Framework	WindField		
	Pavilion	Innvictis		
	Satellite*	UPL		
	Stealth	Loveland		
quinclorac	Prize	Sharda	Pasture	Paramount/Facet
	Quinstar 4L	Albaugh/Agri-Star		
rimsulfuron	Grapple	NuFarn	Corn	Resolve, Matrix
	Hinge/Inflict	Rotam North Amer.		
	Pruvin	ADAMA		
	Tetris SG	Atticus		
rimsulfuron + nicosulfuron	Sparrow	Rotam	Corn	
rimsulfuron + thifensulfuron	Stringent	Rotam	Corn	
S-metolachlor	Brawl*/Charger*	Tenkoz	Corn, soybean, sorghum	Dual Magnum
	Charger Max	Winfield		Dual II Magnum
	Everprex	Corteva		
	Moccasin	UPL		
	StreliuS II	Atticus		
	Visor S-MOC*	Innvictis		
S-metolachlor + atrazine	Brawl II ATZ	Tenkoz	Corn, sorghum	Bicep II Magnum
	Charger MAX ATZ*	WinField		
	Visor S-MOC ATZ	Innvictis		

Table 5.3 - Selected Generic (or Post-Patent) Alternative Herbicides for Agronomic Uses (cont.)

Active ingredient(s)	Trade name	Manufacturer	Labeled crops*	Alternative to:
S-metolachlor + metribuzin	Ledger	Tenkoz	Soybean	Boundary
	MetalliS MTZ	Atticus		
	Moccasin MTZ	UPL		
	Presidual	WinField		
	Tyrant	Helena		
sulfentrazone	Antares*	Helena	Soybean	Authority 75DF, Spartan
	Aquesta	Atticus		
	Blanket 4F	Tenkoz		
	Boycott	UPL		
	Intensa	Sharda		
	Shutdown	UPL		
	Sulfin 4SC	SummitAgro		
	Surepyc	Amvac		
	Vandal 4SC	Innvictis		
Zone 4F	Helm Agro			
sulfentrazone + imazethapyr	Compensa	Sharda	Soybean	
thifensulfuron	Thief	Loveland	Corn, soybean, small grains	Harmony*
	Treaty	NuFarm		
	Volta	Rotam North Amer.		
thifensulfuron + rimsulfuron	Crusher	FMC	Field corn, cotton, peanut, soybeans	LeadOff
	Leopard	Nufarm		
	Stringent	Albaugh		
thifensulfuron + tribenuron	Audit*	UPL	Corn, soybean, small grains	Harmony Extra SG
	Civility Extra	Innvictis		
	Rapport*	NuFarm		
	Treaty Extra	NuFarm		
	Volta Extra	Rotam North Amer.		
tribenuron	Taqua	Rotam	Barley, oats, wheat	Express

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Table 5.3 - Selected Generic (or Post-Patent) Alternative Herbicides for Agronomic Uses (cont.)

Active ingredient(s)	Trade name	Manufacturer	Labeled crops*	Alternative to:
triclopyr	Boulder 6.3	Alligare	Pasture	Garlon*/Remedy Ultra
	Relegate	NuFarm		
	Triclopyr*	Albaugh/Agri-Star/Alligare		
	Tahoe 3A	NuFarm	Pasture and Noncrop	
triclopyr + 2,4-D	Candor	NuFarm	Pasture	Crossbow
	Chaser 2 Amine	Loveland		
	Crossroad	Albaugh/Agri-Star		
trifluralin	Trust	Winfield	Corn, soybean, wheat	Treflan

*Products contain multiple formulations.

Table 5.4 - Herbicide Rotational Restrictions for Cash Crops

The information listed in this rotation restriction table is our interpretation of label statements. Consult the label if two or more of these materials are applied during the same season. Herbicide labels are constantly changing; therefore, this list is not a substitute for the most recent herbicide label.

Trade Name	Rotational Crops (months after application) ¹																										
	Alfalfa	Cabbage	Clover	Cotton	Cucumber	Field Corn	Grain Sorghum	Lima Bean	Muskmelon	Onion	Peanut	Peas	Pepper	Pumpkin	Snap Bean	Soybean	Spring Oat	Squash	Sweet Corn	Tobacco	Tomato	Watermelon	White Potato	Winter Barley	Winter Rye	Winter Wheat	
2,4-D ¹	3	3	3	1	3	0.25-1	1	3	3	3	1	3	3	3	3	0.25-1 ¹	1	3	1	3	3	3	1	1	1	1	1
Accent/Accent Q	12 ¹	10 ²	12	10	10 ²	NR	10-18 ¹	10-18 ¹	10 ²	10 ²	10	10 ²	10	10 ²	10	0.5	8	10 ²	10	10 ²	10 ²	10 ²	10 ¹	4	4	4	
Acuron	18	18	18	10	18	NR	10	18	18	10	18	18	18	18	18	10	4	18	NR	18	18	18	10	4	4	4	
Acuron Flex ²³	10	18	18	10	18	NR	10	18	18	10	18	18	18	18	18	10	4	18	NR	18	18	18	10	4	4	4	
Acuron GT	10 ¹	18	18	10	18	NR	10	18	18	10	18	18	18	18	18	10	4.5	18	NR	18	18	18	10	4.5	4.5	4.5	
Afforia (2.5 oz)	4 ²⁴	4 ²⁴	4 ²⁴	1	4 ²⁴	0.5 ²⁴	1	4 ²⁴	4 ²⁴	1.5	3	4 ²⁴	4 ²⁵	4 ²⁵	3	NR ²⁴	4 ²⁴	4 ²⁴	3	1.5	4 ²⁴	4 ²⁴	4 ²⁴	3	3	1 ²⁴	
Aim	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Antares Complete	12	18B	18B	12-18 ¹	18B	4-10 ¹	12-18 ¹	18B	18B	12	18B	18B	18B	18B	18B	18B	18B	18B	18B	18	4 ⁹	18B	12	4.5	18B	4.5	
Anthem Flex(5.46-7.27 oz)	10	18	18	4	18	NR	10 ⁵	11	18	4	4	NR	18	18	11	NR	11 ²⁵	18	NR	9	9	18	NR	11 ²⁵	11 ²⁵	4 ²⁵	
Anthem Maxx (4.87 oz)	10	18	18	4	18	NR	10 ⁵	11	18	4	4	1	18	18	11	NR	11 ²⁵	18	NR	9	9	18	1	11 ²⁵	11 ²⁵	4 ²⁵	
Armezon/Impact (0.75 oz)	9	18	18	9	18	NR	9	9	18	18	9	9	18	18	9	9	3	18	NR	18	18	18	9	3	3	3	
Armezon PRO (16-20 fl oz/A)	9	18	18	9	18	NR	9	18 ³	18	18	9	9 ³	18	18	9 ³	9	4	18	NR	18	18	18	9	4	4	4	
Assure II	4	4	4	NR	4	4	4	4	4	4	4	NR	4	4	NR	NR	4	4	4	4	4	4	4	4	4	4	
Atrazine	SY	SY	SY	SY	SY	NR	NR	SY	SY	NY	SY	SY	SY	SY	SY	NY	SY	SY	NR	SY	SY	SY	SY	SY	NY	NY	NY
Authority Edge (8.9 -15 oz)	12	18 ⁹	18	12 ¹	18	4	10-18 ¹	9	18	4	4	9	18	18	9	NR ¹	12-18 ¹	18	12	18	18	18	4	11-18 ¹	11-18 ¹	4-10 ¹	
Authority Elite/Broadaxe XC	12	2 ⁹	12B	12-18 ⁴	12B	4	10	12B	12B	4	8	12B	12B	12B	12B	NR	12	12B	12	10	4	12B	4	4.5	4.5	4.5	
Authority First/Sonic	12	30B	30B	12-18 ¹	30B	10-18 ¹	12	12	30B	30B	12	9	30B	30B	12	NR	12	30B	10-18 ¹	30 ¹	30B	18	18	12	12	4	
Authority MTZ	12	18	18	18 ⁴	18	10	12-18 ¹	18	18	12	18	18	18	18	18	NR	18	18	18	12	NR ⁹	18	12	4	4	4	

5-14 Weed Control in Field Crops: Introduction

Table 5.4 - Herbicide Rotational Restrictions for Cash Crops (cont.)

The information listed in this rotation restriction table is our interpretation of label statements. Consult the label if two or more of these materials are applied during the same season. Herbicide labels are constantly changing; therefore, this list is not a substitute for the most recent herbicide label.

		Rotational Crops (months after application) ¹																								
Trade Name	Alfalfa	Cabbage	Clover	Cotton	Cucumber	Field Corn	Grain Sorghum	Lima Bean	Muskmelon	Onion	Peanut	Peas	Pepper	Pumpkin	Snap Bean	Soybean	Spring Oat	Squash	Sweet Corn	Tobacco	Tomato	Watermelon	White Potato	Winter Barley	Winter Rye	Winter Wheat
Authority Supreme	12	18 ⁹	18	12-18 ¹	18	4	10 ¹	9	18	18	4	9	18	18	9	NR ¹	12 ¹	18	10	18	18	18	4	11 ¹	11 ¹	4 ¹
Authority XL	12-18 ¹	18	18	18	18	10-18 ¹	10-18 ¹	36	36	36	18	36	36	18	36	NR	12-18 ¹	36	18	10-18 ¹	12-18 ^{1,9}	10 ¹	36	4	4	4
Autumn Super ¹	18B	18B	18B	10	18B	1	18B	18B	18B	18B	18B	18B	18B	18B	18B	2	18B	18B	9	18B	18B	18B	18B	9	18B	3
Axial Bold	3	1	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	1	NR	3	NR
Axial Star	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	NR	4	NR
Axial XL	3	1	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	1	NR	3	NR
Axiom	12	12B	12	8	12B	NR	12	12B	12B	18	12B	12B	12B	12B	12B	NR	12	12B	12B	12B	12B	12B	1	12	12	0.23-4
Balance Flexx ¹	10 ¹	18	18	10 ¹	18	NR	6	18	18	18	11	18	18	18	18	6	18	18	6	12	18	18	6	6	4	4
Basagran	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Basis	10	18	10	1 ⁶	10	NR	10 ⁶	18	18	18	18	10	18	18	10	10 ⁶	9	18	10	18	1	18	NR	3	3	3
Basis Blend ⁶	10 ⁶	18	10 ⁶	1 ⁶	10	NR	10 ⁶	18	18	18	1.5	10	18	18	10	10 ⁶	9	18	10	1.5	1	18	1	3	3	3
Beyond/																										
Beyond Extra	3	9	18	9	9	8.5 ⁸	9	NR	9	9	9	NR	9	9	NR	NR	9	9	8.5	9	9	9	9	9	4	3 ⁸
Bicep products	SY	SY	SY	NY	SY	NR	NR ¹⁰	SY	SY	SY	NY	SY	SY	SY	SY	NY	SY	SY	NY	SY	SY	SY	SY	SY	NY	NY
Boundary	4.5	12	12	12	12	4	12	12	12	18	12	8	12	12	12	12	12	12	4	12	12	12	12	NR	4.5	12
Buciril/Maestro	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cadet	AH	AH	AH	AH	AH	NR	AH	AH	AH	AH	AH	AH	AH	AH	AH	NR	AH	AH	AH	AH	NR	AH	AH	AH	AH	AH
Caibra	10	18	18	10	18	NR	NR	18	18	18	10	18	18	18	18	10	18	18	18	10	18	18	10	4.5	4.5	
Callisto	10	18	18	10	18	NR	NR	18	18	18	10	10 ¹	18	18	10 ¹	10	NR	18	18	10	18	18	10	4	4	
Callisto Xtra	10	18	18	10	18	NR	NR	18	18	18	10	10 ¹	18	18	10 ¹	10	NR	18	18	10	18	18	10	4	4	
Canopy ¹	10	18	12	10	18	10	12	30	30	30	18	12	30	18	12	NR	30	30	18	10 ¹⁰	10 ¹⁰	18	30	4	4	
Canopy Blend	10	18	18	18	18	10 ²⁶	18	30	30	30	18	12	30	18	18	NR	4	30	18	18 ⁹	10 ⁹	18	30	4	4	
Canopy EX	10	18	12	10	18	10 ¹	10 ¹	30	30	18 ¹	8	12	30	18	12	0.25 ¹	4	30	18	10 ⁹	10 ⁹	18	18 ¹	4	4	
Caparol	12	5	12	5 ¹	12	5	12	12	12	8	12	5	12	12	12	12	12	12	5	12	12	12	12	12	12	12
Capreno ¹	10-18	18	18	10	18	NR	10	18	18	18	11	18	18	18	18	10	10	18	10	12	18	18	18	10	18	4
Chaparral	SYB	SYB	SYB	SYB	SYB	NY	NY	SYB	SYB	SYB	SYB	SYB	SYB	SYB	SYB	NY	NY	SYB	SYB	SYB	SYB	SYB	SYB	NY	NY	NY
Chateau (up to 3 oz) ¹¹	5 ¹¹	12B	5 ¹¹	2 ¹¹	12B	0.5-1	1 ¹	12B	12B	12B	NR	4	12B	12B	4	NR	5 ¹¹	12B	4	2	12B	12B	5 ¹¹	4	4	2

Table 5.4 - Herbicide Rotational Restrictions for Cash Crops (cont.)

The information listed in this rotation restriction table is our interpretation of label statements. Consult the label if two or more of these materials are applied during the same season. Herbicide labels are constantly changing; therefore, this list is not a substitute for the most recent herbicide label.

Trade Name	Rotational Crops (months after application) ¹																																
	Alfalfa	Cabbage	Clover	Cotton	Cucumber	Field Corn	Grain Sorghum	Lima Bean	Muskmelon	Onion	Peanut	Peas	Pepper	Pumpkin	Snap Bean	Soybean	Spring Oat	Squash	Sweet Corn	Tobacco	Tomato	Watermelon	White Potato	Winter Barley	Winter Rye	Winter Wheat							
Cimarron Max/metsulfuron ¹	12 ¹	NYB	12 ¹	NYB	NYB	NYB	NYB	NYB	NYB	NYB	NYB	NYB	NYB	NYB	NYB	NYB	10	NYB	NYB	NYB	NYB	NYB	NYB	10	NYB	10	NYB	1					
Cimarron Plus	4	B	4-12 ¹	B	B	12 ¹	B	B	B	B	B	B	B	B	B	B	10	B	B	B	B	B	B	10	NY	10	NY	1					
Clarity	4	4	4	0.75-1.5 ⁵	4	NR	NR	4	4	4	4	4	4	4	4	0.5-1.5 ⁵	4	4	4	4	4	4	4	4	0.5-1.5 ⁵	0.5-1.5 ⁵	0.5-1.5 ⁵	1.5 ⁵					
Classic ¹	12	18	12	9	18	9	9	30	30	15	9	30	18	9	9	NR	3	30	18	9 ⁹	9 ⁹	NR	NR	NR	NR	NR	NR	NR	3				
Cobra	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Command/Up-stage	12	9	12	NR ¹²	9	9	9	12	9	9	NR ¹	NR	NR	NR ¹	9	NR	12	NR ¹	9	NR	9 ⁹	9	9	12	12	12	12	12	12				
Convus	17	17B	17B	10	17B	NR	17B ¹	17B	17B	11 ¹	17B	17B	17B	17B	17	9	17	17B	9	12 ¹	17B	17B	17	17	9	4	4	4	4				
Crossbow ²⁰	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI			
Curbit	AH	AH	AH	AH	NR	AH	AH	AH	NR	NR	AH	AH	AH	NR	AH	NR	AH	NR	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH			
Curtail	10.5-18 ¹	10.5-18 ¹	10.5B	10.5B	10.5B	1	18 ¹	10.5B	B	18 ¹	10.5B	18	10.5B	B	10.5B	18 ¹	1	B	18 ¹	10.5B	10.5B	10.5B	18	1	10.5B	1	10.5B	1	10.5B	1			
Degree Xtra	SY	SY	SY	NY	SY	NR	NR ¹⁰	SY	SY	SY	SY	SY	SY	SY	SY	NY	SY	SY	NR	NY	SY	SY	SY	SY	SY	SY	SY	SY	SY	SY	SY		
Devrinol	12	NR	12	12	12	12	12	12	12	12	12	12	NR	12	12	12	6	12	12	NR	NR	NR	12	12	6	6	6	6	6	6			
DiFlexx	4	4	4	2	4	NR	2	4	4	4	4	4	4	4	4	2 ¹	2	4	4	4	4	4	4	4	2	4	4	4	2	4	2		
DiFlexx Duo	10	18B	18B	10	18	NR	10	18B	18	18 ²⁷	11	10	18B	18	10	8	4	18	4	12	10	18	10	4	4	4	4	4	4	4			
Distinct ¹	1	4	4	1	4	0.25	1	4	4	4	4	4	4	4	4	1	1	4	4	4	4	4	4	4	1	1	1	1	1	1	1		
Dual products	4	2 ¹	9	NR	12	NR	NR ¹⁰	NR	12	2 ¹	NR	NR	2	2 ¹	NR	NR	4.5	12	NR	NY	2 ¹	12	NR	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		
DuraCor	24B	24B	24B	24B	24B	12	24B	24B	24B	24B	24B	24B	24B	24B	24B	24B	12	24B	12	24B	24B	24B	24B	24B	24B	12	12	12	12	12	12		
Elevore	9	15B	9	1	15B	0.5	15B	15B	15B	15B	9	9	15B	15B	15B	0.5	15B	15B	15B	15B	15B	15B	15B	24B	0.5	0.5	0.5	0.5	0.5	0.5			
Erlist Duo	NI	NS	NS	132	NS	0.532	NS	NS	NS	NS	NS	NS	NS	NS	NS	132	NS	NS	0.23-	0.5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		
Enversa ¹	9	NY	NY	NR	NY	NR	NR	NY	NY	NY	NR	NY	NY	NY	NY	NR	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	
Envive	10	18	12	10	18	10	12	30	30	8	12	30	18	12	12	NR	10	30	18	10 ⁹	12 ⁹	18	30	4	4	4	4	4	4	4	4	4	
Eptam	NR	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	NR	AH	AH	AH	AH	AH	AH	AH	AH	AH	NR	AH	AH	AH	AH	AH	AH	AH	
Evik	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	3	11	11	11	11	11	11	10	3	3	3	3	3	3	3	3	
Expert	SY	SY	SY	NY	SY	NR	NR ¹⁰	SY	SY	SY	NY	SY	SY	SY	SY	NY	SY	SY	NY	SY	SY	SY	SY	SY	NY	NY	NY	NY	NY	NY	NY	NY	NY

Table 5.4 - Herbicide Rotational Restrictions for Cash Crops (cont.)

The information listed in this rotation restriction table is our interpretation of label statements. Consult the label if two or more of these materials are applied during the same season. Herbicide labels are constantly changing; therefore, this list is not a substitute for the most recent herbicide label.

Trade Name	Rotational Crops (months after application) ¹																											
	Alfalfa	Cabbage	Clover	Cotton	Cucumber	Field Corn	Grain Sorghum	Lima Bean	Muskmelon	Onion	Peanut	Peas	Pepper	Pumpkin	Snap Bean	Soybean	Spring Oat	Squash	Sweet Corn	Tobacco	Tomato	Watermelon	White Potato	Winter Barley	Winter Rye	Winter Wheat		
Extreme	4	18	4	18	18	8.5 ⁹	18	NR	18	40B	NR	NR	40B	40B	2	NR	18	40B	18	9.5	18	18 ^{9/}	40B	18	26	4	4	3
Facet L	24B	10	24B	10	10	10	NR	10	10	10	10	24B	24B	10	10	10	10	10	10	24B	24B	10	24B	10	24B	10	10	NR
Fierce/ Fierce EZ	10	18	18	1-2'	18	0.25-1'	18	11	18	18	4	11	18	18	11	NR	12'	11-	18	18	12	18	4	12'	11-	11-	12'	1-2'
Fierce XLT ¹	18	18-30	18	18-30	18-30	10-18	18	18-30	18-30	18-30	30	18-30	18-30	18-30	30	18-30	NR	18-30	18-30	18-30	18 ⁹	18-30	18-30	18-30	30	18	18	4
Finesse	B	B	B	18	B	18	4-18'	B	B	B	B	B	B	B	B	18 ¹⁴	10	B	B	B	B	B	B	10	10-16'	0-4'	0-4'	
Cereal & Fallow (0.4 oz)																												
FirstRate	9	18	18	9	18	9	9	9	18	18	9	9	18	18	9	NR	9	18	18	18	18 ¹⁵	18	18	18	18	12	18	4
Flexstar/ Flexstar GT	18	18	18	NR	12	10	18	4	12	18	4	4	10 ⁹	10	NR	NR	18	12	10	18	10 ⁹	10	NR	4	4	4	4	4
Fulltime/ Keystone	15	SY	SY	NY	SY	NR	NY	SY	SY	SY	NY	15	SY	SY	SY	NY	15	SY	NR	15	SY	SY	15	15	15	15	SY	4
Fusilade/ Fusion	NR	NR	NR	NR	NR	2	2	NR	NR	NR	NR	NR	NR	NR	NR	NR	2	NR	2	NR	2	NR	NR	NR	2	2	2	2
Glyphosate products	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Goal/ GoalTender	2	3	2	0.25	3	10	10	1-2	2-3'	6'	2	2	3 ⁹	3	2	0.25	10	3	10	2	1 ⁹	2	2	2	10	10	10	10
Gramoxone/ paraquat	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
GrazonNext HL	24B	24B	24B	24B	24B	12	24B	24B	24B	24B	24B	24B	24B	24B	24B	24B	12	24B	12	24B	24B	24B	24B	24B	12	12	12	12
Grazon P+D	B	B	B	B	B	B	8	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	2	2	2
Halex GT	10	18	18	10	18	NR	NR ¹⁰	18	18	18	10	10'	18	18	10'	10	4.5	18	NR	10	18	18	10	4.5	4.5	4.5	4.5	4.5
Harmony Extra SG	1.5	1.5	1.5	0.75	1.5	0.75	0.75	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	NR
Harmony SG	1.5	1.5	1.5	0.25	1.5	NR	NR	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	NR	NR	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	NR	NR
Harness	9	SY	SY	NY	SY	NR	NR ¹⁰	SY	SY	SY	NY	SY	SY	SY	SY	NY	SY	SY	SY	NY	SY	SY	SY	NY	NY	NY	NY	4
Harness Xtra	SY	SY	SY	NY	SY	NR	NY	SY	SY	SY	NY	SY	SY	SY	SY	NY	SY	SY	SY	NY	SY	SY	SY	SY	SY	SY	SY	NY

Table 5.4 - Herbicide Rotational Restrictions for Cash Crops (cont.)

The information listed in this rotation restriction table is our interpretation of label statements. Consult the label if two or more of these materials are applied during the same season. Herbicide labels are constantly changing; therefore, this list is not a substitute for the most recent herbicide label.

Trade Name	Rotational Crops (months after application) ¹																										
	Alfalfa	Cabbage	Clover	Cotton	Cucumber	Field Corn	Grain Sorghum	Lima Bean	Muskmelon	Onion	Peanut	Peas	Pepper	Pumpkin	Snap Bean	Soybean	Spring Oat	Squash	Sweet Corn	Tobacco	Tomato	Watermelon	White Potato	Winter Barley	Winter Rye	Winter Wheat	
Hornet WDG	10.5 ¹	26B	26B	18	26B	1B	1B	10.5 ¹	26B	26B	18	18 ¹⁶	26B	26B	18 ¹⁶	10.5	4	26B	18 ¹⁶	18	26B	26B	18	4	4	4	4
Huskie	4 ¹	1B	1B	10	1B	4	0.25	1B	1B	9 ¹	1B	9	1B	1B	9	4	1	1B	1B	1B	1B	1B	18	4	4	4	0.25
Impact Core	9	18	18	10	18	NR	9	18	18	18	10	18	18	18	18	10	9	18	NR	18	18	18	10	9	9	4	4
Instigate	18	18	18	10	18	NR	10	18	18	18	10	10 ¹	18	18	10 ¹	10	9	18	10	10	18	18	10	4	4	4	4
Karmex	24	24	24	NR	24	NY	NY	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	4
Kerb ¹	NR	3-6	NR	3-5	3-6	12	12	3	3-6	3-6	12	3-4	3-6	3-6	3-4	3-4	12	3-6	12	12	3-6	3-6	3	12	12	12	
Keystone NXT	SY	18	SY	NY	18	NR	NY	SY	18	18	SY	SY	18	18	18	NY	SY	18	NR	NR	SY	18	SY	15	15	15	
Kyro	10.5	18	18	12	18	NR	10.5	18	18	18	18	18	18	18	18	10.5	10.5	18	NR	18	18	18	18	10.5	10.5	4	
Laudis	10	18	18	10	18	NR	10	18	18	8 ¹	11	10	18	18	10	8	4	18	NR	12	10	18	10	4	4	4	
Leadoff (1.5 oz)	10	18	10 ¹	1	10	NR	10	18	18	18	1.5	10	18	18	10	1 ¹	9	18	10	1.5	1	18	1	3	3	3	
Lexar/Lexar EZ	18	18	18	NY	18	NR	NR ¹⁰	18	18	18	NY	18	18	18	18	NY	NY	18	NR	18	18	18	18	18	NY	NY	
Liberty	6	2.3	6	NR	6	NR	6	6	6	2.3	6	6	6	6	6	NR	2.3	6	NR	6	6	6	2.3	2.3	2.3	2.3	
Lorox/Linex	4	4	4	4	4	NR ¹	NR ¹	4	4	4	4	4	4	4	4	NR ¹	4	4	4	4	4	4	NR	12	4	4	
Lumax/Lumax EZ	18	18	18	NY	18	NR	NR ¹⁰	18	18	18	NY	18	18	18	18	NY	NY	18	NR	18	18	18	18	4.5	4.5	4.5	
Marvel	18	18	18	NR	18	10	18	18	18	18	10	10	4 ⁹	18	NR	NR	4	18	18	18	4 ⁹	18	NR	4	4	4	
Matrix	4	12	18	10	10	NR	18	10	18	10	18	8	12	12	10	4	9	18	10	18	NR	12	NR	12	12	4	
Maverick	18	18	18	18	18	NR	18	18	18	18	18	18	18	18	18	10.5	18	18	NR	18	18	18	18	18	18	4-6	
Metribuzin products	4	18	18	18	18	4	18	18	18	18	8	8	18	18	18	4	18	18	4	18	4	18	12	4 ¹	18	4 ¹	
Milestone	24B	24B	24B	24B	24B	12	24B	24B	24B	24B	24B	24B	24B	24B	24B	24B	12	24B	24B	24B	24B	24B	24B	24B	12	12	12
Optill ¹	4	40B	4	18	18	8.5 ⁶	18	4	40B	40B	4	4	18	40B	4	0-1	18	40B	18	9.5	18	40B	26	9.5	4-18	4 ⁸	
Option	2	2	2	2	2	0.25	2	2	2	2	2	2	2	2	2	0.5	2	2	2	2	2	2	2	2	2	2	
Osprey	10	10	10	3	10	3	3	10	10	10	3	3	10	10	10	3	10	10	10	10	10	10	10	1	10	0.25	
Outlook ¹	4-6	6-9	6-9	4	6-9	NR	NR ¹⁰	6-9	6-9	6-9	NR	4	6-9	6-9	6-9	NR	4	6-9	NR	6-9	6-9	6-9	6-9	4	4	4	
Outrider	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	3B	NR	
Overdrive	1	4	4	1	4	0.25	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	1	1	
PastureGard HL	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	4	NI	NI	NI	NI	NI	NI	NI	4	NI	4
Peak (0.25 oz) ¹	22	22	22	10	22	1 ⁸	1	22	22	22	10	10	22	22	10	10	NR	22	10	10	10	22	22	NR	NR	NR	

Table 5.4 - Herbicide Rotational Restrictions for Cash Crops (cont.)

The information listed in this rotation restriction table is our interpretation of label statements. Consult the label if two or more of these materials are applied during the same season. Herbicide labels are constantly changing; therefore, this list is not a substitute for the most recent herbicide label.

Trade Name	Rotational Crops (months after application) ¹																									
	Alfalfa	Cabbage	Clover	Cotton	Cucumber	Field Corn	Grain Sorghum	Lima Bean	Muskmelon	Onion	Peanut	Peas	Pepper	Pumpkin	Snap Bean	Soybean	Spring Oat	Squash	Sweet Corn	Tobacco	Tomato	Watermelon	White Potato	Winter Barley	Winter Rye	Winter Wheat
Permit	9	15	9	4	2	1 ⁸	2	NI	9	18	6	9	10	9	2	9 ¹	2	9	3	36	2	9	9	2	2	2
Permit Plus	9	15	9	4	2	1	2	NI	9	18	6	9	10	9	2	9 ^{1,14}	2	9	3	36	2 ⁹	9	9	2	2	2
Perpetuo	10	18	18	2-4	18	NR	6-8 ¹	11	18	18	2-4 ¹	9-11 ¹	18	18	11	NR	18	18	8	18	18	18	4	18	18	1-4
Poast	NR	NR	NR	NR	NR	1	1	NR	NR	NR	NR	NR	NR	NR	NR	NR	30	NR	17	NR	NR	NR	NR	NR	1	1
Powerflex HL	9	12	12	3 ¹	12	9	3	12	12	12	9	9	12	12	12	3 ¹	9	12	9	12	12	12	12	9	9	12
Prefar ¹	4	NR	4	4	NR	4	4	4	NR	NR	4	4	NR	NR	4	4	4	NR	4	4	NR	NR	4	4	4	4
Prefix	18	18	18	1	12	10	18	4	12	18	4	4	10 ⁹	10	NR	NR	4.5	12	10	18	10 ⁹	10	1	4.5	4.5	
Princep 4L	SY	SY	SY	NY	SY	NR	NY	SY	SY	SY	NY	SY	SY	SY	SY	NY ¹⁷	SY	SY	NY	SY	SY	SY	SY	SY	NY	NY
Prowl H ₂ O	6 ¹	NY	NY	NR	NY	NR ¹⁸	NY	NR	NR	NY	NR	NR	NR ¹	NY	NR	NR	NY	NR	NR ¹⁸	NR ¹	NR ¹	NR	NR ¹	4 ¹	NY	4 ¹
Pursuit ¹	4	40B	4	18 ¹⁹	40B	8.5 ⁹	18	NR	40B	40B	NR	NR	18 ⁹	40B	2	NR	18	40B	18	9.5	40B ⁹	40B	26 ¹	9.5 ¹	4	
Python	4	26B	9	9 ¹	26B	NR	12	4	26B	26B	4	4	26B	26B	4 ¹	NR	4	26B	18 ¹	9	26B	26B	12	4	4	
Quelex ¹	9	15	15	3	15	3	3	9	15	15	9	9	15	15	9	3	3	15	3	15	15	15	15	15	NR	
Raptor	3	9	18	9	9	8.5 ⁹	9	NR	9	9	9	NR	9	9	NR	NR	9	9	8.5	9	9	9	9 ¹	9 ¹	4	
Realm Q	10	18	18 ¹	10	18	NR	10	18	18	18	10	10 ¹	18	18	10 ¹	10	9	18	10	10	10	18	10	4	4	
Reflex	18	18	18	NR	12	10	18	4	12	18	4	4	10 ⁹	10	NR	NR	18	12	10	18	10 ⁹	10	NR	4	4	
Remedy Ultra ²⁰	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Resicore/Resicore XL	10.5 ²⁸	18	18	12	18	NR ²⁸	10.5 ²⁸	18	18	18	18	18	18	18	18	10.5 ²⁸	10.5 ²⁸	18	10.5	18	18	18	18	10.5 ²⁸	10.5 ²⁸	4
Resolve SG (1 oz)	10	18	10 ¹	1	10	NR	10	18	18	18	18	10	18	18	10	10 ¹⁴	9	18	10	18	1	18	NR	9	18	3
Resolve Q (1.25 oz)	10	18	10 ¹	1	10	NR	10	18	18	18	1.5	10	18	18	10	2 ¹	9	18	10	1.5	1	18	NR	3	3	
Resource	1	1	1	1	1	NR	1	1	1	1	1	1	1	1	1	NR	1	1	1	1	1	1	1	1	1	
Reviton (2 oz)	5	5	5	0.5	5	NR	5	5	5	5	5	5	5	5	5	0.25	5	5	5	5	5	5	5	5	5	NR
Revolin Q	10 ¹	18	18	10	18	NR	10 ¹	18	18	18	18	18	18	18	18	10	8	18	10 ²⁰	18	18	18	10 ¹	4	4	
Ro-Neet	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH
Sandea	9	15	9	4	2	1 ⁸	2	36	9	18	6	9	10	9	2	9 ¹	2	9	3	36	2	9	9	2	2	
Scepter ¹	18	18	18	18	18	9.5 ¹³	11	11	18	18	11	18	18	18	11	NR	11	18	18	9.5	18	18	18	11	18	3

Table 5.4 - Herbicide Rotational Restrictions for Cash Crops (cont.)

The information listed in this rotation restriction table is our interpretation of label statements. Consult the label if two or more of these materials are applied during the same season. Herbicide labels are constantly changing; therefore, this list is not a substitute for the most recent herbicide label.

Trade Name	Rotational Crops (months after application) ¹																											
	Alfalfa	Cabbage	Clover	Cotton	Cucumber	Field Corn	Grain Sorghum	Lima Bean	Muskmelon	Onion	Peanut	Peas	Pepper	Pumpkin	Snap Bean	Soybean	Spring Oat	Squash	Sweet Corn	Tobacco	Tomato	Watermelon	White Potato	Winter Barley	Winter Rye	Winter Wheat		
Select/Select Max	NR	NR	NR	NR	NR	0.2	1	NR	NR	NR	NR	NR	NR	NR	NR	NR	1	NR	1	1	NR	NR	NR	NR	1	1	1	
Sentrallas	4	4	4	4	4	NR	NR	4	4	4	4	4	4	4	4	4 ¹	NR	4	4	4	4	4	4	NR	4	NR	4	
Sequence	4	NY	9	NR	NI	NR	NR	NR	NI	NI	NR	NR	NY	NI	NR	NR	4.5	NI	NI	NY	6 ¹	NI	NY	4.5	4.5	4.5	4.5	
Sharpen (1 oz) ¹	4	4	4	1.5	4	NR	NR	4	4	4	4	NR	4	4	4	0-1	NR	4	0.5	4	4	4	4	NR	NR	NR	NR	
Shieldex	9	9	12	9	9	NR	9	9	9	12	9	9	12	9	9	3	9	NR	12	9	9	9	9	NR	NR	3	NR	
Sinate	9	18	18	9	18	NR	9	18	18	18	9	9-18 ¹	18	18	9-18 ¹	9	3	18	NR	18	18	18	18	9	3	3	3	
Sinbar	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	
Solicam	16	24B	24B	1-16 ¹	24B	24B	24B	24B	24B	24B	1-16 ¹	24B	24B	24B	24B	24B	1.5-16 ¹	24B	24B	24B	24B	24B	24B	24B	24B	24B	24B	24B
Sonalan	AH	AH	AH	AH	AH	AH	AH	AH	AH	NR	NR	AH	AH	AH	AH	NR	12	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	
Spartan	12	NR	12B	18	12B	10	10 ¹	NR	12B	12B	12B	12B	12B	12B	12B	NR	12	12B	18	NR	NR ⁸	12B	12B	4	4	4	4	
Spartan Charge	12	NR ⁸	12B	12-18 ¹	12B	NR	10 ¹	12B ¹	12B	12B	NR	12B	12B	12B	12B	NR	12	12B	12	NR	NR ⁸	12B	NR ¹	4	4	4	4	
Spin-aid	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	AH	4	AH	AH	AH	AH	AH	AH	AH	4	4	4	
Spirit	18	10	18	10	18	1 ⁸	10	18	18	18	18	10	18	18	10	10	3	18	8	10	10	18	10	3	3	3		
Spur	12-18	NR	10.5B	10.5-18B	10.5-18B	NR	12	10.5B	10.5	12	10.5B	18B	10.5B	10.5B	10.5B	12-18	NR	10.5B	NR	10.5B	10.5B	10.5	10-18B	NR	10.5B	NR		
Starane Ultra	4	4	4	4	4	NR	NR	4	4	4	4	4	4	4	4	4 ³¹	NR	4	NR	4	4	4	4	NR	NR	NR		
Status	1 ⁵	4	4	1 ⁵	4	0.25	1 ⁵	4	4	4	4	4	4	4	4	1 ⁵	1 ⁵	4	4	4	4	4	4	1 ⁵	1 ⁵	1 ⁵		
Steadfast Q	10 ¹	18	10 ¹	10	10-18	NR	10-18	10-18	10-18	10-18	10-18	10	10-18	10-18	10-18	0.5	4	10-18	10 ²⁰	10-18	10-18	10-18	10 ¹	4	4	4		
Stinger	10.5	NR	18	B	18B	NR	10.5	18B	18B	10.5	18B	18B	18B	18B	18B	10.5 ¹	NR	18B	NR	18B	18B	18B	18B	NR	NR	NR		
Storm	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	NR	3.3	3.3	3.3	3.3	NR	1.3	3.3	3.3	3.3	3.3	3.3	3.3	1.3	1.3	1.3		
Storen	10	18	18	10	18	NR	10	18	18	18	10	18	18	18	18	10	11	18	NR	18	18	18	10	11	11	4.5		
Stout	10 ¹	18	10 ¹	10	18	NR	10	18	18	18	18	10	18	18	10	0.5	8	18	10 ²⁰	18	18	18	10 ¹	4	4	4		
SureStart/ TripleFLEX	NY ¹	26B	NY ¹	26B	26B	NR	12	26B	26B	26B	26B	NY	26B	26B	26B	NY ¹	NY	26B	18 ¹	18	26B	26B	18	NY	NY	4		
Surpass NXT	9	NI	9	NY	NI	NR	NR ¹⁰	NY	NI	NI	NI	NY	NI	NI	NI	NY	NY	NI	NR	NY	NY	NI	NY	NY	NY	4		

Table 5.4 - Herbicide Rotational Restrictions for Cash Crops (cont.)

The information listed in this rotation restriction table is our interpretation of label statements. Consult the label if two or more of these materials are applied during the same season. Herbicide labels are constantly changing; therefore, this list is not a substitute for the most recent herbicide label.

Trade Name	Rotational Crops (months after application) ¹																										
	Alfalfa	Cabbage	Clover	Cotton	Cucumber	Field Corn	Grain Sorghum	Lima Bean	Muskmelon	Onion	Peanut	Peas	Pepper	Pumpkin	Snap Bean	Soybean	Spring Oat	Squash	Sweet Corn	Tobacco	Tomato	Watermelon	White Potato	Winter Barley	Winter Rye	Winter Wheat	
Surtain (14 fl oz)	10	18	4	4	18	NR	6	11	18	18	7	4	18	18	11	3	11	18	2	18	18	18	10 ¹	4	4	4	4
Surveil	10	30B	30B	9	30B	9	9	9	30B	30B	9	9	30B	30B	9	NR	9	30B	18	10 ²¹	30B	30B	18	30B	30B	3	3
Synchrony XP ¹	12	18	12	9	18	9	9	30	30	30	15	9	30	18	9	NR	3	30	18	9 ⁹	9 ⁹	18	30	3	3	3	
Targa	4	4	4	NR	4	4	4	4	4	4	4	NR	4	4	NR	NR	4	4	4	4	4	4	4	NR	4	NR	
Tavium	6	6	9	1.4 ¹	12	NR	6	6	12	6	6	6	6	6	6	1 ¹	4.5	12	NR	NY	6	12	6	4.5	4.5	4.5	
Treflan	NR	NR	5	NR	5	12-14	NR	5	5	5	NR	NR	NR ⁹	5	NR	NR	12-14 ³³	5	12-14 ³³	5	5	NR	5	NR	NR	NR	
Trivence	10	18	18	18	18	10 ¹	18	30	30	30	18	12	30	18	30	NR	18	30	18	18 ⁹	12 ⁹	18	30	4	30	4	
TriVolt	17	17	17	10	17	NR	17	17	17	17	12	17	17	17	17	9	17	17	9	17	17	17	17	12	12	4	
Ultra Blazer	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	NR	3.3	3.3	3.3	3.3	NR	1.3	3.3	3.3	3.3	3.3	3.3	3.3	1.3	1.3	1.3	
Valor SX/Valor EZ (up to 3 oz)	5 ¹¹	6-12B	5 ¹¹	2 ¹¹	6-12B	0.5-1 ¹	1	6-12B	6-12B	6-12B	NR	4	6-12B	12B	4	NR	5 ¹¹	12	4	2 ¹¹	6-12B	6-12B	5 ¹¹	4	4	2 ¹¹	
Valor XLT ²²	12-18	18-30	12	10-18	18-30	10-18	10-18	18-30	18-30	18-30	18-30	12	18-30	18-30	12	NR	18-30	18-30	18-30	10-18 ⁹	12-18 ⁹	18-30	18	4	4	4	
Varisto	3	9	18	9	18	8.5 ²⁹	9	NR	9	9	9	NR	9	9	NR	NR	9	8.5	9	9	9	9 ⁹⁹	9	9	4	3 ²⁹	
Verdict	7	7	7	6	7	NR	NR	7	7	7	7	4	7	7	7	NR	4	7	4	7	7	7	7	4	4	4	
Vida	1	1 day	1	NR	1 day	NR	1 day	1 day	1 day	1 day	1	1 day	1 day	1 day	1 day	NR	1 day	1	1	1	1 day	1 day	NR	1 day	1 day	NR	
Warrant	9	NI	9	NR	NI	NR	NR ¹⁰	NY	NI	NI	NR	SY	SY	SY	NY	NR	NY	NI	NY	NY	NI	NI	NY	NY	NY	4	
Warrant Ultra	18	NI	18	1	NI	10	18	NY	NI	NI	10	10	NI	NI	NY	NR	NY	NI	12	NI	NI	NI	NI	NY	NY	4	
Xtendimax ¹	4	4	4	1 ¹	4	NR	0.5 ¹	4	4	4	4	4	4	4	4	1	1	4	4	4	4	4	4	1	1	1	
Yukon	9	15	9	4	9	1 ⁵	2	NI	9	18	6	9	10	9	2	9 ¹	2	9	3	NI	2 ⁹	9	9	2	2	2	
Zalo	6	4	6	NR	6	4	6	6	6	4	6	6	6	6	6	NR	4	6	4	6	6	6	4	4	4		
Zeus XC	12	NR ⁹	12B	18	12B	10	10 ¹	NR	12B	12B	4	NR	12B	12B	12B	NR	12	12B	18	NR	12B ⁹	12B	12B	4	4	4	
Zidua/Zidua SC (3 oz or 5 fl oz) ¹	10	18	18	4	18	NR	10	11	18	18	4	11 ¹	18	18	11	NR	11	18	NR	18	18	18	4	11 ¹	11 ¹	4 ¹	
Zone Defense	12	4 ³⁴	4 ³⁴	18	12	10	10	4 ³⁴	4 ³⁴	12	NR	4 ³⁴	12	12	12	NR	12	12	18	1	4 ³⁴	4 ³⁴	4 ³⁴	4	4	4	

Abbreviations: **AH** = after harvest; **B** = Bioassay of soil recommended before planting, **NS** = next season, **NY** = next year; **SY** = second year following application, **NR** = no restrictions.

¹ Read the label for additional restrictions due to application rate, timing, geographical region, rainfall, soil, pH, tillage, variety, or supplemental labeling.

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- ² 18 months with a soil pH > 6.5. At rates greater than 2.1 oz/A, a rotational interval of 30 months and a successful field bioassay are required.
- ³ Rotation interval for lima bean is 18 months if Armezon PRO is applied at greater than 20 fl oz/A. Rotation interval for pea and snap bean is extended to 18 months if Armezon PRO is applied at greater than 25 fl oz/A.
- ⁴ Cotton may be planted after 12 months where Authority Elite/Broadaxe was applied at rates less than 36 oz/A, Authority MTZ DF at rates less than 17 oz/A, or Authority First/Sonic at rates less than 5 oz/A and the following conditions are met: Medium and fine soils, pH < 7.2, and rainfall or irrigation must exceed 15" after herbicide application and prior to planting cotton.
- ⁵ Following application of Clarity and a minimum of 1" of rainfall or overhead irrigation, a waiting interval of 21 days is required per 8 fluid ounces per acre applied prior to planting cotton, 30 days per pint restriction for soybean, and 20 day per pint restriction for small grains. If less than 1" or rainfall or irrigation is received after application and Status is applied at greater than 5 oz/A the rotational interval is 4 months.
- ⁶ If Basis rate is 0.33 to 0.5 oz/A or Basis Blend rate is 1.25 oz/A, alfalfa, sorghum, pea = 18 months; soybean, snap bean = 10 months; STS soybean = 1 month; spring oat = 9 months; if Basis rate is greater than 0.5 oz/A or Basis Blend rate is 2.5 oz/A, cotton = 10 months and 18 months if greater than and less than 15 inches of rainfall or irrigation occur after application and prior to planting, respectively; STS soybean = 4 months; if Basis rate is 0.33 oz/A or Basis Blend rate is 0.825, soybean = 0.5 month.
- ⁷ 8 months if 0.38 oz/A Beacon is applied.
- ⁸ NR for IMI (IR/IT) or Clearfield (CL) varieties.
- ⁹ Transplanted.
- ¹⁰ Use safener with seed.
- ¹¹ Cotton may be planted no-till or strip-till after 14 or 21 days when applied at 1 oz/A or 1.5 to 2 oz/A, respectively. For winter wheat, at rates up to 2 oz/A, the rotation interval is 7 days for no-till or minimum-till wheat and 30 days for conventional-till wheat. At least 1 inch of rainfall/irrigation must occur between application and cotton, field corn, grain sorghum, tobacco, or wheat planting, or crop injury may occur. For alfalfa, clover, potato, and spring oats the rotation interval is 5 months if the soil is tilled prior to planting or 10 months if no tillage is preformed prior to planting. At lower rates of Valor/Rowel/Chateau, rotation interval for many crops are reduced. Chateau may be applied to potato following hilling at a rate of 1.5 oz/A. Consult labels for more specific information.
- ¹² Command may be applied preemergence to cotton only if Di-Syston or Thimet insecticides are applied in furrow with the seed at planting.
- ¹³ Corn hybrids that are classified as IMI-corn or as tolerant (IT) or resistant (IR) may be planted in the spring of the year following regardless of rainfall or time interval from chemical treatment to corn planting.
- ¹⁴ Rotational interval is shorter for STS soybean.
- ¹⁵ Transplanted tobacco = 10 months if ≤ 0.3 oz/A.
- ¹⁶ If Hornet WDG rate is < 4 oz/A, snap beans, peas, and some varieties of sweet corn = 10.5 months.
- ¹⁷ If no more than 2 lb ai applied the previous year.
- ¹⁸ Regardless of tillage, be sure to plant corn at least 1.5 inches deep and completely cover with soil.
- ¹⁹ Cotton may be planted 9.5 months following Pursuit if all of the following criteria are met: Pursuit is applied to peanuts only; soil texture is sandy loam or loamy sand only; and greater than 16 inches of rainfall/irrigation is received following application of Pursuit through October of the application year.
- ²⁰ The rotational interval for the sweet corn varieties 'Merit', 'Carnival', and 'Sweet Success' is 15 months.
- ²¹ Transplanted tobacco may be planted 10 months after application of 2.1 oz/A of Surveil. Tobacco in seeded nurseries may be planted 18 months after application of 2.1 oz/A of Surveil and following a successful field bioassay. At rates greater than 2.1 oz/A, a rotational interval of 30 months and a successful field bioassay are required.
- ²² Rotational intervals based on soil pH less than 7.0. In Pennsylvania, rotational interval for clover, lima bean, muskmelon, onion, pepper, spring oat, squash, and white potato is 18, 30, 30, 30, 30, 30, 30, 30, and 30 months, respectively. Consult seed corn agronomist regarding inbred sensitivity to Valor XLT/Rowel FX prior to planting inbred seed corn lines.
- ²³ If applied after June 1, rotating to crops other than corn (all types) may result in crop injury.
- ²⁴ For Bolt or Non-Bolt soybean and minimum- or no-till field corn, if Afforia is used on coarse textured soils, such as sands and loamy sands, or on high pH soils (>7.9), extend time to planting by 7 additional days. For minimum- or no-till wheat in the states of DE, MD, NJ, or VA, Afforia may be applied at a minimum 7 days before planting. Do not use on Durum wheat and do not irrigate between emergence and spike. Wheat must be planted at least 1 inch deep. Do not graze until wheat has reached 5 inches in height. For conventional-till field corn, grain sorghum, cotton, and wheat, at least one inch of rainfall/irrigation must occur between application and planting or crop injury may occur. For alfalfa, cabbage, clover, cucumber, lima bean, muskmelon, onion, pepper, pumpkin, spring oat, squash, sweet corn, tobacco, tomato, watermelon, and white potato, the rotational interval is 4 months if the soil is tilled prior to planting. If no tillage is performed prior to planting these crops the rotational interval is extended to 8 months.
- ²⁵ Rotation interval for spring oat or winter barley at 5.7 oz/A or greater rates, the rotation interval is extended to 18 months. For winter wheat, at 5.7 oz/A or greater rates, the rotation interval is extended to 6 months.
- ²⁶ Seed corn inbred lines vary in sensitivity to herbicides, therefore, users should seek advice from seed corn agronomist regarding inbred sensitivity to Canopy Blend prior to planting inbred seed corn.
- ²⁷ For onion, the rotational interval for irrigated and non-irrigated is 8 and 18 months, respectively.

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²⁸ For corn, if the original corn crop is lost do not make a second application. Injury may occur to soybean planted the year following application on soils having a calcareous subsurface layer, if products containing atrazine were used at rates greater than 0.75 lb/ai atrazine per acre in tank mixtures and/or sequentially with Resicore. If Resicore is applied after June 1, rotating to crops other than corn or grain sorghum the next spring may result in crop injury.

²⁹ NR for Clearfield corn (field and seed). For wheat, planting non-Clearfield cultivars in areas receiving less than 10 inches of precipitation from time of application up until wheat planting may result in wheat injury. Injury potential increases if less than normal precipitation occurs in the 2 months just after Varisto application. For barley, the rotation interval at pH > 6.2 and > 18 inches of rainfall/irrigation, pH < 6.2 and < 18 inches of rainfall/irrigation and with moldboard plowing, and pH < 6.2 and < 18 inches rainfall/irrigation and without moldboard plowing is 9, 9, and 18 months, respectively. For potato, the rotation interval at pH > 6.2 and > 18 inches of rainfall/irrigation and pH < 6.2 and < 18 inches of rainfall/irrigation is 9 and 18 months, respectively.

³⁰ Rotation information is unknown for this product. Please contact manufacturer for recommendations.

³¹ In Delaware and Virginia, a Special Local Needs Label 24(c), has approved a 3 month plant back restriction for soybeans after an application to winter wheat.

³² NR for Enlist varieties.

³³ In areas receiving 20 inches of rainfall or irrigation; 12 months after a spring application or 14 months after a fall application of Treflan 4L or 4EC. Labelled for these crops or after crop plants have emerged.

³⁴ Rotation is 8 months in no-till.

Surtain (Sharpen)

Beyond extra/ Raptor/ Imiflex

Banded Herbicide Application

Herbicide use can be reduced by fifty to seventy-five percent by applying the herbicide in a narrow strip or band over the row. Preemergence and postemergence herbicides can be applied as banded sprays to reduce cost and the amount of herbicide used in conventional and certain minimum tillage systems. Band spraying consists of applying an herbicide in an 8- to 15-inch band over the crop row, leaving the row middles unsprayed. Weeds that emerge between the rows must be controlled by mechanical cultivation which may be done more economically than treating them with herbicides. Banding is not practical with herbicides that must be preplant incorporated, in no-till planting systems, or when rows are planted at a close spacing.

Off-Target Movement

Off-target movement, sometimes called drift, is the movement of any pesticide to areas not intended for treatment. There are three primary forms of off-target movement: spray drift (also known as physical drift), volatility (also known as vapor drift), and sprayer contamination. Spray drift is when, during application, droplet or particle drift occurs as spray droplets or dust particles are carried by air movement from the application area to other places. Vapor drift takes place after application as herbicides evaporate (volatilize) and yield fumes (gases) that are carried on wind currents and deposited on soils or plants outside of the treated areas.

Herbicide off-target movement may injure sensitive crops, ornamentals, gardens, livestock, wildlife, or people, and may contaminate streams, lakes, or buildings. It may contaminate crops and cause illegal or intolerable residues. Excessive drift may mean poor performance in the desired spray area because the application rate is lower than expected.

Drift control should be considered with each pesticide application. Here are some ways to prevent severe drift problems:

- Use sprayer nozzles especially designed for drift reduction
- Use low-volatile or nonvolatile formulations
- Use low spray-delivery pressures (15–30 psi) and nozzles with a larger orifice
- Use drift-inhibiting adjuvants in the spray mixture when spraying under less-than-ideal conditions
- Use nozzles that allow for lowered boom height
- Avoid application of volatile chemicals at high (85 F) temperatures
- Spray when wind speed is low (less than 10 mph) or when the wind is blowing away from areas that should not be contaminated
- Use higher spray volumes during applications (e.g., 20 to 30 gallons per acre versus 5 to 10 gallons per acre)

- Spray during the early morning or evening hours when there is usually less wind. (However, applications should not be made if wind speed is less than 3 mph.)
- Leave border areas unsprayed if they are near sensitive crops

General Herbicide Mixing Procedures

Specific mixing or tank-mixing procedures may vary among product labels. When using a product alone, adhere to the mixing instructions on the product label. When tank-mixing two or more products, adhere to the most restrictive label's instructions. If it is difficult to determine which instructions to follow or when the instructions on the labels contradict each other, use the general instructions outlined below.

1. Make sure the spray equipment is properly cleaned according to the labels of the products that were last applied with the sprayer.
2. Make sure the sprayer is properly calibrated, has good agitation, and is equipped with the appropriate screens (no finer than 50 mesh; 100 mesh is finer than 50 mesh) and spray tips.
3. If tank-mixing two or more products, make sure there are no label restrictions prohibiting those products from being tank-mixed.
4. If tank-mixing two or more herbicides that are not specifically allowed on the labels, or if the labels require it, perform a compatibility test (such as a jar test) to assure that the products mix properly.
5. If a suspension or liquid fertilizer is being used as the carrier, perform a compatibility test (such as a jar test) to assure that the products dissolve properly and remain stable.
6. Fill the spray tank $\frac{1}{2}$ to $\frac{3}{4}$ full with clean water or suspension or liquid fertilizer (if being used as the carrier) and begin agitation. If possible, maintain agitation until all applications are completed.
7. If ammonium sulfate (AMS) is being added as a water conditioner, add the AMS first. This is particularly important if glyphosate (Roundup, etc.) or paraquat (Gramoxone) products are being used. Make sure the AMS is completely dissolved before continuing.
8. If compatibility agents are required, follow the herbicide label first, followed by the directions with the compatibility agent. Compatibility agents are generally either mixed or slurried with the products and/or added to the carrier solution prior to adding any products.
9. Add water soluble packets and thoroughly mix. Make sure the packets are completely dissolved.
10. Add wettable powders (WP) and thoroughly mix.
11. Add dispersible granules (DG) and dry flowables (DF) that are not in water soluble packets and thoroughly mix.
12. Add liquid flowable (FL) formulations and thoroughly mix.
13. The products in steps 9-12 can be slurried in water to assure that the products are completely dissolved before adding them to the spray tank. Some labels require that the product be slurried, particularly when using a suspension or liquid fertilizer as the carrier. Make sure to use enough water to allow the products to be completely dissolved.
14. Add water soluble concentrates (SC) and other aqueous solution products and thoroughly mix.
15. Add emulsifiable concentrate (EC) formulations and thoroughly mix.
16. Add spray adjuvants (nonionic surfactants, crop oil concentrates, methylated seed oil, etc.).
17. Add nitrogen fertilizer solutions such as urea ammonium nitrate (UAN) or ammonium sulfate (AMS) that is not being added as a water conditioner.
18. Add other tank products such as defoamers, drift control agents, dyes, etc., unless labels require their addition earlier in the mixing process.
19. Finish filling the spray tank.

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General Jar Test Procedures

A “jar test” is a type of compatibility test used to determine if two or more herbicides will mix properly, or if an herbicide(s) will mix properly with a carrier solution such as a suspension or liquid fertilizer. Incompatibility of tank mixtures is more common with suspensions of liquid fertilizers and pesticides. The idea of the jar test is to create a miniature of the actual spray tank mixture with all of the components in the proper ratios. Many herbicide labels have specific jar test procedures. If possible, follow the procedures outlined on the product label(s). If it is difficult to determine which label instructions to follow or when the instructions on the labels contradict each other, use the general instructions outlined below.

1. Use only water or carrier solution from the intended source and at the source temperature.
2. One jar will usually be adequate if only herbicide compatibility in water is being tested. Two or three jars may be needed if compatibility agents and/or adjuvants will be compared to the tank mixture alone. Use quart-size jars with re-sealable lids.
3. Add the appropriate amount of water or carrier solution to each quart jar using this formula: **[spray volume (gal/A) x 0.04 = carrier to add in pint/jar]**. For example, for a spray volume of 20 gal/A, add $20 \times 0.04 = 0.8$ pint (378 ml) of carrier to each jar.
4. If a compatibility agent will be used, add the appropriate amount of the compatibility agent to one labeled jar based on this formula: **[compatibility agent rate (pint/100 gal) x spray volume (gal/A) x 0.005 = compatibility agent to add in teaspoons/jar]**. For example, if the label rate for the compatibility agent is 3 pints/100 gal and the spray volume is 20 gal/A, then $3 \times 20 \times 0.005 = 0.3$ teaspoon (1.5 ml) of compatibility agent to one jar.
5. Add the appropriate amount of pesticides in the proper order (wetable powders, dispersible granules, dry flowables, liquid flowables, soluble concentrates and other aqueous solutions, and emulsifiable concentrates) to all jars according to one of the methods below. After each addition shake, invert several times, or stir gently to thoroughly mix.
 - a. Use the formula **[product rate/A x 0.005]**, and convert to an appropriate measurement using the conversion factors below. Or,
 - b. For dry products add 1 teaspoon per pound of product per acre, and for liquid products add ½ teaspoon per pint of product per acre.
 - i. **Dry product conversion factors:**
 1. 1 pound = 16 ounces = 454 grams
 2. 1 ounce = 28.3 grams
 - ii. **Liquid product conversion factors:**
 1. 1 gallon = 4 quarts = 8 pints = 128 fluid ounces
 2. 1 pint = 2 cups = 16 fluid ounces = 473 milliliters
 3. 1 fluid ounce = 29.57 milliliters = 2 tablespoons = 6 teaspoons
 4. 1 teaspoon = 4.93 milliliters = 60 drops
6. If adjuvants are being tested for compatibility, these should be added last to one labeled jar. Use one of these formulas based on how the adjuvant rate is expressed: **[adjuvant rate (pint/100 gal) x spray volume (gal/A) x 0.005 = adjuvant to add in teaspoons/jar]**, or **[adjuvant rate (pint/A) x 0.48 = adjuvant to add in teaspoons/jar]**.
7. When all components have been added to the jar(s), invert each jar ten times to mix and let stand for 15 to 30 minutes. If the spray solution balls up or forms flakes, sludges, jels, oily films or layers, or other precipitates it is not compatible. If a compatibility agent has not already been tested, repeat the test with a suitable compatibility agent. The tank mixture should not be used if any signs of incompatibility are evident. If the mixture separates but can be remixed readily, the mixture can be sprayed as long as good agitation is used.

8. Compatibility may be improved by using the following methods when testing and mixing.

a. Slurry the dry pesticides in water before addition to the mixture.

Oily films are usually caused by incompatibility of emulsifiable concentrates (EC). Add ½ of the compatibility agent to the carrier and ½ to emulsifiable concentrates and/or flowable pesticides before adding them to the mixture.

Sprayer Cleanout (*Modified from article Iowa State University of Science and Technology, Ames, Iowa. File code: Pest Management; PAT-30, Nov. 1997.*)

Crop injury due to contaminated sprayers is a continuing problem for both vegetables and field crops. Herbicide residues can be dissolved with time and some herbicide formulations are very effective at removing residues. This problem can be avoided by ensuring that sprayers are properly cleaned between tank loads. Sprayer cleaning is particularly important before you begin spraying a different crop or the same crop but with a different herbicide resistance trait. When determining the correct clean-out procedure, it is important to consider the product's site of action, carrier, and additives. They all have an impact on what cleaning solutions to use and potential damage to sensitive crops.

Rinsate disposal. Clean the sprayer in an area that will not contaminate water supplies, streams, or crops and in an area inaccessible to children, pets, and livestock. Pay particular attention to sensitive vegetation that is in the runoff area. The best method for rinsate disposal is in the field in a manner consistent with the product's label. The easiest way to do this is to have rinse water available in the field, either on the sprayer or support vehicle.

Tank-cleaning agents. A tank-cleaning agent's function is to penetrate, loosen, and dissolve herbicide residues and then to remove them through dilution. In some cases, the agent will provide deactivation or decomposition of the herbicide.

- Commercial tank cleaners are recommended on many product labels and help remove water and oil-soluble herbicides.
- Household ammonia, a commonly recommended cleaning agent, is effective at penetrating and loosening deposits and residues in the spraying system. Although ammonia does not decompose herbicides, it increases the solubility of some herbicides by raising the pH.
- Chlorine bleach can decompose residues of most sulfonyleurea and other herbicides into inactive compounds. However, some tank-mix partners may inhibit the decomposition. Care must be used with chlorine bleach. Chlorine bleach can combine with fertilizers containing ammonia to produce dangerous chlorine gas, which is irritating to the eyes, nose, throat, and lungs. Also, rinsate containing chlorine bleach is not labeled for application to cropland.
- Kerosene or fuel oil should be used to remove oil-based herbicide formulations such as 2,4-D esters. Following the oil rinse, the system should be cleaned with detergent or ammo

Removing precipitated pesticides. Tank-mixing more than one pesticide can sometimes result in the chemicals forming a "gunky mess" in the bottom of the tank. The result is that the pesticides are not compatible with one another and the pesticides will settle out (form gunk). If your tank does end up with incompatible pesticides gunking up the bottom use a compatibility agent (usually at a pint/100 gallons, follow directions).

Surfactants and fertilizer additives. When switching from a growth regulator (group 4) herbicide (2,4-D, dicamba, Stinger, and others) to a postemergence application in soybeans, special care should be taken if the application involves surfactants or fertilizer additives. Such materials are particularly adept at removing these herbicides from poly tanks, hoses, and strainers. It is recommended that a small amount of fertilizer or crop oil be flushed through the system before the application.

General cleaning guidelines. To avoid drying and hardening of pesticide residues, and potential corrosion and damage to equipment, clean the sprayer immediately following an application. If you are continuing with the same pesticide the next day, flushing with water is sufficient. However, if you are switching products or crops, a more thorough cleaning is required.

Be sure to clean the entire sprayer system, not just the tank. Operate the pump and flush the cleaning solution through all hoses, strainers, screens, nozzles, and the boom. Small amounts of residue left in these areas can be sufficient to cause serious damage to a sensitive crop.

Most injury occurs when switching between crops or the same crop but with a different herbicide resistance trait. The following procedure is recommended when there are no specific cleaning requirements given on the label.

1. Drain the sprayer tank and lines and rinse tank, boom, and lines with water for a minimum of 5 minutes.

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2. Fill the tank with clean water and one of the following cleaning solutions per 100 gallons of water:

- 1 gallon household ammonia, **or**
- 8 lbs trisodium phosphate cleaner detergent, **or**
- commercial tank cleaner (follow instructions).

Flush the solutions through the entire sprayer system. For growth regulator herbicides (2,4-D, Clarity, Distinct, Stinger, etc.), let the solution stand overnight. Add more water to fill tank and agitate solution for at least 15 minutes and flush through the nozzles. Drain the tank.

3. Remove the nozzles, screens, and strainers and clean them separately in a bucket of cleaning agent and water.

4. Rinse the entire system with clean water.

Sprayer Calibration

Proper sprayer calibration is one of the most important steps in any integrated pest management program. There are many reasons why you should calibrate your sprayers at least once a year. One of the most important reasons is to ensure you are not over-applying or under-applying a pesticide. Applying too much pesticide hurts your bottom line, may harm non-target plants or insects and is illegal. Too little can lead to poor pest control. Sprayer calibration is a step many producers skip because they think it is too complicated or time consuming.

A simple method for sprayer calibration has been developed which requires very few calculations. This method is based on spraying 1/128th of an acre per nozzle and simply collecting the spray released during the time it takes to travel over that area. Since there are 128 fluid ounces in 1 gallon, the number of ounces collected equals the application rate in gallons per acre. This method works well for broadcast applications, banded applications and directed applications.

To calibrate your sprayer, you will need a measuring tape, a stopwatch and a graduated liquid measuring cup. Follow these steps to determine the sprayer output:

Step 1. Determine the nozzle spacing, band width or row spacing based on type of application. Example: 18 inch band application (see Table 1).

Step 2. Determine the calibration distance for the appropriate spacing using the information in Table 1. Example: 18 inch band = 226.9 feet calibration distance.

Step 3. Mark off the appropriate calibration distance you determined in step 2. To obtain the most accurate results, conduct this step in the actual field or under similar conditions to where you will be spraying.

Step 4. Drive the calibration distance at a safe operating speed several times to determine the average time to travel the course. **Note:** It is important that ALL attachments such as harrows or planters are in operation to ensure proper calibration. Write down the engine RPM, gear, speed and time required to travel the calibration distance. To ensure accuracy, drive the course at least twice and calculate the average time to travel the distance.

Step 5. With the sprayer parked and operating at the same engine speed used to drive the calibration distance (Step 4), adjust spray pressure to the desired setting. The recommended spray pressure setting can be found on the pesticide label or based on the nozzles selected.

Step 6. With the sprayer running, collect the spray from **all** nozzles that contribute to the desired spacing for the number of seconds that were required to travel the calibration distance in step 4. The number of nozzles that contribute to the spray area will depend on your application method:

- a. Broadcast Application:** All outlets are evenly spaced; however, because pressure differences can occur along the length of the boom, collect spray from all nozzles for the number of seconds required to travel the calibration distance.
- b. Band Application:** Spray from one or more nozzles contribute to cover a specific area. Collect spray from the total number of nozzles that contribute to the selected band width for the number of seconds required to travel the calibration distance

- c. Directed Application/Row Application:** Spray from one or more nozzles contributes to cover a specific area. Collect spray from the total number of nozzles that contribute to the selected width for the number of seconds required to travel the calibration distance.

The total number of fluid ounces collected is equal to the gallons per acre rate. The rate can be adjusted by adjusting the pressure, changing nozzles or by changing the applicator speed. If speed is adjusted, begin at step 4 and recalibrate.

Determining Tank Mix

To determine the amount of chemical to mix into the spray tank, divide the number of gallons in the tank by the broadcast application rate in gallons per acre (Step 6) and multiply by the labeled per acre application rate for the pesticide. Example: A sprayer has a 200-gallon tank, and it is calibrated to apply 20 gallons per acre. The labeled rate is one pint of pesticide per acre.

- a) 200-gallon tank/ 20 gallons per acre = 10 acres covered per tank
- b) 10 acres X 1 pint per acre = 10 pints of chemical per tank

Determine the Total Number of Acres Covered by a Banded Application

Use the broadcast pesticide rates to mix into the tank for a banded application. Since a banded application sprays less area than a broadcast application, the total treated acres can be determined by dividing the treated band width by the total treated band width plus the untreated band area. Example: The above sprayer set to spray a 12-inch band over a 36-inch row spacing.

- a) 12” band/36” row spacing = 0.33.
- b) 0.33 X 10 acres per tank (broadcast) = 3.3 acres sprayed for every 10 acres covered.
- c) 10 acres/tank (broadcast)/0.33 acres sprayed in the band = 30.3 acres sprayed per tank.

Row spacing, nozzle spacing (broadcast) or band width (banded application) (inches)	Calibration distance (feet)
48	85.1
40	102.1
36	113.4
32	127.6
30	136.1
28	145.8
24	170.2
20	204.2
18	226.9
12	340.3
8	510.5

To determine a nozzle spacing not listed above, divide the band width in feet into 340.3.

Example: 7-inch band = 340.3 ÷ 7”/12” = 583.4

Taken with permission from Rutgers Cooperative Extension, Fact Sheet FS1085 by Stephen Komar, Bill Bamka, and Robert Mickel.

Corn Weed Management

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Integrated Weed Management

An integrated approach to managing weeds in corn includes using cultural weed control, mechanical controls where applicable, and the judicious use of herbicides. Corn fields that are weed free for the first four to six weeks after planting will often yield the same as fields that are weed free for the entire growing season. This approach relies on starting with a clean seedbed and using residual soil-applied herbicides or mechanical control. Weeds that germinate with the crop but are controlled in a timely fashion (four to five weeks after planting) will also not impact final yields. This POST herbicide approach relies on effective and timely postemergence weed control. Also, it is not necessary to control all weeds in a field to achieve maximum yield. However, certain weeds can still be problematic at harvest even at low levels (e.g., burcucumber). Weed populations of one to two weeds per 10 square feet are sufficient to cause severe yield loss depending on the species. However, weed populations at one plant per 100 square feet will have no impact on final yield. The impact of weed populations between one and 10 per 100 square feet is difficult to predict. The decision to treat the field depends on the weed species present, crop vigor, weather conditions, and herbicide cost. For more comprehensive discussion of integrated weed management see the *Integrated Weed Management Guide for Mid-Atlantic Grain Crops*.

Chemical Weed Control

Herbicides are useful tools in most weed management programs. This chapter will focus on herbicides available for use in corn. They should be used to supplement, not replace, other methods or tools available. The following are definitions of terms you will find in this and similar publications on herbicides:

Early preplant (EPP) - The herbicide is applied at least 14 days before planting. EPP applications are generally used in no-till systems to control existing vegetation and provide residual control of early-emerging weed species.

Preplant - The herbicide is applied from 0 to 14 days before planting. Preplant applications are generally used in no-till systems to control emerged weed species.

Preplant Incorporated (PPI) - The herbicide is applied to the soil after primary tillage, but before planting, and mechanically mixed with the top 1 to 3 inches of soil with one of a variety of secondary tillage implements.

Preemergence (PRE) - The herbicide is applied to the soil after the crop is planted but before emergence. Rainfall or irrigation is needed to move the herbicide into the zone of weed seed germination before weed emergence for maximum effectiveness. If adequate rainfall for herbicide activation does not occur, a shallow cultivation or rotary hoeing should be done to control weeds that have germinated.

Postemergence (POST) - The herbicide is applied to the foliage of the crop and weeds after they have emerged.

Post-directed (or directed) - Refers to use of special spray equipment to direct the spray at the weeds but avoid the spray coming in contact with as much of the crop as possible.

Residual activity - Herbicides that can be taken up by plants' roots and shoots and injure or kill the plant. All soil-applied herbicides have residual activity as well as many postemergence herbicides. Length of residual activity ranges from a few weeks to a few months.

Translocated herbicide - These herbicides move throughout the plant and can cause injury to parts of the plants that do not come in direct contact with the herbicide spray.

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Contact herbicide - These herbicides do not move throughout the plant. They cause injury only to those parts of the plant that comes in contact with the spray. Spray coverage is more critical for contact than translocated herbicides.

Non-selective herbicide - This refers to herbicides that control a broad-spectrum of plant species, including most crops and weeds. These herbicides are generally used with no-tillage production and are sprayed prior to planting when control of all plants is required.

Herbicide-Resistant Varieties

Some corn hybrids have been genetically enhanced to withstand herbicide applications that previously would have injured or killed corn. Genetically enhanced varieties allow herbicides to be used that provide a broader spectrum of control than would otherwise be available. Herbicide programs for genetically enhanced varieties also reduce the risk of crop injury associated with herbicide programs for conventional varieties.

LibertyLink corn is a GMO corn trait that allows over-the-top applications of Liberty (glufosinate) herbicide. This program should provide broad-spectrum control of annual broadleaves and grasses when in the seedling stage. Sequential applications or tank mixtures may be required for new weed flushes and perennials. This herbicide is becoming more important for the management of glyphosate resistant weeds such as horseweed, waterhemp, and Palmer amaranth.

Roundup Ready corn was developed using genetic engineering techniques (GMO). It has an altered target site that is not sensitive to glyphosate and allows postemergence applications of glyphosate directly to corn. Glyphosate resistant weeds are becoming an increasing issue in Roundup Ready crops.

Enlist corn is a GMO trait that is tolerant to glyphosate and improves 2,4-D tolerance. It also provides tolerance to FOP herbicides such as Assure II, but is sensitive to DIM herbicides such as clethodim. More varieties are becoming available that contain multiple or “stacked” traits such as both Roundup Ready and LibertyLink as well as various insect-resistant traits.

Herbicide Resistant Weeds in Corn

Herbicide-resistant weeds are common in corn in the Mid-Atlantic region. Weed species with a very high amount of seed production and a variable genetic variation are more likely to develop resistant populations—for example, common lambsquarters and pigweed species. Resistance management requires using herbicides with multiple effective modes of action and integrating mechanical (tillage and cultivation) or cultural weed control (cover crops, narrow row spacing, proper crop fertility, etc.) with chemical weed control.

Triazine-resistance. Weeds resistant to the Group 5 herbicides (triazines) in the Mid-Atlantic region include common lambsquarters, Palmer amaranth, redroot and smooth pigweed, horseweed, scattered populations of barnyardgrass, giant foxtail, goosegrass, and suspected populations of common ragweed and velvetleaf. Atrazine and simazine are the primary Group 5 herbicides used in corn. A number of POST products can provide good control of triazine-resistant (TR) weeds on corn.

For TR pigweed control, include a Group 15 herbicide for residual control (acetochlor, dimethenamid, *S*-metolachlor, or pyroxasulfone) at planting. The Group 15 herbicides will suppress initial TR pigweed, but in most years a postemergence application of a non-triazine herbicide will be needed for full-season control.

For TR lambsquarters, some of the Group 15 herbicides will help suppress emergence (acetochlor and pyroxasulfone), but they are not as active on lambsquarters as they are on pigweed. The Group 3 herbicide pendimethalin can provide good control of TR lambsquarters when applied prior to emergence. In addition, residual control can be obtained with products such as mesotrione or isoxaflutole.

ALS-resistance. Weeds resistant to the Group 2 herbicides (ALS) in the Mid-Atlantic region include several pigweed species, common and giant ragweed, common chickweed, horseweed, Italian ryegrass, giant foxtail, Johnsongrass, and shattercane. The principal issue with most ALS-resistant weeds in corn is lack of efficacy with POST ALS inhibitor products. For example, do not rely on nicosulfuron or rimsulfuron for POST control of resistant foxtail, Johnsongrass, or shattercane. ALS-resistant Johnsongrass and shattercane are a particular concern as only glyphosate and glufosinate are available for POST control in corn. Also, ALS-resistant broadleaves will not be controlled with halosulfuron or other Group 2 herbicides.

Glyphosate-resistance. Weeds resistant to the Group 9 herbicide glyphosate in the Mid-Atlantic region include Palmer ama-

ranth and waterhemp, common and giant ragweed, and horseweed. In corn, all of these can be managed with alternative herbicides, including the Group 4 growth regulators, the triazines if they are not Group 5 resistant, and several others, including the Group 27 herbicides such as mesotrione and isoxaflutole.

Control of Roundup Ready Corn: Volunteers or Replanting. There are times when corn has to be removed from a field with the intention of replanting a corn crop. Tillage is one effective method, but it is not appropriate in no-tillage situations. Use of glyphosate is highly effective for non-Roundup Ready corn. However, the challenge is in removing Roundup Ready hybrids. There are limited herbicides to consistently kill small corn plants. Gramoxone SL, Liberty, and Select are three products that have shown the most activity. Research conducted in this region with Gramoxone and Select demonstrated that Select was the most effective for corn 2 to 3 inches tall. For taller corn (4 to 6 inches tall), Gramoxone in combination with a photosystem II-inhibiting herbicide (metribuzin, Lorox, or atrazine) was the most effective. Liberty is a third option, but it will not control LibertyLink hybrids.

Select Max. up to 6 oz of Select Max with a nonionic surfactant at 0.25% v/v plus AMS at 2.5 to 4 lbs/A. Do not use a COC or MSO. Wait a minimum of 6 days from time of application until planting corn due to risk of crop injury. (Select Max will also control corn hybrids containing Roundup Ready and LibertyLink stacked traits.)

Gramoxone SL 2.0. 3 to 4.5 pt/A (2 to 2.7 pints of 3.0 SL formulation) in combination with metribuzin (4 to 6 oz/A), Lorox (1 pt/A) or atrazine (1 lb/A). These photosystem II inhibitors are not added to control the corn but are used to slow down the Gramoxone activity, which helps provide more consistent control.

Liberty 280. 22 to 29 oz Liberty has not been as consistent for controlling corn as Gramoxone and will not control varieties that contain the LibertyLink trait.

Table 5.6 - Corn Herbicides and Their Restrictions

Herbicide Trade Name	Herbicide Common Name	Herbicide group # (site of action)	Manufacturer	Restricted-Use Pesticide ¹	Water Quality Advisory ²	Worker Reentry (Hours) ³
2,4-D amine 4S	2,4-D amine	4	several	—	—	48
2,4-D LVE 4E	2,4-D LVE	4	several	—	—	12
Aatrex, Atrazine 4L/90DF	atrazine	5	Syngenta, others	yes	yes	12
Accent Q 54.5WG	nicosulfuron + safener	2	Corteva	—	—	4
Acuron 3.44SC	S-metolachlor + atrazine + mesotrione + bicyclopyrone	15/5/27/27	Syngenta	yes	yes	24
Acuron Flexi 3.26SC	S-metolachlor + mesotrione + bicyclopyrone	15/27/27	Syngenta	—	yes	24
Acuron GT 4.295SC	S-metolachlor + mesotrione + bicyclopyrone + glyphosate ⁴	15/27/27/9	Syngenta	—	yes	24
Aim 2EC	carfentrazone-ethyl	14	FMC	—	—	12
Anthem ATZ 4.5SE	atrazine + pyroxasulfone + fluthiacet	5/15/14	FMC	yes	yes	12
Anthem Maxx 4.3SC	pyroxasulfone + fluthiacet	15/14	FMC	—	yes	12
Anthem Flex 4SE	pyroxasulfone + carfentrazone	15/14	FMC	—	yes	12
Armezon 2.8SC	topramezone	27	BASF	—	—	12
Armezon PRO 5.35EC	topramezone + dimethenamid	27/15	BASF	—	yes	12
Assure II 0.88E/Targa	quizalofop	1	AMVAC/ Gowan	—	—	12

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Table 5.6 - Corn Herbicides and Their Restrictions (cont.)

Trade Name	Common Name	Herbicide group # (site of action)	Manufacturer	Restricted-Use Pesticide ¹	Water Quality Advisory ²	Worker Reentry (Hours) ³
Autumn Super 51WDG	iodosulfuron + thien carbazon	2/2	Bayer CropScience	—	—	12
Axiom 68DF	flufenacet + metribuzin	15/5	Bayer CropScience	—	yes	12
Balance Flexx 2SC	isoxaflutole + safener	27	Bayer CropScience	yes	yes	12
Basagran 4S	bentazon	6	several	—	yes	12
Basis Blend 30DF	rimsulfuron + thifensulfuron	2/2	Corteva	—	—	4
Bicep II Magnum 5.5SC/ Cinch ATZ	S-metolachlor + atrazine + safener	15/5	Syngenta/ Corteva	yes	yes	24
Bicep Lite II Magnum 6SC/ Cinch ATZ Lite	S-metolachlor + atrazine + safener	15/5	Syngenta/ Corteva	yes	yes	24
Cadet 0.91EC	fluthiacet	14	FMC	—	yes	12
Calibra 3.1ZC	S-metolachlor + mesotrione	15/27	Syngenta	—	yes	24
Callisto 4SC	mesotrione	27	Syngenta	—	—	12
Callisto Xtra 3.7SC	mesotrione + atrazine	27/5	Syngenta	yes	yes	12
Capreno 3.45SC	tembotrione + thien carbazon + safener	27/2	Bayer CropScience	—	yes	12
Clarity 4S	dicamba	4	BASF	—	yes	24
Corvus 2.63SC	isoxaflutole + thien carbazon + safener	27/2	Bayer CropScience	yes	yes	12
Coyote 3.67EC	S-metolachlor + mesotrione	15/27	UPL	—	yes	24
Curtail 2.38L	clopyralid + 2,4-D	4/4	Corteva	—	—	48
Defol 5L	sodium chlorate	not classified	Drexel	—	—	12
Degree Xtra 4.04ME	acetochlor + atrazine	15/5	Monsanto	yes	yes	12
DiFlexx 4SC	dicamba + safener	4	Bayer CropScience	—	yes	24
DiFlexx DUO 1.53SC	dicamba + tembotrione + safener	4/27	Bayer CropScience	—	yes	24
Distinct 70DF	dicamba + diflufenzopyr	4/19	BASF	—	yes	12
Dual Magnum 7.62E	S-metolachlor	15	Syngenta	—	yes	24
Dual II Magnum 7.64E	S-metolachlor + safener	15	Syngenta	—	yes	24
Durango DMA/DuraMax 4S	glyphosate	9	Corteva	—	—	4
Elevore 0.57L	halauxifen	4	Corteva	—	yes	12
Engenia 5SL	dicamba (BAPMA salt)	4	BASF	yes	yes	24
Enlist Duo 3.3SL	2,4-D choline + glyphosate	4/9	Corteva	—	—	48
Enlist One 3.8SL	2,4-D choline	4	Corteva	—	—	48
Empyros 3.82EC	S-metolachlor + tolpyralate	15/27	Helena	—	yes	12
Enversa 3CS	acetochlor	15	Corteva	—	yes	12
EverpreX 7.62E	S-metolachlor	15	Corteva	—	yes	24

Table 5.6 - Corn Herbicides and Their Restrictions (cont.)

Trade Name	Common Name	Herbicide group # (site of action)	Manufacturer	Restricted-Use Pesticide ¹	Water Quality Advisory ²	Worker Reentry (Hours) ³
Evik 80W	ametryn	5	Syngenta	—	—	12
Expert 4.88L	atrazine + S-metolachlor + glyphosate	5/15/9	Syngenta	yes	yes	12
Fierce 76WDG/Fierce EZ 3.04SC	pyroxasulfone + flumioxazin	15/14	Valent	—	yes	12
FirstShot 50WDG	thifensulfuron + tribenuron	2/2	FMC	—	—	12
FulTime NXT 4.04EC	acetochlor + atrazine	15/5	Corteva	yes	yes	12
Gramoxone SL 2S/3S	paraquat	22	Syngenta	yes	—	12–24
Halex GT 4.39EC	S-metolachlor + mesotrione + glyphosate ⁴	15/27/9	Syngenta	—	yes	24
Harmony Extra SG 50WDG/Audit 1:1	thifensulfuron + tribenuron	2/2	FMC/UPL	—	—	12
Harmony SG 50WDG	thifensulfuron	2	FMC	—	—	4
Harness 7E	acetochlor + safener	15	Bayer CropScience	—	yes	12
Harness MAX 3.85L	acetochlor + mesotrione	15/27	Bayer CropScience	—	yes	12
Harness Xtra 5.6/6L	acetochlor + atrazine	15/5	Bayer CropScience	—	yes	12
Hornet 78.5WDG	flumetsulam + clopyralid	2/4	AMVAC	—	yes	48
Impact 2.8SC/Armezon	topramezone	27	AMVAC/BASF	—	—	12
Impact Core 7.15SC	topramezone + acetochlor	27/15	AMVAC	—	yes	12
ImpactZ 4.26SC	topramezone + atrazine	27/5	AMVAC	yes	yes	12
Katagon 2OD	tolpyralate + nicosulfuron	27/2	Helm	—	yes	12
Keystone LA NXT 6SE	acetochlor + atrazine	15/5	Corteva	yes	yes	12
Keystone NXT 5.6SE	acetochlor + atrazine	15/5	Corteva	yes	yes	12
Kyro 3.1CS	acetochlor + topramezone + clopyralid	15/27/4	Corteva	—	yes	48
Laudis 3.5SC	tembotrione	27	Bayer CropScience	—	yes	12
Liberty 280 2.34L ⁵ /Rely 280	glufosinate	10	BASF	—	—	12
Lightning 70DG ⁶	imazethapyr + imazapyr	2/2	BASF	—	yes	12
Lorox 50DF/Linex 4L	linuron	5	Nova Source	—	—	24
Lumax EZ 3.67SC/Lexar EZ 3.7SC	S-metolachlor + mesotrione + atrazine	15/27/5	Syngenta	yes	yes	24
Maestro 2E/Moxy (Buctril)	bromoxynil	6	Nufarm/WinField	—	—	24
Maverick 2.04SC	pyroxasulfone + mesotrione + clopyralid	15/27/4	Valent	—	yes	12
Metribuzin 75DF/4L	metribuzin	5	various	—	yes	12
Outlook 6EC	dimethenamid	15	BASF	—	yes	12

5-34 Weed Control in Field Crops: Corn

Table 5.6 - Corn Herbicides and Their Restrictions (cont.)

Trade Name	Common Name	Herbicide group # (site of action)	Manufacturer	Restricted-Use Pesticide ¹	Water Quality Advisory ²	Worker Reentry (Hours) ³
Panoflex 50WDG	thifensulfuron + tribenuron	2/2	FMC	—	—	12
Peak 57WG	prosulfuron	2	Gowan	—	yes	12
Permit 75WG	halosulfuron	2	Gowan	—	—	12
Permit Plus 74WDG	halosulfuron + thifensulfuron	2/2	Gowan	—	—	12
Perpetuo 2.3SC	pyroxasulfone + flumiclorac	15/14	Valent	—	yes	12
Princep, Simazine, 4L/90DF	simazine	5	Syngenta, others	—	yes	12
Prowl 3.3E	pendimethalin	3	BASF	—	—	24
Prowl H ₂ O 3.8CS	pendimethalin	3	BASF	—	—	24
Python 80WDG	flumetsulam	2	AMVAC	—	yes	12
Realm Q 39WDG	rimsulfuron + mesotrione + safener	2/27	Corteva	—	yes	12
Resicore 3.29SE/Resicore REV 3.26SE	acetochlor + mesotrione + clopyralid + safener	15/27/4	Corteva	—	yes	12
Resolve 25DF	rimsulfuron	2	Corteva	—	—	4
Resolve Q 22.4WDG	rimsulfuron + thifensulfuron + safener	2/2	Corteva	—	—	4
Resource 0.86E	flumiclorac	14	Valent	—	—	12
Restraint 6.5EC	acetochlor + tolpyralate	15/27	Summit Agro	—	yes	12
Reviton 2.83SC	tiafenacil	14	Helm	—	yes	12
Revolin Q 51.2WDG	nicosulfuron + mesotrione	2/27	Corteva	—	—	12
Roundup WeatherMax 4.5S/PowerMax 4.5S/PowerMAX3 4.8S	glyphosate	9	Monsanto	—	—	4
Sequence 5.25EW	glyphosate + S-metolachlor	9/15	Syngenta	—	yes	24
Sharpen 2.85SC	saflufenacil	14	BASF	—	yes	12
Shieldex 400SC (3.33SC)	tolpyralate	27	Summit Agro	—	yes	12
Sinate 2.57L	topramezone + glufosinate	27/10	AMVAC	—	yes	12
Starane Ultra 2.8L	fluroxypyr	4	Corteva	—	—	12
Status 56WG	dicamba + diflufenzopyr + isoxadifen	4/19	BASF	—	yes	12
Steadfast Q 37.7WG	nicosulfuron + rimsulfuron + safener	2/2	Corteva	—	—	4
Stinger 3S	clopyralid	4	Corteva	—	yes	12
Storen 3.2ZC	S-metolachlor + mesotrione + pyroxasulfone + bicyclopyrone	15/27/15/27	Syngenta	—	yes	24
Stout 72.5WDG	nicosulfuron + thifensulfuron	2/2	Corteva	—	—	4
SureStart II 4.25SE/ TripleFLEX II	acetochlor + flumetsulam + clopyralid	15/2/4	Corteva/ Monsanto	—	yes	12

Table 5.6 - Corn Herbicides and Their Restrictions (cont.)

Trade Name	Common Name	Herbicide group # (site of action)	Manufacturer	Restricted-Use Pesticide ¹	Water Quality Advisory ²	Worker Reentry (Hours) ³
Surpass NXT 7E	acetochlor + safener	15	Corteva	—	yes	12
Sustain 1.63CS	saflufenacil + pyroxasulfone	14/15	BASF	—	yes	12
TopNotch 3.2ME	acetochlor + safener	15	Corteva	—	yes	12
Tough 5EC	pyridate	6	Belchim	—	—	12
TriVolt 3.65SC	isoxaflutole + flufenacet + thiencazone	27/15/2	Bayer CropScience	yes	yes	12
Tripzin 4ZC	pendimethalin + metribuzin	3/5	UPL	—	yes	24
ValorSX 51WDG/Valor EZ 4SC	flumioxazin	14	Valent	—	—	12
Verdict 5.57EC	saflufenacil + dimethenamid	14/15	BASF	—	yes	12
Warrant 3CS	acetochlor	15	Monsanto	—	yes	12
Xtendimax 2.9SL	dicamba	4	Monsanto	yes	yes	24
Yukon 67.5WDG	halosulfuron + dicamba	2/4	Gowan	—	—	12
Zidua SC 4.17L	pyroxasulfone	15	BASF	—	yes	12

¹ Only licensed applicators may purchase and apply restricted-use pesticides. To become licensed, contact the Pennsylvania Department of Agriculture.

² These herbicides have properties that may result in ground or surface water contamination. Do not apply them in areas where soils are permeable or coarse and groundwater is near the surface. Practices should be followed to minimize the potential for dissolved runoff and/or runoff erosion. See the herbicide label for specific restrictions.

³ If soil-applied products are incorporated at application time, under certain circumstances the Worker Protection Standard allows workers to enter the treated area if they will have no contact with anything that has been treated. Personal protective equipment is required for early entry to treated areas if contact with treated soil, plants, or water is involved.

⁴ For use on glyphosate-resistant corn hybrids only (Roundup Ready).

⁵ For use on glufosinate-resistant corn hybrids only (Liberty Link).

⁶ For use only on IMI (IR/IT) or Clearfield (CL) corn hybrids.

Table 5.7 - Corn Herbicide Prepackaged Mixes or Co-Packs, and Equivalents

Herbicide Trade Name	Components (ai or ae/gal or lb)	If you apply (per acre)...	You have applied (ai or ae)	Site of Action Number	An equivalent tank-mix of
Acuron 3.44SC	2.14 lb S-metolachlor	2.5 qt	1.34 lb S-metolachlor	15	1.4 pt Dual II Magnum 7.64E
	0.24 lb mesotrione		0.15 lb mesotrione	27	4.8 fl oz Callisto 4SC
	0.06 lb bicyclopyrone		0.038 lb bicyclopyrone	27	0.038 lb bicyclopyrone
	1 lb atrazine		0.625 lb atrazine	5	0.625 qt atrazine 4L
Acuron Flexi 3.26SC	2.86 lb S-metolachlor	2 qt	1.43 lb S-metolachlor	15	1.5 pt Dual II Magnum 7.64E
	0.32 lb mesotrione		0.16 lb mesotrione	27	5.12 fl oz Callisto 4SC
	0.08 lb bicyclopyrone		0.04 lb bicyclopyrone	27	0.04 lb bicyclopyrone

Table 5.7 - Corn Herbicide Prepackaged Mixes or Co-Packs, and Equivalents (cont.)

Product	Components (ai or ae/gal or lb)	If you apply (per acre)...	You have applied (ai or ae)	Site of Action Number	An equivalent tank- mix of
Acuron GT 4.29SC	2 lb S-metolachlor	3.75 pt	0.94 lb S-metolachlor	15	1 pt Dual Magnum 7.62E
	0.2 lb mesotrione		0.09 lb mesotrione	27	3 fl oz Callisto 4SC
	0.095 lb bicyclopyrone		0.044 lb bicyclopyrone	27	0.044 lb bicyclopyrone
	2 lb glyphosate		0.94 lb glyphosate (ae)	9	27 fl oz glyphosate 4.5S
Anthem Flex 4SE	3.733 lb pyroxasulfone	3.5 fl oz	0.102 lb pyroxasulfone	15	3.1 fl oz Zidua 4.17SC
	0.267 lb carfentrazone		0.007 lb carfentrazone	14	0.47 fl oz Aim 2EC
Anthem Maxx 4.3SC	4.174 lb pyroxasulfone	4 fl oz	0.133 lb pyroxasulfone	15	4.1 oz Zidua 4.17SC
	0.126 lb fluthiacet		0.004 lb fluthiacet	14	0.56 oz Cadet 0.91EC
Armezon PRO 5.35EC	0.1 lb topramezon	24 fl oz	0.017 lb topramezon	27	0.76 fl oz Armezon 2.8SC
	5.25 lb dimethenamid		0.84 lb dimethenamid	15	18 fl oz Outlook 6EC
Autumn Super 51WDG	0.06 lb iodosulfuron	0.4 oz	0.002 lb iodosulfuron	2	0.024 oz ai iodosulfuron
	0.45 lb thiencazabone		0.011 lb thiencazabone	2	0.18 oz ai thiencazabone
Axiom 68DF	0.544 lb flufenacet	16 oz	0.544 lb flufenacet	15	17 oz Define 4SC
	0.136 lb metribuzin		0.136 lb metribuzin	5	2.9 oz Metribuzin 75DF
Basis Blend 30DF	0.20 lb rimsulfuron	0.825 oz	0.01 lb rimsulfuron	2	0.64 oz Resolve 25DF
	0.10 lb thifensulfuron		0.005 lb thifensulfuron	2	0.16 oz Harmony SG 50DF
Bicep II Magnum 5.5SC/ Cinch ATZ	2.4 lb S-metolachlor	2.1 qt	1.26 lb S-metolachlor	15	1.33 pt Dual II Magnum 7.64E
	3.1 lb atrazine		1.63 lb atrazine	5	1.63 qt atrazine 4L
Bicep Lite II Magnum 6L/Cinch ATZ Lite	3.33 lb S-metolachlor	1.3 qt	1.08 lb S-metolachlor	15	1.13 pt Dual II Magnum 7.64E
	2.67 lb atrazine		0.87 lb atrazine	5	0.87 qt atrazine 4L
Callisto GT	0.38 lb mesotrione	2 pt	0.095 lb mesotrione	27	3.04 fl oz Callisto 4SC
	3.8 lb glyphosate		0.95 lb glyphosate	9	27 fl oz glyphosate 4.5S
Callisto Xtra 3.7SC	0.5 lb mesotrione	24 fl oz	0.09 lb mesotrione	27	3 fl oz Callisto 4SC
	3.2 lb atrazine		0.6 lb atrazine	5	1.2 pt atrazine 4L
Capreno 3.45SC	2.88 lb tembotrione	3 fl oz	0.068 lb tembotrione	27	2.5 fl oz Laudis 3.5SC
	0.57 lb thiencazabone		0.013 lb ai thiencazabone	2	0.21 oz ai thiencazabone
Corvus 2.63SC	1.88 lb isoxaflutole	5.6 fl oz	0.083 lb isoxaflutole	27	5.3 fl oz Balance Flexx 2SC
	0.75 lb thiencazabone		0.033 lb thiencazabone	2	0.52 oz ai thiencazabone
Coyote 3.67SC	0.33 mesotrione	2 qts	0.168 lb mesotrione	27	5.36 fl oz Callisto 4SC
	3.34 S-metolachlor		1.67 lb S-metolachlor	15	1.75 pt Dual II Magnum 7.64 EC

Table 5.7 - Corn Herbicide Prepackaged Mixes or Co-Packs, and Equivalents (cont.)

Product	Components (ai or ae/gal or lb)	If you apply (per acre)...	You have applied (ai or ae)	Site of Action Number	An equivalent tank-mix of
Curtail 2.38L	0.38 lb clopyralid	2 pt	0.095 lb clopyralid	4	0.25 pt Stinger 3S
	2.0 lb 2,4-D		0.5 lb 2,4D	4	1.0 pt 2,4-D 4S
Degree Xtra 4.04ME	2.7 lb acetochlor	3 qt	2.03 lb acetochlor	15	2.3 pt Harness 7E
	1.34 lb atrazine		1.0 lb atrazine	5	1.0 qt atrazine 4L
DiFlexx Duo 1.53SC	1.26 lb dicamba	32 fl oz	0.32 lb dicamba	4	10.25 oz DiFlexx 4SC
	0.27 lb tembotrione		0.068 lb tembotrione	27	2.5 fl oz Laudis 3.5SC
Enlist Duo 3.3SL	1.6 lb 2,4-D choline salt	4.75 pt	0.95 lb ae 2,4-D	4	30 fl oz Enlist One 3.8SL
	1.7 lb glyphosate		1.0 lb ae glyphosate	9	32 fl oz Durango DMA
Expert 4.88L	1.74 lb S-metolachlor	3 qt	1.3 lb S-metolachlor	15	1.4 pt Dual II Magnum 7.64E
	2.14 lb atrazine		1.6 lb atrazine	5	1.6 qt atrazine 4L
	0.75 lb ae glyphosate		0.75 lb glyphosate	9	1.5 pt glyphosate 4S
Fierce 76WDG	0.335 lb flumioxazin	3 oz	1.0 oz flumioxazin	14	2.0 oz Valor SX 51WG
	0.425 lb pyroxasulfone		1.28 oz pyroxasulfone	15	1.5 oz Zidua 85WG
Fierce EZ 3.04SC	1.34 lb flumioxazin	6 fl oz	0.063 lb flumioxazin	14	2 oz Valor SX 51WDG
	1.70 lb pyroxasulfone		0.08 lb pyroxasulfone	15	2.46 fl oz Zidua 4.17SC
FulTime NXT 4.04CS	2.7 lb acetochlor	3 qt	2 lb acetochlor	15	2.5 qt TopNotch 3.2ME
	1.34 lb atrazine		1 lb atrazine	5	1 qt atrazine 4L
Halex GT 4.39EC	2.09 lb S-metolachlor	3.6 pt	0.94 lb S-metolachlor	15	1.0 pt Dual Magnum 7.62E
	0.209 lb mesotrione		0.09 lb mesotrione	27	3.0 fl oz Callisto 4SC
	2.09 lb glyphosate		0.94 lb glyphosate (ae)	9	27 fl oz glyphosate 4.5S
Harness MAX 3.85L	3.52 lb acetochlor	2 qt	1.76 lb acetochlor	15	2 pt Harness 7E
	0.33 lb mesotrione		0.165 lb mesotrione	27	5.3 fl oz Callisto 4SC
Harness Xtra 6.0L	4.3 lb acetochlor	2 qt	2.15 lb acetochlor	15	2.46 pt Harness 7E
	1.7 lb atrazine		0.85 lb atrazine	5	0.85 qt atrazine 4L
Harness Xtra 5.6L	3.1 lb acetochlor	2.5 qt	1.94 lb acetochlor	15	2.21 pt Harness 7E
	2.5 lb atrazine		1.56 lb atrazine	5	1.56 qt atrazine 4L
Hornet 78.5 WDG	0.185 lb flumetsulam	5 oz	0.058 lb flumetsulam	2	1.15 oz Python 80WDG
	0.5 lb clopyralid		0.195 lb clopyralid	4	6.7 fl oz Stinger 3S
Impact Core 7.15SC	7.08 lb acetochlor	30 fl oz	1.66 lb acetochlor	15	1.9 pt Harness 7E
	0.071 lb topramezone		0.017 lb topramezone	27	0.77 fl oz Impact 2.8SC
ImpactZ 4.26SC	4 lb atrazine	10.7 fl oz	0.33 lb atrazine	5	10.6 fl oz atrazine 4L
	0.26 lb topramezone		0.02 lb topramezone	27	1 fl oz Impact 2.8SC
Keystone LA NXT 6SE	4.3 lb acetochlor	2.3 qt	2.47 lb acetochlor	15	2.7 pt Surpass NXT 7EC
	1.5 lb atrazine		1.43 lb atrazine	5	1.95 pt atrazine 4L

Table 5.7 - Corn Herbicide Prepackaged Mixes or Co-Packs, and Equivalents (cont.)

Product	Components (ai or ae/gal or lb)	If you apply (per acre)...	You have applied (ai or ae)	Site of Action Number	An equivalent tank- mix of
Keystone NXT 5.6SE	3.1 lb acetochlor	2.5 qt	1.94 lb acetochlor	15	2.22 pt Surpass/ Breakfree NXT
	2.5 lb atrazine		1.57 lb atrazine	5	3.15 pt atrazine 4L
Kryo 3.1CS	2.78 lb acetochlor	45 fl oz	0.977 lb acetochlor	15	1.1 pt Harness 7E
	0.046 lb topramezone		0.016 lb topramezone	27	0.73 fl oz Armezon 2.8SC
	0.247 lb clopyralid		0.087 lb clopyralid	4	0.23 pt Stinger 3S
Lexar EZ 3.7SC	1.74 lb S-metolachlor	3 qt	1.3 lb S-metolachlor	15	1.36 pt Dual II Magnum 7.64E
	0.224 lb mesotrione		0.168 lb mesotrione	27	5.36 oz Callisto 4SC
	1.74 lb atrazine		1.3 lb atrazine	5	1.3 qt atrazine 4L
Lumax EZ 3.67SC	2.49 lb S-metolachlor	2.7 qt	1.67 lb S-metolachlor	15	1.75 pt Dual II Magnum 7.64E
	0.249 lb mesotrione		0.168 lb mesotrione	27	5.36 oz Callisto 4SC
	0.935 lb atrazine		0.625 lb atrazine	5	0.625 qt atrazine 4L
Maverick 2.04SC	0.693 lb pyroxasulfone	32 fl oz	0.173 lb pyroxasulfone	15	5.3 fl oz Zidua 4.17SC
	0.829 lb mesotrione		0.207 lb mesotrione	27	6.6 fl oz Callisto 4SC
	0.525 lb clopyralid		0.131 lb clopyralid	4	5.6 fl oz Stinger 3S
Permit Plus 74WDG	0.662 lb halosulfuron	0.75 oz	0.031 lb halosulfuron	2	0.67 oz Permit 75WG
	0.078 lb thifensulfuron		0.004 lb thifensulfuron	2	0.12 oz Harmony 50SG
Perpetuo 2.3SC	0.59 lb flumiclorac	8 fl oz	0.037 lb flumiclorac	14	5.5 fl oz Resource 0.86EC
	1.71 lb pyroxasulfone		0.107 lb pyroxasulfone	15	3.28 fl oz Zidua 4.17SC
Realm Q 38.75WDG	0.075 lb rimsulfuron	4 oz	0.019 lb rimsulfuron	2	1.2 oz Resolve 25WG
	0.313 lb mesotrione		0.078 lb mesotrione	27	2.5 fl oz Callisto 4SC
Resicore 3.29SE	2.8 lb acetochlor	2.5 qt	1.75 lb acetochlor	15	2 pt Surpass NXT 7E
	0.3 lb mesotrione		0.18 lb mesotrione	27	5.76 fl oz Callisto 4SC
	0.19 lb clopyralid		0.119 lb clopyralid	4	0.3 pt Stinger 3S
Resolve Q 22.4WDG	0.184 lb rimsulfuron	1.25 oz	0.014 lb rimsulfuron	2	0.9 oz Resolve 25DF
	0.04 lb thifensulfuron		0.003 lb thifensulfuron	2	0.1 oz Harmony 50SG
Revulin Q 51.2WDG	0.144 lb nicosulfuron	4 oz	0.58 oz nicosulfuron	2	1.1 oz Accent Q 54.5WG
	0.368 lb mesotrione		1.5 oz mesotrione	27	3 fl oz Callisto 4SC
Sinate 2.57L	0.1 lb topramezone	28 fl oz	0.022 lb topramezone	27	1 fl oz Impact 2.8SC
	2.47 lb glufosinate		0.54 lb glufosinate	10	29.5 fl oz Liberty 2.34L
Status 56WG	0.4 lb dicamba	5 oz	0.125 lb dicamba	4	4 fl oz Clarity 4S
	0.16 lb diflufenzopyr		0.05 lb diflufenzopyr	19	0.05 lb diflufenzopyr

Table 5.7 - Corn Herbicide Prepackaged Mixes or Co-Packs, and Equivalents (cont.)

Product	Components (ai or ae/gal or lb)	If you apply (per acre)...	You have applied (ai or ae)	Site of Action Number	An equivalent tank- mix of
Steadfast Q 37.7WG	0.125 lb rimsulfuron	1.5 oz	0.012 lb rimsulfuron	2	0.76 oz Resolve 25WG
	0.252 lb nicosulfuron		0.02 lb nicosulfuron	2	0.7 oz Accent Q 54.5WG
Storen 3.24ZC	2.69 lb S-metolachlor	2.1 qt	1.41 lb S-metolachlor	15	1.48 pt Dual II Magnum 7.64E
	0.31 lb mesotrione		0.163 lb mesotrione	27	5.2 fl oz Callisto 4SC
	0.15 lb pyroxasulfone		0.079 lb pyroxasulfone	15	2.4 fl oz Zidua 4.17SC
	0.075 lb bicyclopyrone		0.039 lb bicyclopyrone	27	0.039 lb bicyclopyrone
Stout 72.5WDG	0.675 lb nicosulfuron	0.75 oz	0.031 lb nicosulfuron	2	0.67 oz Accent 75DF
	0.05 lb thifensulfuron		0.002 lb thifensulfuron	2	0.05 oz Harmony 75DF
SureStart II 4.25SE or TripleFLEX II	3.75 lb acetochlor	2 pt	0.94 lb acetochlor	15	1.1 pt Surpass NXT 7E
	0.29 lb clopyralid		0.075 lb clopyralid	4	3.2 fl oz Stinger 3S
	0.12 lb flumetsulam		0.03 lb flumetsulam	2	0.6 oz Python 80WDG
Surtain 1.63ZC	0.63 lb saflufenacil	14 oz	0.068 lb saflufenacil	14	3 fl oz Sharpen 2.85SC
	1.00 lb pyroxasulfone		0.109 lb pyroxasulfone	15	3.8 fl oz Zidua 4.17SC
TriVolt 3.65SC	0.57 lb isoxaflutole	20 fl oz	0.09 lb isoxaflutole	27	5.76 fl oz Balance Flexx 2SC
	2.85 lb flufenacet		0.45 lb flufenacet	15	0.45 lb flufenacet
	0.23 lb thien carbazon		0.04 lb thien carbazon	2	0.04 lb thien carbazon
Verdict 5.57EC	5.0 lb dimethenamide	13 fl oz	0.5 lb dimethenamide	15	11 fl oz Outlook 6EC
	0.57 lb saflufenacil		0.058 lb saflufenacil	14	2.6 fl oz Sharpen 2.85L
Yukon 67.5WDG	0.125 lb halosulfuron	4 oz	0.03 lb halosulfuron	2	0.67 oz Permit 75WG
	0.55 lb dicamba		0.125 lb dicamba	4	4.0 fl oz Clarity 4S

Table 5.8 - Relative Effectiveness of “Burndown” Treatments for Control of Weeds in No-Till Corn

This table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rates and weed size or growth stage. Treatments are rated only for control of vegetation existing at the time of application.

Weed control rating: 10 = 95–100% 9 = 85–95% 8 = 75–85% 7 = 65–75% 6 = 55–65%
 N = less than 55% or no control + = upper end of rating scale — = not applicable or no local data available

Herbicide ¹	Site of Action Number	Burdock, common	Chickweed ⁴	Dandelion	Dock, Curly	Downy Brome	Evening Primrose,	Cutleaf	Field Violet/Pansy	Annual Flea-banes	Foxtail	Garlic, Wild	Geranium, Carolina	Groundsel, common ²	Hemp Dogbane, Dewberry, Milkweed, etc.	Henbit/Dead-nettle	Horseweed/Marestail ^{3,4}	Lambs-quarters	Mustards spp.	Quack-grass Sod	Ragweed, common	Smart-weed	Thistle, Canada
2,4-D (1 qt) (spring-applied)	4	7	6	8	7	N	9	6	6	6	N	7	—	6	N	N	8+	9	9	N	9	7	8
2,4-D + dicamba (spring-applied)	4/4	8	8	8	7+	N	9	7	7	8	N	7	7+	7	6	6	9	9	N	9	9	8+	
Atrazine	5	6	8	N	6	7	7	8	8	7+	7	N	9	9	N	8	8	N	8	8	9	9	6
Atrazine + 2,4-D	5/4	7+	8	9	7	7	9	8	8	7+	7	7	9	9	N	8	9	9	9	7	9	9	8+
Autumn Super + 2,4-D (fall-applied)	2/4	9	9 ⁴	9	7	N	9	6	6	8	N	—	—	8	N	9	9	—	9	N	—	—	6
Balance/Corvus	27/(2)	7	8	6	N	N	—	6	6	7	6	—	—	8	N	7+	7	7	8	N	7	6	6
Glyphosate (fall-applied) ⁵	9	8+	9	9	7	9	7	7	7	8	—	9	8	9	8+	8	N	—	9	9	—	—	9
Glyphosate (spring-applied) ⁵	9	7	9	6	6	9	6	6	6	7+	9+	8	7	9	7	6	N	9	9	8	9	7	8
Gramoxone	22	N	8+	N	N	7	7	8	8	6	9	6	8	8+	6	7	7	8	8	6	8	7	6
Liberty	10	6	8	6	—	6	6	N	8	8	8	—	—	7	N	6	8	8	8	6	8	8	6
Reviton (2 fl oz)	14	—	8	6	—	6	8	8	8	7+	6	—	—	—	—	8	7	8	8	—	8	—	—
Sharpen ⁷ (2 fl oz)	14	N	6	7	—	N	N	N	N	7+	N	—	—	8	N	6	8	8	8	N	8	8	6
Valor SX/Fierce	4/(15)	N	9	7	N	8 ⁷	6	N	N	N	N	—	—	7	N	7	6	9	8	N	7	7	N
Mixtures																							
Glyphosate + 2,4-D or dicamba (fall-applied)	9/4	9+	9	9	7	9	9+	7	7	9 ⁶	—	9	8	9	9	8+ ⁶	9 ⁶	—	9 ⁶	9	—	—	9+
Glyphosate + 2,4-D or dicamba (spring-applied)	9/4	7+	9	8	7	9	9	8	8	8	9+	8	7	9	7+	8+	9	9	9	9	9	8+	8+
Glyphosate + Atrazine	9/5	7+	9	7	6	9	6	8	8	7+	9	8	7	9	N	9	—	9	9	9	9	9	8

Table 5.8 - Relative Effectiveness of “Burndown” Treatments for Control of Weeds in No-Till Corn (cont.)

This table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rates and weed size or growth stage. Treatments are rated only for control of vegetation existing at the time of application.

Weed control rating: 10 = 95–100% 9 = 85–95% 8 = 75–85% 7 = 65–75% 6 = 55–65%
 N = less than 55% or no control + = upper end of rating scale — = not applicable

Herbicide ¹	Site of Action Number	Burdock, common	Chickweed ⁴	Dandelion	Dock, Curly	Downy Brome	Evening Primrose,	Field Violet/Pansy	Annual Fleabanes	Foxtail	Garlic, Wild	Geranium, Carolina	Groundsel, common ²	Hemp Dogbane, Dewberry, Milkweed, etc.	Henbit	Deadnettle	Horseweed/ ³ Marestail ⁴	Lambs-quarters, TR	Mustards spp.	Quackgrass Sod	Ragweed, common	Smartweed	Thistle, Canada
Glyphosate + Metribuzin	9/5	7	9	6	6	9	6	8	8	9	8	7	9	7	8+	N	9	9	9	9	9	9	8
Glyphosate + Sharpen	14/9	7	9	6	6	9	6	6	8	9+	—	—	9	7	6	9	9	9	9	8	9	9	8
Gramoxone + 2,4-D or dicamba ⁵	22/4	7	9	7	7	7	9	8+	7	9	7	8	8+	6	8	8+	9	9	9	6	9	8+	8
Gramoxone + Atrazine	22/5	6	9	N	6	8	7	8	7	9	6	8	8+	6	9	8+	8	8	8+	8	9	9	7
Gramoxone + Metribuzin	22/5	6	9	N	N	7	7	8	6	9	6	8	8+	6	8	8	8	8	8+	6	9	9	6
Harmony Extra/FirstShot/Audit	2/2	6	9	6	8	N	—	N	N	N	8+	—	9	6	8	8	7+	9	9	N	6	9	8
Harmony Extra/FirstShot/Audit + 2,4-D	2/4	7	9	9	9	N	9	7	6	N	8+	—	9	6+	9	8+	9	9	9	N	9	9	8+
Lumax	15/5/ 27	8	9	8	8	N	—	7	8	6	N	8+	9	N	8	8	8	9	8	N	8+	9	7

¹ See Table 5.2 for additional formulations or trade names containing some of these same active ingredients.

² Certain populations of common groundsel in the northeastern U.S. are resistant to triazine herbicides. Herbicide programs that contain bromoxynil (Maestro, Moxy) or clopyralid (Stinger) provide good control of groundsel in-crop.

³ Roundup and other glyphosate products are not effective on glyphosate-resistant horseweed biotypes.

⁴ Group 2 herbicides will not control ALS-resistant biotypes.

⁵ Activity is reduced if applied in certain tank-mixes; glyphosate with photosynthesis inhibitors such as triazine herbicides; 2,4-D and dicamba with Gramoxone. May still be tank-mixed for convenience, but burndown is improved if applied separately.

⁶ Based on control in early spring. Emergence of seedlings in the spring will reduce effectiveness.

⁷ Use rate of 1.5 fl oz/A has been more consistent for horseweed/marestail control than 1.0 fl oz/A.

⁸ Valor provides control of germinating dandelion seedling; however, it is weak on dandelion when applied post.

Table 5.9 - Effectiveness of Herbicides for Control of Common Cash or Cover Crops in Spring Before Corn Establishment

Control ratings: 10 = 95-100%; 9 = 85-95%; 8 = 75-85%; 7 = 65-75%; 6 = 55-65%; and N = less than 55%; L= listed as controlled on herbicide label, but local data are limited, + = upper end of rating scale, - = not applicable or no local data available.

Herbicide	Rate ¹ (lb/acre)	Site of Action Number	Broadleaf species							Grass species					
			Alfalfa ²	Austrian Winter Pea	Clover, crimson	Clover, red ²	Clover, white ²	Mustards/Radish/Rapeseed	Vetch, hairy	Bluegrass/timothy ²	Bromegrass/orchardgrass/fescue ²	Ryegrass, annual ⁴	Rye, cereal	Triticale	Wheat, winter
2,4-D ester	0.5	4	7+	N	7	8	6	8	9	N	N	N	N	N	N
	1	4	8	N	8	9	7	9	9+	N	N	N	N	N	N
atrazine	1.0	5	N	-	6	6	6	6	7	6	6	6	6	6	6
clopyralid	0.25	4	8+	8	8	9	9	N	9	N	N	N	N	N	N
dicamba	0.5	4	9	7	8	9	9	6	9	N	N	N	N	N	N
Elevore	0.004	4	-	7	N	-	-	N	8	N	N	N	N	N	N
glyphosate	0.75	9	6	8	8+	7	6	7+	7	9	8	8	9	9	9
	1.5	9	7	8+	9	7+	7	8+	8	9+	8+	9	9	9	9
paraquat	0.5	22	N	7	8	7	7	8	7	7	6	6	7	7	8
	0.75	22	N	8	9	8	7	8+	8	7+	7	6	8	7+	8+
Liberty, others ³	0.59	10	N	8+	9	L	-	6	9	-	N	6	6	7	7
Reviton (2 fl oz)	0.04	14	N	6+	8	-	-	-	N	N	N	N	N	N	N
Sharpen (1 fl oz)	0.02	14	N	6	N	-	-	N	N	N	N	N	N	N	N
Mixtures															
2,4-D ester + dicamba	0.5 + 0.5	4 + 4	9+	7	8+	9	9	8	9+	N	N	N	N	N	N
2,4-D ester + Liberty, others ³	0.5 + 0.59	4 + 10	N	9	9	-	-	8	9+	-	N	6	6	6	7
glyphosate + 2,4-D ester	0.75 + 0.5	9 + 4	8+	9	9	8	8	9	9+	9	8	8	9	9	9
glyphosate + dicamba	0.75 + 0.5	9 + 4	9	9	9	9	9	8	9+	9	8	8	9	9	9
glyphosate + Liberty, others ³	0.75 + 0.59	9 + 10	-	9	9	-	-	6	9	-	-	8	9	9	9
glyphosate + Reviton	0.75 + 0.04	9 + 14	6	8	9	-	-	9	7	9	8	8	9	9	9
glyphosate + Sharpen	0.75 + 0.02	9 + 14	-	9	8	-	-	7	8	-	8	8+	9	9	9

Table 5.9 - Effectiveness of Herbicides for Control of Common Cash or Cover Crops in Spring Before Corn Establishment (cont.)

Control ratings: 10 = 95-100%; 9 = 85-95%; 8 = 75-85%; 7 = 65-75%; 6 = 55-65%; and N = less than 55%; L= listed as controlled on herbicide label, but local data are limited, + = upper end of rating scale, – = not applicable or no local data available.

Herbicide	Rate ¹ (lb/acre)	Site of Action Number	Broadleaf species							Grass species					
			Alfalfa ²	Austrian Winter Pea	Clover, crimson	Clover, red ²	Clover, white ²	Mustards/Radish/Rapeseed	Vetch, hairy	Bluegrass/timothy ²	Bromegrass/orchardgrass/fescue ²	Ryegrass, annual	Rye, cereal	Triticale	Wheat, winter
paraquat + 2,4-D or dicamba	0.75 + 0.5	22 + 4	7+	8	9	8+	8	9	9+	7	6	6	8	7	8+
paraquat + atrazine	0.5 + 1	22 + 5	7	8+	9+	8+	7	9	9	9	8	7	8+	8	8+
paraquat + metribuzin	0.5 + 0.25	22 + 5	7	8+	9+	8+	7	8+	9	9	8	7	8+	7+	8+

¹0.75 lb Glyphosate = 32 fl. oz of a 41% glyphosate; 0.5 lb paraquat = 2 pt Gramoxone SL2.0 or 1.33 pt Gramoxone SL 3.0. Clopyralid is a component of Stinger, and Surestart/Tripleflex.

²Application in the fall can improve control with some herbicides.

³Warm temperatures, high humidity, and bright sunlight improve the performance of Liberty. Weed control may be reduced when applications are made to weeds under stress from drought or cool temperatures.

⁴Tank mixing clethodim (Select, etc.) or rimsulfuron (Resolve, Basis Blend) with glyphosate has shown improved burndown activity on annual ryegrass cover crop control in university field trials. Consult herbicide label for use guidelines.

See Table 5.8 for relative effectiveness of these treatments. May need to combine with residual treatment or postemergence program (Tables 5.6 and 5.11) for complete no-till weed-control program.

Table 5.10 - Characteristics of “Burndown” Herbicides for No-Till Corn

Herbicide Trade name	Herbicide Common name	Herbicide group # (site of action)	product/A	lb ai/A
2,4-D LVE 4E	2,4-D ester	4	1 – 2 qt	1–2
Atrazine 90DF	atrazine	5	1.8–2.2 lb	1.6–2

- Apply 7–14 days before planting or 3–5 days after planting for greater crop safety.
- Plant corn at least 1.5 inches deep.
- This product is poor on chickweed, henbit, and deadnettle, and ineffective on all grasses.
- Add Clarity (dicamba) to increase efficacy on legume sods. A combination of 2,4-D + Clarity/Banvel controls most annual broadleaf weeds and alfalfa. Emerged perennial broadleaves are partially controlled. This combination is fair on chickweed, henbit, and deadnettle, and ineffective on all grasses.
- Spray droplet size plays an important role in minimizing off-target movement. Nozzles that produce extremely coarse or ultra coarse droplets while limiting the amount of driftable fine droplets are necessary to limit spray drift. Comply with guidelines for drift management (see label for details).

- Apply 1.6–2 qt atrazine 4L prior to planting.
- Controls small emerged annual broadleaves and some grasses.
- Can be applied in liquid nitrogen as the carrier to improve burndown characteristics.

ATRAZINE USE RESTRICTIONS**Preplant or Preemergence**

- On highly erodible soils (as defined by the U.S. Natural Resources Conservation Service):
- Fields where more than 30 percent of the soil surface is covered with plant residue at planting, apply a maximum of 2.0 lb of active ingredient per acre as a broadcast spray.
- Fields where less than 30 percent of the soil surface is covered with plant residue at planting, apply a maximum of 1.6 lb of active ingredient per acre as a broadcast spray.
- Apply a maximum of 2.0 lb of active ingredient per acre as a broadcast spray.

Postemergence

- If no atrazine was applied prior to crop emergence, use a maximum rate of 2.0 lb of active ingredient per acre.
- If a soil-applied application was made in the same calendar year, the combined preplant or preemergence and postemergence applications may not exceed 2.5 lb of active ingredient per acre.

Safety Precautions for Using Atrazine

- Do not mix, load, or apply within 50 feet of drinking water wells, livestock wells, agricultural drainage wells, irrigation wells, abandoned wells, or sinkholes.
- Do not mix or load within 50 feet of intermittent streams, perennial streams, rivers, lakes, or reservoirs.
- Do not apply within 200 feet of lakes or reservoirs.
- Do not apply within 66 feet of the points where surface water runoff enters intermittent streams, perennial streams, or rivers. The 66-foot buffers should be planted to a crop or seeded with grass on highly erodible land.
- *Restricted-use pesticide and water quality advisory.*

Table 5.10 - Characteristics of “Burndown” Herbicides for No-Till Corn (cont.)

Herbicide Trade name	Herbicide Common name	Herbicide group # (site of action)	product/A	lb ai/A
Autumn Super 51WDG	iodosulfuron	2	0.3–0.5 oz	0.001–0.002
	thiencarbazone	2		0.01–0.014
<ul style="list-style-type: none"> • Autumn Super may be applied after fall harvest and up to 30 days prior to corn planting. • Do not apply to frozen ground. Apply to actively growing weeds. • Autumn Super will provide short-term residual control of small seeded broadleaves but will not provide season-long pre control of annual grasses and broadleaf weeds. • Apply Autumn Super at 0.3–0.5 oz/A plus necessary adjuvants. • For enhanced burndown activity, tank-mix with 2,4-D, glyphosate, paraquat, simazine, or metribuzin. • Be cautious of crop rotation restrictions. 				
dicamba-containing products	dicamba	4	varies	0.25–0.5 lb ae
<ul style="list-style-type: none"> • Apply 7–14 days before planting or 3–5 days after planting for greater crop safety. • Plant corn at least 1.5 inches deep. • A combination of 2,4-D + dicamba controls most annual broadleaf weeds and alfalfa. Emerged perennial broadleaves are partially controlled. This combination is fair on chickweed, henbit, and red deadnettle, and ineffective on all grasses. Applications should be made while annual weeds are small (4 inches) and actively growing. • Spray droplet size plays an important role in minimizing off-target movement. Nozzles that produce extremely coarse or ultra coarse droplets while limiting the amount of driftable fine droplets are necessary to limit spray drift. Comply with guidelines for drift management (see label for details). • Dicamba can be difficult to completely remove from spray equipment and residue is capable of injuring sensitive plants. Follow label instructions concerning sprayer cleanout. 				
Engenia 5SL XtendiMax 2.9SL	dicamba (BAPMA salt) dicamba (DGA salt with VaporGrip Technology)	4	6.4–12.8 fl oz 11–22 fl oz	0.25–0.5 lb ae
<ul style="list-style-type: none"> • Carefully read and follow product labels. • See comments under Clarity for more details. • <i>Engenia/XtendiMax are restricted-use products; all dicamba formulations have a water quality advisory.</i> 				
Enlist Duo 3.3SL	2,4-D choline +	4	3.5–4.75 pt	0.7–0.95 ae
	glyphosate	9		0.74–1.0 ae
<ul style="list-style-type: none"> • Can be used as a burndown application to corn with or without the Enlist trait to control broadleaves and grasses. • Apply 7–14 days before planting for greater crop safety. • Do not apply less than 10 gpa total spray solution and do not use nitrogen solutions as a carrier. • Comply with guidelines for drift management (see label for details). • For best results do not apply to light sandy soils as a pre application. • Can be tank-mixed with residual herbicides. 				
Enlist One 3.8SL	2,4-D choline	4	1.5–2 pt	0.71–0.95
<ul style="list-style-type: none"> • See comments under 2,4-D LVE and Enlist Duo for more details. 				

Table 5.10 - Characteristics of “Burndown” Herbicides for No-Till Corn (cont.)

Herbicide Trade name	Herbicide Common name	Herbicide group # (site of action)	product/A	lb ai/A
Expert 4.88L	S-metolachlor +	15		1.09–1.63
	atrazine +	5	2.5–3.75 qt	1.33–2.0
	glyphosate	9		0.63–0.94 ae

- Expert is a premix of metolachlor (Dual II Magnum), atrazine, and glyphosate.
- The 3 qt. rate contains 1.3 lb S-metolachlor, 1.6 lb atrazine and 0.75 lb ae glyphosate.
- Expert can be used as a burndown/preprogram in corn or as an early post application in Roundup Ready hybrids.
- See Expert label for additional information.
- *Restricted-use pesticide and water quality advisory.*

Glyphosate¹	glyphosate	9	See Table 5.2	
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Fall applications of glyphosate are better than spring applications for control of orchardgrass sods and quackgrass.

- If controlling orchardgrass sod in spring it is best to spray when sod is 6 to 10 inches tall.
- Use at least 1.13 lbs ae glyphosate or higher, especially if tank-mixing with preresidual herbicide and nitrogen carriers.
- Spring applications may be used for control of annual weeds.
- Using low-volume sprays may allow for a reduced rate.
- For control of small annual weeds or volunteer small grains, glyphosate may be used at reduced rates.
- Can be tank-mixed with residual herbicides such as atrazine. When tank-mixing glyphosate with residual herbicides, apply in 10–20 gal water/A or 10–60 gal liquid fertilizer nitrogen/A.
- Adding 2,4-D or dicamba improves control of large annual broadleaf weeds, dandelion, and alfalfa.
- Glyphosate may be applied in clear liquid nitrogen fertilizers and clear liquid complete-analysis fertilizers, but may be less effective on certain annual grasses and perennials.
- Do not use glyphosate with suspension-type liquid fertilizers.

Gramoxone SL 2.0			2–4 pt	
Gramoxone SL 3.0	paraquat	22	1.3–2.7 pt	0.5–1

- Apply in 20–60 gal/A for control of emerged annual weeds.
- Add 16–32 oz non-ionic surfactant/100 gal of spray.
- Adding 2,4-D or dicamba improves control of large annual broadleaf weeds and alfalfa. Alfalfa control is improved by applying 2,4-D or dicamba separately at least 1 day ahead of paraquat.
- Can be tank-mixed with residual herbicides; adding atrazine to paraquat can improve control of fescue and certain other perennial sods.
- Phosphate-containing liquid fertilizer solutions diminish paraquat activity if used as a carrier.
- Use appropriate precautions when handling paraquat to minimize exposure to the herbicide.
- Do not use flood jet tips larger than size 20 or spacing greater than 40 inches.
- Other labeled formulations of paraquat are available; see Table 5.3 for options.

Paraquat Use Restrictions

- Only certified applicators, who successfully complete the paraquat-specific training, can mix, load or apply paraquat.
- Application of paraquat "under the direct supervision" of a certified applicator is no longer allowed; registered technicians cannot apply.
- Required training link (<http://usparaquattraining.com>); certified applicators must repeat training every three years.
- *Gramoxone is a restricted-use pesticide.*

Table 5.10 - Characteristics of “Burndown” Herbicides for No-Till Corn (cont.)

Herbicide Trade name	Herbicide Common name	Herbicide group # (site of action)	product/A	lb ai/A
Harmony Extra SG 50DF	thifensulfuron +	2	0.45–0.9 oz	0.009–0.018
	tribenuron	2		0.005–0.009
<ul style="list-style-type: none"> • Adding Harmony Extra to glyphosate or 2,4-D can improve control of certain winter annual broadleaves and perennials. • Must be applied in fall or early spring at least 14 days ahead of planting. • Other products that contain thifensulfuron and tribenuron include Audit 1:1, FirstShot and Panoflex. 				
Liberty 2.34SL	glufosinate	10	32–43 fl oz	0.59–0.79
<ul style="list-style-type: none"> • Liberty may be applied as a burndown treatment prior to the planting or emergence of any corn variety. • However, early season burndown activity may be reduced since warm temperatures, high humidity, and bright sunlight are necessary to maximize the performance of Liberty. Weed control may be reduced when applications are made to weeds under stress from drought or cool temperatures. • Liberty performs better as a POST herbicide as compared to burndown applications in April. • Apply a minimum of 32 fl oz/A to young, actively growing weeds; burndown and in-crop applications may not exceed 87 fl oz/A per season. • Applications should be made from dawn until 2 hours prior to sunset to avoid the possibility of reduced weed control. • Liberty must be applied with ammonium sulfate and the recommended use rate is 3 lb/A. • Uniform, thorough spray coverage (20 gal/A is recommended) is necessary to achieve consistent weed control; do not use nozzles that produce large droplets; use at least 15 gal/A (20 gal/A if dense vegetation is present). 				
Metribuzin 75DF/4L	metribuzin	5	2–4 oz DF	0.094–0.19
<ul style="list-style-type: none"> • Include metribuzin as part of an herbicide program for burndown of existing vegetation prior to crop emergence. • Metribuzin may be tank-mixed with 2,4-D LVE, Gramoxone, or glyphosate. • Use a maximum of 4 oz DF if applying less than 10 days before planting or on soils with less than 2% organic matter. • Do not use on coarse soils with less than 1.5% organic matter or on soils having pH 7.0 or greater. • Plant corn at least 1.5 inches deep to avoid injury. • <i>Water quality advisory.</i> 				
Reviton 2.83SC	tiafenacil	14	1–3 fl oz	0.022–0.066
<ul style="list-style-type: none"> • Reviton may be applied as an early preplant/burndown treatment through preemergence timings; it will injure emerged corn. There are no plant back restrictions between application and corn planting. • It is best to apply before weeds are taller than 5 inches and complete spray coverage is important for adequate weed control. • Reviton can be applied with glyphosate (or other herbicides) to enhance the speed of burndown and increase weed spectrum. • Include necessary additives MSO plus nitrogen solution or AMS to the spray mixture. • Burndown activity may be decreased or slowed under cloudy, foggy, or cooler weather or when weeds are drought stressed. • Reviton is similar to Sharpen but is less active on marestail, however it has better grass, field pansy/violet, and primrose activity. 				

Table 5.10 - Characteristics of “Burndown” Herbicides for No-Till Corn (cont.)

Herbicide Trade name	Herbicide Common name	Herbicide group # (site of action)	product/A	lb ai/A
Sharpen 2.85SC	saflufenacil	14	1–3 fl oz	0.022–0.067
<ul style="list-style-type: none"> Sharpen may be applied as a preplant/burndown treatment from 14 days early preplant through preemergence timings; do not apply to emerged corn. Apply Sharpen in a typical glyphosate burndown herbicide program to enhance the speed of burndown and increase weed spectrum including glyphosate-resistant horseweed. Depending on the rate, Sharpen can provide some short-term residual control of certain annual broadleaf weeds. Include necessary additives MSO plus nitrogen solution or AMS to the spray mixture. Do not apply more than 1 fl oz/A where an at planting OP or carbamate insecticides are being used. Sharpen is a Group 14 herbicide, and due to concerns for long-term viability of this herbicide mode of action, extension specialists in the Mid-Atlantic region recommend not using it every year. This mode of action has greater utility in soybeans than corn, especially for control of glyphosate-resistant horseweed (marestail). As such, we suggest that Sharpen and other saflufenacil-containing products (e.g., Verdict, Optill) be used in soybean first and only in alternate years. The use of Sharpen in continuous corn should also be limited to every other year (alternating years with HPPD-containing herbicide [Group 27]) and avoided if Sharpen is used in soybean in a corn-soybean rotation. 				
Valor SX 51WDG	flumioxazin	14	1–2 oz	0.51–1.02 oz
<ul style="list-style-type: none"> Valor may be included in a typical no-till burndown herbicide program to enhance the speed of burndown and increase weed spectrum. Corn can be planted 7 days after application if there is at least 25% soil residue cover and ¼ inch rainfall. Fierce 76WDG contains the active ingredients in Valor and Zidua and can be used in burndown programs; see Table 5.15 for additional details. Valor is a Group 14 herbicide, and due to concerns for long-term viability of this herbicide mode of action, extension specialists in the Mid-Atlantic region recommend not using it every year. This mode of action has greater utility in soybeans than corn, especially for control of glyphosate-resistant horseweed (marestail). As such, we suggest that Valor and other flumioxazin-containing products (e.g., Fierce, Valor XLT, Envive) be used in soybean first and only in alternate years. The use of Valor in continuous corn should also be limited to every other year (alternating years with HPPD-containing herbicide [Group 27]) and avoided if Valor is used in soybean in a corn-soybean rotation. 				
<p>¹ Refer to current product label for active ingredient concentration and application rate (e.g., 1 qt/A glyphosate 4S = 22 fl oz/A Roundup WeatherMax).</p>				

Water Solubility and Residual Length Of Soil-Applied Herbicides

Solubility (parts per million; ppm): How many microliters of the herbicide will dissolve in 1 liter of water. The less soluble the herbicide, the more moisture (rain or irrigation) is needed to activate the herbicide and move it into the root zone. Solubility is used as a guideline for rainfall or irrigation required within a short time after application. Moisture needed also depends on the soil moisture at time of application.

Relative moisture levels to move herbicide into the soil to achieve optimum level of control:

Relative Moisture to Activate	ppm	Estimate Water to Activate*
Low	>500 ppm (very soluble)	0.33 inch
Medium	250-500 ppm	0.33-0.5 inch
High	100-250 ppm	0.5-0.75 inch
Very High	<100 ppm	>0.75 inch

*More water (additional irrigation) maybe necessary if soil is dry at time of application, soils with higher clay content, or high plant residues are present.

Relative duration of residual control is for comparison only based on herbicide half-life (length of time it takes for half the herbicide to break down). Herbicide breakdown results from chemical and/or microbial activity. Since the speed of breakdown is affected by a number of factors including soil pH, soil temperature, and soil moisture, duration can vary for herbicides based on the specific conditions. Residual activity is not the same as herbicide carryover.

Duration of residual control assumes 1) good activation; 2) no excessive rain or irrigation; and 3) weed species are sensitive to the herbicide(s) applied.

Table 5.11 - Water Solubility and Longevity Of Soil-Applied Herbicides

Herbicide Trade Name	Solubility (ppm)	Relative moisture amount required to activate	Duration of residual weed control
Atrazine	33	Very High	4-5 weeks
Balance Flexx	7	Very High	2-4 weeks
Callisto	1500	Low	2-4 weeks
Dual II Magnum Cinch	488	Medium	4-5 weeks
Flufenacet	56	Very High	2-4 weeks
Harmony SG	pH5-223	High	1-2 weeks
	pH7-2240	Low	
Harness / Breakfree / Surpass	223	High	2-4 weeks
Intrro	242	High	2-4 weeks
Metribuzin	1,200	Low	2-4 weeks
Outlook	1,174	Low	2-4 weeks
Princep	5	Very High	4-5 weeks
Prowl / other Pendimethalin Formulations	1	Very High	4-5 weeks
Python	5,600	Low	4-6 weeks
Resolve SG	pH7-7300	Low	1-2 weeks
Sharpen	pH 5: 30	Very High	1-3 weeks
	pH 7: 2,100	Low	
Stinger	1000	Low	1-3 weeks
Thiencarbazone-methyl	436	Medium	2-4 weeks
Topnotch	223	High	2-4 weeks
Valor SX	2	Very High	4-5 weeks
Zidua	3.49	Very High	4-5 weeks
Premixes	Constituents		
Acuron	Dual II Magnum, Callisto, atrazine, bicyclopyrone		
Acuron Flexi	Dual II Magnum, Callisto, bicyclopyrone		
Anthem ATZ	Zidua, Cadet, atrazine		
Anthem Flex	Zidua, Aim		
Anthem Maxx	Zidua, Cadet		
Bicep II Magnum /Cinch ATZ	Dual II Magnum (or Cinch), atrazine		
Bicep Lite II Magnum	Dual II Magnum, atrazine		
Corvus	Balance Flexx, thiencarbazone		
Coyote	Dual Magnum, Callisto		
Fierce	Valor SX, Zidua		

5-50 Weed Control in Field Crops: *Corn*

Table 5.11 - Water Solubility and Longevity Of Soil-Applied Herbicides (cont.)

Premixes	Constituents
FulTime / Keystone / Breakfree ATZ	Topnotch (or Surpass), atrazine
Harness MAX	Harness, Callisto
Harness Xtra / Degree Xtra	Harness (or Degree), atrazine
Lumax EZ / Lexar EZ	Dual II Magnum, Callisto, atrazine
Maverick	Zidua, Callisto, Stinger
Resicore	Surpass, Callisto, Stinger
Resolve Q/Basis Blend	Resolve SG, Harmony SG
Storen	Dual II Magnum, Callisto, Zidua, bicyclorpyrone
SureStart II / TripleFLEX II	Harness, Python, Stinger
Surtain	Sharpen, Zidua
TriVolt	Balance Flexx, thiencazone, flufenacet

Table 5.12 - Relative Effectiveness of Soil-Applied (Preemergence) Corn Herbicides¹

Weed control rating:	Crop tolerance:
10 = 95–100%	E = excellent; almost never any crop injury observed
9 = 85–95%	VG = very good; on rare occasion is crop injury observed
8 = 75–85%	G = good; seldom is crop injury observed as long as proper management practices are followed (e.g., seedling depth, seed slit closure, herbicide rate and application timing, adjuvants)
7 = 65–75%	FG = fair to good; occasionally crop injury is observed even with proper management practices; injury is often due to herbicide interactions with environmental conditions
6 = 55–65%	F = fair; some crop injury is commonly observed
N = less than 55% or no control	
+ = upper end of rating scale	
— = not applicable or no local data available	

Grasses	Site of Action Number	Barnyardgrass	Bermudagrass	Broadleaf signalgrass	Crabgrass	Fall Panicum	Foxtail spp.	Goosegrass	Johnsongrass (Seedling)	Johnsongrass (Rhizome)	Quackgrass	Shattercane	Texas panicum	Wirestem Muhly	Yellow Nutsedge
Trade Name ¹															
Atrazine	5	7	N	N	7	6	6+	7	N	N	7+	6	N	6	6
Balance Flexx ²	27	8	N	N	7	8	8 ³	N	7+	6	N	7+	N	N	N
Dual products	15	9	N	8	9	8	9	9+	6	N	N	6	N	N	8
Harness, Surpass NXT, or TopNotch	15	9	N	8	8+	8	9	9+	7	N	N	6	N	N	7+
Outlook	15	9	N	7	8	8	9	9	6	N	N	6	N	N	7+
Princep	5	8+	N	N	8	8+	8	8	6	N	7	6	N	8	6
Prowl	3	8+	N	8	8+	8+	8	8	7	N	N	7	7	N	6
Zidua	15	8+	N	8	9	8	8+	9+	6	N	N	6	N	N	6
Mixtures															
Acuron	5/15/27	9	N	8	9	8	9	9+	6	N	6	6	N	6	8+
Acuron Flexi	15/27/27	9	N	8	9	8	9	9+	6	N	N	6	N	N	8+
Anthem Maxx or Flex	14/15	8+	N	8	9	8	8+	9+	6	N	N	6	N	N	6
Atrazine + Princep	5/5	8+	N	N	8+	8+	8+	8	6	N	8+	6	N	8	8+
Axiom	5/15	9	N	N	9	8	9	8	6	N	N	6	N	N	6

Table 5.12 - Relative Effectiveness of Soil-Applied (Preemergence) Corn Herbicides¹ (cont.)

<u>Grasses</u>	Site of Action Number	Barnyardgrass	Bermudagrass	Broadleaf signalgrass	Crabgrass	Fall Panicum	Foxtail spp.	Goosegrass	Johnsongrass (Seedling)	Johnsongrass (Rhizome)	Quackgrass	Shattercane	Texas panicum	Wirestem Muhly	Yellow Nutsedge
Tradename ¹															
Bicep, Cinch ATZ	5/15	9	N	8	9	8	9	9+	6	N	6	6	N	6	8+
Corvus	2/27	8	N	N	8	8	8+	N	7+	7	N	7+	N	N	7
Fierce	14/15	8+	N	–	9	8	9	9+	6	N	N	6	N	N	6
Harness MAX, Coyote	15/27	9	N	8	8+	8	9	9+	7	N	N	6	N	N	7+
Harness Xtra, Degree Xtra, FulTime NXT or Keystone NXT	5/15	9	N	8	9	8	9	9+	7	N	6	6	N	6	8+
Lumax/Lexar	5/15/27	9	N	8	9	8	9	9+	6	N	6	6	N	6	8+
Maverick	15/27/4	8+	N	8	9	8	8+	9+	6	N	N	6	N	N	6
Resicore/Resicore XL	15/27/4	9	N	8	8+	8	9	9+	7	N	N	6	N	N	7+
Storen	15/27/15/27	9	N	8	9	8	9	9+	6	N	N	6	N	N	8+
SureStart II/ TripleFLEX II	2/4/15	8	N	8	8	8	8	9+	6	N	N	6	N	N	6
TriVolt	27/15/2	9	N	8	9	8	9	9	7+	7	N	7+	N	N	7
Verdict	14/15	8	N	N	8	8	8	9	N	N	N	N	N	N	7+

¹ See Table 5.4 and 5.6 for additional products that contain these active ingredients.

² Performance ratings based on full labeled rates.

³ Herbicide is less effective on yellow foxtail: Balance-6, and Liberty-7.

Table 5.12 - Relative Effectiveness of Soil-Applied (Preemergence) Corn Herbicides¹ (cont.)

<u>Broadleaves</u>	Site of Action Number	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters ²	Marestail / Horseweed ⁵	Annual Morningglory	Eastern Black Nightshade	Palmer Amaranth / Waterhemp ⁷	Pigweed ²	Common Ragweed ⁸	Giant Ragweed ⁸	Prickly Sida	Smartweed	Spurred Anoda	Velvetleaf	Corn Tolerance, medium soils	Corn Tolerance, coarse soils
Tradename ¹																		
Atrazine	5	6	8+	9	N	9	8+	9	9+	N	9	8	9	9+	8	8	F	F
Balance Flexx	27	7	N	8	9	8+	N	9	8	8	8	7	7	7+	–	9	F–G ³	G
Dual Products	15	N	N	N	6	N	N	7+	8+	8	6	N	N	N	N	N	G	G
Harness, Surpass NTX, or TopNotch	15	N	N	N	7	N	N	8+	8	9	7+	N	N	7	N	6	G	G
Lorox	7	N	7+	7	8+	7	N	6	7	8	7	N	N	9	–	7	F–G	F

5-52 Weed Control in Field Crops: Corn

Table 5.12 - Relative Effectiveness of Soil-Applied (Preemergence) Corn Herbicides on Grasses, Grasslike Species, and Broadleaf Weeds¹ (cont.)

Broadleaves																		
Tradename¹	Site of Action Number	Burcucumber	Cocklebur	Jimsonweed	Lambs-quarters²	Marestail / Horseweed⁵	Annual Morning Glory	Eastern Black Nightshade	Palmer Amaranth / Waterhemp⁷	Pigweed²	Common Ragweed⁸	Giant Ragweed⁸	Prickly Sida	Smartweed	Spurred Anoda	Velvetleaf	Corn Safety medium soils	Corn Safety coarse soils
Outlook	15	N	N	N	6	N	N	7+	8	8	6	N	N	6	N	N	G	G
Princep	5	6	8	9	N	9	9	9	9+	N	9+	7	9	9	8	8	F	F
Prowl	3	N	N	6	9	N	N	N	8	8	N	N	N	8	N	8	G ³	FG
Python	2	6	8	8	8+	N	N	7	N	9	7+	6	8	8+	7	8	F-G ³	F
Zidua	15	N	N	7	8	N	N	8	9+	9	7+	N	7	6	N	7	G	G
Mixtures																		
Acuron	5/15/27	7	9	9	9	9	9	9	9+	9	9	8+	9	9	9	9	G	G
Acuron Flexi	15/27/27	N	6	8	9	8+	6	8+	8+	8+	7	7	N	8+	-	9	G	G
Anthem ATZ	5/14/15	6	9	9	8	9	8+	9	9+	9	8+	8	9	9	8	8	G	G
Anthem Maxx or Flex	14/15	N	N	7	8	N	N	8	9	9	7+	6	6	7	N	7	G	G
Atrazine + Princep	5/5	7	9	9+	N	9	9	9	9+	N	9	8+	9	9	8	8+	F	F
Axiom	5/15	N	N	6	N	6	N	N	7	N	N	N	6+	6	-	N	G	FG
Basis Blend/ Resolve ⁶	2/2	N	6	6	8+	N	N	N	N	9	N	N	N	6	-	6	F-G	F ⁶
Bicep, Cinch ATZ	5/15	6	8+	9	7	9	8+	9	9+	8+	8+	8	9	9	9	8+	G	G
Corvus	2/27	7	8	8	9	8+	7	9	8	9	7+	7+	7	8+	-	9	G	F
Fierce	14/15	N	6	8	9	8+	7+	9	9	9	7+	6	8	7	8	8	G	F
Harness MAX, Coyote	15/27	6	8+	8	9	8	6	8+	8+	8+	7	7	N	8+	-	9	G	G
Harness Xtra, Degree Xtra ⁴ , Fultime NXT, Keystone NXT	5/15	6	8+	9	7+	9	8+	9	9+	9	8+	8	9	9	9	8+	G	G
Lexar	5/15/27	7	9	9	9	9	9	9	9	8+	8+	8+	9	9	9	9	G	G
Lumax	5/15/27	6	8+	9	9	9	8+	9	9	8+	9	8	7+	9	9	9	G	G
Maverick	15/27/4	N	6	8	9	9	6	8+	9	8+	7	7	N	8+	-	9	G	G
Prowl + Atrazine	3/5	6	8+	9	9	9	8+	9	9+	9	8+	8	9	9+	8	9+	G ³	FG
Resicore/ Resicore XL	15/27/4	N	6	8	9	9	6	8+	8+	8+	7	7	N	8+	-	9	G	G
Storen	15/27/15/27	N	6	8	9	8+	6	8+	9	8+	7	7	6	8+	-	9	G	G
SureStart II/ TripleFLEX II	2/4/15	N	7	7	8	9	6	8	8+	8+	8	7+	7	8	-	8	G	F
TriVolt	27/15/2	7	8	8	9	8+	7	9	8	9	7+	7+	7	8+	-	9	G	F
Verdict	14/15	6	8	8	9	7+	8	9	9	9	8	8	7	9	-	8	G	G

Table 5.12 - Relative Effectiveness of Soil-Applied (Preemergence) Corn Herbicides on Grasses, Grasslike Species, and Broadleaf Weeds¹ (cont.)

- ¹ See Table 5.4 and 5.6 for additional products that contain these active ingredients.
- ² Triazine-resistant (TR) biotypes of common lambsquarters and redroot/smooth pigweed are widespread in the region and thus triazine (Group 5) herbicides are not effective against these populations.
- ³ See remarks in Table 5.14 and the herbicide label for specific management guidelines to maximize crop tolerance.
- ⁴ Degree Xtra may be less consistent on lambsquarters control compared to other acetochlor products.
- ⁵ ALS-resistant biotypes of marestail/horseweed are found in the region and thus Group 2 herbicides will not be effective against these populations.
- ⁶ Corn stunting is likely with products that contain rimsulfuron if: 1) used on coarse-textured soils; 2) applied with 7 days of planting; and 3) growing conditions are less than ideal.
- ⁷ Biotypes resistant to Groups 2 and 9 herbicides are common in the region; do not rely on Groups 2 or 9 herbicides to provide effective control.
- ⁸ Biotypes resistant to Groups 2 and 9 herbicides are found in the region; Groups 2 or 9 herbicides may not provide effective control.

Table 5.13 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Corn

See specific product label to determine correct rate for soil type and weed species found in each field.

- These treatments may be used in conventional, reduced-till, and no-till systems.
- Treatments may be applied preplant-incorporated or preemergence, unless stated otherwise.
- Incorporation reduces the need for timely rainfall after application and may improve control of certain weeds.
- The higher rates for a given soil may be required for no-till.
- In no-till situations, “burndown” herbicides may be required to control weeds or cover crops present at time of application. Tables 5.12, 5.13, and 5.14 list characteristics of “burndown” herbicides.
- EPP = early preplant means application prior to plant (in most cases it’s 7-14 days before planting); PPI = applied to conventionally tilled soil than mechanically incorporated; PRE = preemergence (applied before the crop has emerged); EPOST = early postemergence (during the early stages of crop and weed growth)

Trade Name ¹	Common name	Site of Action Number	Application	Product/A	lb ai/A
Anthem Flex	pyroxasulfone +	15	EPP, PRE, or EPOST	3.5–6 fl oz	0.102–0.175
	carfentrazone	14			0.007–0.012
Anthem Maxx 4.3SE	pyroxasulfone +	15	EPP, PRE, or EPOST	3–6 fl oz	0.1–0.2
	fluthiacet	14			0.003–0.006

- Fluthiacet (Cadet) or carfentrazone (Aim) does not provide any residual weed control.
- See Zidua (pyroxasulfone) entry for more details.

Table 5.13 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Corn (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Atrazine 4L	atrazine	5	EPP or PRE	1–2 qt	1–2

- Atrazine may be used at 1–2 qt/A. Most commonly used in combination with other herbicides at 1–1.5 qt.
- On highly erodible ground with less than 30% surface residue, no more than 1.6 qt may be applied prior to crop emergence.

ATRAZINE USE RESTRICTIONS**Preplant or Preemergence**

- On highly erodible soils (as defined by the U.S. Natural Resources Conservation Service):
- Fields where more than 30 percent of the soil surface is covered with plant residue at planting, apply a maximum of 2.0 lb of active ingredient per acre as a broadcast spray.
- Fields where less than 30 percent of the soil surface is covered with plant residue at planting, apply a maximum of 1.6 lb of active ingredient per acre as a broadcast spray.
- Apply a maximum of 2.0 lb of active ingredient per acre as a broadcast spray.

Postemergence

- If no atrazine was applied prior to crop emergence, use a maximum rate of 2.0 lb of active ingredient per acre.
- If a soil-applied application was made in the same calendar year, the combined preplant or preemergence and postemergence applications may not exceed 2.5 lb of active ingredient per acre.

Safety Precautions for Using Atrazine

- Do not mix, load, or apply within 50 feet of drinking water wells, livestock wells, agricultural drainage wells, irrigation wells, abandoned wells, or sinkholes.
- Do not mix or load within 50 feet of intermittent streams, perennial streams, rivers, lakes, or reservoirs.
- Do not apply within 200 feet of lakes or reservoirs.
- Do not apply within 66 feet of the points where surface water runoff enters intermittent streams, perennial streams, or rivers. The 66-foot buffers should be planted to a crop or seeded with grass on highly erodible land.
- *Restricted-use pesticide and water quality advisory.*

	isoxaflutole + corn safener				
Balance Flexx 2SC		27	EPP, PRE, or EPOST	3–6 fl oz	0.047–0.094

- Balance Flexx contains isoxaflutole plus a corn safener (cyprosulfamide) and can be applied from preplant through early postemergence (up to V2 corn).
- The medium soil texture rate is 5 fl oz/A.
- Tank-mix with pregrass products (Define, Dual, Harness, TopNotch, Outlook, etc.) to improve residual grass control. Balance Flexx can be mixed with atrazine, 2,4-D, Gramoxone, or glyphosate plus COC or MSO to improve burndown activity on emerged weeds in a no-till setting.
- Early postemergence applications of Balance Flexx will likely not control weeds that are larger than one-leaf stage, but the addition of atrazine can improve control.
- Balance Flexx also can be used as a foundation herbicide in a planned pre herbicide followed by POST herbicide system.
- Do not apply with adjuvants, tank-mixtures with other herbicides or OP or carbamate insecticides, or use fluid fertilizer carriers after corn has emerged.
- To improve crop safety, it is best to plant corn at least 1.5 inches deep and make sure seed is completely covered and seed slit is firmed.
- Do not apply more than 6 fl oz/A/year Balance Flexx (0.094 lb ai isoxaflutole).
- When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds.
- *Restricted-use pesticide and water quality advisory.*

Table 5.13 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Corn (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Basis Blend 30WDG	rimsulfuron +	2	PRE	0.825–1.25 oz	0.01–0.015
	thifensulfuron	2			0.005–0.008
<ul style="list-style-type: none"> • Basis Blend is a mixture of rimsulfuron (Resolve) and thifensulfuron (Harmony SG). • Soil application of Basis Blend is permitted in the Mid-Atlantic region, including Pennsylvania. • Soil-applied Basis Blend is effective on triazine-resistant lambsquarters and pigweed. • Corn stunting is commonly observed when Basis Blend is used on coarse-textured soils. • Tank-mix with other products to broaden the spectrum of control. • For additional remarks, see Basis Blend remarks in the postemergence herbicide for corn section. 					
Bicep II Magnum 5.5SC/Cinch ATZ or	S-metolachlor + atrazine			1.3–2.6 qt	See Table 5-10 for ai rates
Bicep Lite II Magnum 6SC/Cinch ATZ Lite or				0.9–2.2 qt	
Degree Xtra 4.04 ME or	acetochlor + atrazine			2.9–3.7 qt	
FulTime NXT 4.04CS or				2.9–4.4 qt	
Harness Xtra 6L or	acetochlor + atrazine	15, 5	EPP, PRE, or EPOST	1.8–2.3 qt	
Harness Xtra 5.6L				1.4–3 qt	
Keystone LA NXT 6SE/Breakfree NXT Lite or				1.8–2.7 qt	
Keystone NXT 5.6SE/Breakfree NXT ATZ				1.4–3 qt	
<ul style="list-style-type: none"> • These mixtures contain one of the chloroacetamide herbicides plus atrazine. • Bicep Lite II Magnum, Cinch ATZ Lite, Harness Xtra 6L, and Keystone LA NXT are premixes of reduced-atrazine-rate ratios. • The application rates based on soil texture for each of these products are listed in Table 5-17. • These products may be applied to emerged corn in a water carrier; refer to Table 5-19 for maximum corn and weed size restrictions. • Degree Xtra can be applied early POST in a UAN carrier if the temperature is below 85°F. Some corn leaf burn should be expected. Refer to label for more details. Do not include surfactants, crop oils, or other additives. • See individual component sections in this table and atrazine use restrictions under that entry for additional information. • <i>Restricted-use pesticides and water quality advisory.</i> 					

5-56 Weed Control in Field Crops: *Corn*

Table 5.13 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Corn (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
	isoxaflutole +	27			0.049–0.083
Corvus 2.63SC	thiencarbazone + corn safener	2	EPP, PRE, or EPOST	3.33–5.6 fl oz	0.02–0.033
<ul style="list-style-type: none"> • Corvus is a premix of isoxaflutole, cyprosulfamide (Balance Flexx), and thiencarbazone (ALS-inhibitor herbicide that improves control of annual weeds) and can be applied from preplant through early postemergence (up to V2 corn) to provide residual control of annual broadleaves and grasses, especially when tank-mixed with atrazine. • The typical use rate is 5.6 fl oz/A. • Corvus can provide some control of small, emerged annual weeds (<6 inches) in no-till. • To improve burndown activity on emerged weeds in a no-till setting, mix with atrazine, 2,4-D, Gramoxone, or glyphosate plus COC or MSO. • Early postemergence applications of Corvus will control small, emerged weeds, but the addition of atrazine can improve control. • Corvus also can be used as a foundation herbicide in a planned preherbicide followed by postherbicide system. • Do not apply with adjuvants (COC or MSO), tank mixtures with other herbicides or OP or carbamate insecticides, or use fluid fertilizer carriers after corn has emerged. • To improve crop safety, it is best to plant corn at least 1.5 inches deep and make sure seed is completely covered and seed slit is firmed. • Do not apply more than 0.094 lb ai isoxaflutole/A/year. • When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds. • <i>Restricted-use pesticide and water quality advisory.</i> 					
Dicamba-containing products	dicamba	4	PRE or EPOST	varies	0.5 lb ae
<ul style="list-style-type: none"> • Dicamba may be applied after planting on medium- to fine-textured soils. • Do not apply preemergence to soil containing less than 2% organic matter or to coarse-textured soils. • Preemergence applications have a greater potential to injure corn under conditions of excessive moisture and cool temperatures. • Crop tolerance is greatest to dicamba, and weeds are generally most susceptible when corn is from the spike to five-leaf stage of growth. 					
Dual II Magnum 7.64E	S-metolachlor	15	EPP or PRE	1–2 pt	0.96–1.9
<ul style="list-style-type: none"> • Dual II Magnum are similar in activity to Harness, Outlook, Surpass, and Zidua. • Dual II Magnum contains a crop-safening agent, benoxacor. • These may be applied broadcast on up to 40-inch- tall corn prior to weed emergence. • The medium soil texture rate is 1.67 pt for Dual II Magnum. • For early preplant applications or fields with heavy surface plant residue, the Dual II Magnum rate may need to be increased by up to 20%. • Incorporation improves control of yellow nutsedge. • <i>Water quality advisory.</i> 					

Table 5.13 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Corn (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Fierce 76WDG	pyroxasulfone +	15	EPP or PRE	3 oz	0.08
	flumioxazin	14			0.063
<ul style="list-style-type: none"> • Fierce contains pyroxasulfone (Zidua) and flumioxazin (Valor) and can be used only in no-till or minimum-tilled fields where crop residue has not been incorporated into the soil and corn will be planted directly into a stale seedbed, cover crop, or previous crop residue. • Apply Fierce at 3 oz/A to field corn early preplant. • Corn must be planted between 7 and 30 days after application. • When applied as part of a burndown program, Fierce must be tank-mixed with appropriate herbicides and adjuvants to control emerged weeds. • In addition, Fierce provides residual control of several annual grass and broadleaf weeds, but other herbicides can be tank-mixed to improve control spectrum. • Do not use on soils with less than 1% organic matter unless an activation rainfall (½ inch or more) has occurred between application and planting. • Fierce also can be used as part of a fall burndown program. • <i>Water quality advisory.</i> 					
Harness 7E				1.25–3.0 pt	1–2.6.0
Surpass NXT 7E	acetochlor	15	EPP or PRE	1.25–3.0 pt	1.09–2.6
TopNotch 3.2CS				2–3.75 qt	1.6–3.0
<ul style="list-style-type: none"> • Harness, Surpass NXT, and TopNotch contain acetochlor. • Acetochlor is similar in activity to Dual, Outlook, and Zidua, but is more active on certain broadleaf weeds. • Acetochlor may be applied on up to 11-inch-tall corn depending on the tank-mix partner. • The medium soil texture rate is about 2 pt/A for Harness, 2.25 pt for Surpass NXT, and 2.25 qt for TopNotch. • For early preplant applications or fields with heavy surface plant residue, the rate of acetochlor may need to be increased by up to 20%. • Incorporation improves control of yellow nutsedge. • <i>Restricted-use pesticide and water quality advisory.</i> 					
Harness MAX 3.85L	acetochlor +	15	EPP or PRE	1.7–2.75 qt	1.5–2.42
	mesotrione	27			0.14–0.227
<ul style="list-style-type: none"> • Controls many annual broadleaf and grass weeds but will not provide consistent control if grasses have already emerged. • Can be applied PRE thru POST; when applied in a planned PRE followed by POST programs better weed control usually can be expected and more modes of action can be incorporated for better resistance management. • Typical medium soil rate is 64 fl oz/A Harness MAX. • It does not contain atrazine, so it provides a non-atrazine alternative for triazine-sensitive areas. However, other herbicides can be tank-mixed to broaden the weed control spectrum. • Harness MAX can be applied to corn that is no more than 11 inches tall; use rates might need to be reduced for POST applications and include necessary adjuvants. • Do not apply more than 0.24 lb ai mesotrione/A/year from any product or combination of products containing mesotrione. • When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds. • See label for additional application guidelines. • Coyote is a similar premix but contains S-metolachlor and mesotrione. May be applied EPP, PRE, or EPOST. 					

Table 5.13 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Corn (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Lexar EZ 3.7SC or	S-metolachlor + mesotrione + atrazine	15, 27, 5		3–3.5 qt	See Table 5-8 for ai rates
Lumax EZ 3.67SC		15, 27, 5		2.7–3.25 qt	
Acuron 3.44SC	S-metolachlor + mesotrione + atrazine + bicyclopyrone	15, 27, 5	EPP, PRE, or EPOST	2.5–3 qt	
Acuron Flexi 3.26SC	S-metolachlor + mesotrione + bicyclopyrone	15, 27		2–2.25 qt	

- Lexar EZ and Lumax EZ are mixtures of S-metolachlor (Dual II Magnum), mesotrione (Callisto), and atrazine.
- Acuron contains the same active ingredients as Lumax/Lexar with the addition of another Group 27 herbicide, bicyclopyrone. In general, it controls a broader weed spectrum and is better on ragweed, cocklebur, and annual morningglory, and effective on many annual broadleaves and some grasses compared to Lumax/Lexar.
- The typical use rates in all tillage systems are 3 qt/A Lexar EZ, 2.7 qt/A Lumax EZ, and 2.5 qt/A Acuron.
- These products may be applied broadcast on up to 12-inch-tall corn, but prior to annual grass emergence.
- Do not apply more than 3.5 qt/A Lexar EZ, 3.25 qt/A Lumax EZ, or 3 qt/A Acuron per growing season.
- Do not apply more than 0.24 lb ai mesotrione/A/year from any product or combination of products containing mesotrione.
- When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds.
- Do not apply Lexar, Lumax, or Acuron early POST if the corn was treated with Counter insecticide. Do not tank-mix Lexar, Lumax, or Acuron with organophosphate (OP) or carbamate insecticides and apply as a foliar POST application. Do not make a foliar POST application of any OP or carbamate insecticide within 7 days before or 7 days after a Lexar EZ, Lumax EZ, or Acuron application, or severe corn injury may occur.
- Corn, soybeans, small grains, and sorghum may be planted the spring following Lexar EZ, Lumax EZ, or Acuron application.
- *Restricted-use pesticide and water quality advisory.*

Lorox 50DF	linuron	7	PRE	0.7–1.0 lb	0.3–0.5
Outlook 6.0E	dimethenamid	15	EPP or PRE	10–21 fl oz	0.47–0.98

- Lorox applied at 0.7 to 1.0 lb/A will help control lambsquarters.
- Do not incorporate.
- Plant corn at least 1.5 inches deep to minimize risk of crop injury.
- *May cause crop injury under adverse conditions*
- Outlook is similar in activity to Dual, Harness, and Zidua.
- Outlook (dimethenamid) may be applied preemergence on up to 12-inch-tall corn prior to weed emergence.
- The medium soil texture rate is 16 fl oz/A for Outlook.
- For early preplant applications or fields with heavy surface plant residue, increase the Outlook rate by 1–2 fl oz/A.
- Lower use rates, 6–16 fl oz/A, may be used in situations where partial control or reduced length of residue control is required, such as early postemergence applications or preemergence applications followed by postemergence herbicides.
- Incorporation improves control of yellow nutsedge.
- *Water quality advisory.*

Table 5.13 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Corn (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Princep 90DF	simazine	5	EPP or PRE	1.1–3.3 lb	1–3
<ul style="list-style-type: none"> • Princep is similar to atrazine but has better grass activity and less broadleaf control. • Like atrazine, Princep can persist in soil and leave carryover residues. • Use in combination with other herbicides to lower the necessary rate and broaden the weed spectrum. • If using Princep in combination with atrazine, follow recrop restrictions. • <i>Water quality advisory.</i> 					
Princep 90DF +	simazine +	5	EPP or PRE	1.1–1.7 lb	1–1.5
Atrazine 90DF	atrazine	5		1.1–1.7 lb	1–1.5
<ul style="list-style-type: none"> • Both simazine and atrazine have long soil residuals. • Plant corn, sorghum, or sudangrass the following year. • Simazine improves annual grass control; use 2:1 ratio of simazine to atrazine in fields with heavy grass pressure. • See comments under atrazine. • When tank-mixing or sequentially applying simazine and/or atrazine or products containing either active ingredient to corn, the total pounds of simazine and/or atrazine applied must not exceed 2.5 lb ai/acre per calendar year. • <i>Atrazine is a restricted-use pesticide, and both atrazine and simazine have a water quality advisory.</i> 					
Prowl 3.3E	pendimethalin	3	PRE or EPOST	1.8–4.0 pt	0.75–1.65
Prowl H₂O 3.8CS	pendimethalin	3	PRE or EPOST	2.0–4.0 pt	0.95–1.9
<ul style="list-style-type: none"> • Plant corn at least 1.5 inches deep to avoid Prowl injury. • Do not incorporate. • Must be applied after planting up until corn reaches 30 inches tall or V8 growth stage (whichever is most restrictive). • Preemergence applications can injure corn. • Delaying application until spike stage helps maximize crop safety. • Prowl H₂O is a water-based capsule suspension formulation that provides similar weed control as the older 3.3E product but causes less staining and odor. 					
Prowl 3.3E or	pendimethalin	3		1.8–3.6 pt	0.75–1.5
H₂O 3.8CS +	pendimethalin	3	PRE or EPOST	2.0–4.0 pt	0.95–1.9
Atrazine 90DF	atrazine	5		1.1–2.2 lb	1.0–2.0
<ul style="list-style-type: none"> • Plant corn at least 1.5 inches deep to avoid Prowl injury. • Do not incorporate. • Must be applied after planting up until corn reaches 12 inches tall. • Preemergence applications can injure corn. • Delaying application until spike stage helps maximize crop safety. • See remarks under atrazine. • <i>Atrazine is a restricted-use pesticide and has a water quality advisory.</i> 					

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Table 5.13 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Corn (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Python 80WDG	flumetsulam	2	EPP or PRE	0.8–1.14 oz	0.04–0.057
<ul style="list-style-type: none"> • Apply before crop or weed emergence. • Plant corn at least 1.5 inches deep. • Do not use where soil pH is greater than 7.8, where organic matter is less than 1.5% or when extended cool, wet conditions exist. • Apply all insecticides in a T band or a band to avoid serious crop injury. • Do not use if Counter insecticide was applied. • See Table 5.4 for recrop restrictions. • To prevent herbicide resistance, avoid repeated annual applications of soil-persistent ALS (group 2) herbicides. • <i>Water quality advisory.</i> 					
Resicore 3.29SE Resicore XL 3.26SE	acetochlor +	15			1.58–2.1
	mesotrione +	27	EPP, PRE, or POST	2.25–3 qt	0.162–0.216
	clopyralid + corn safener	4			0.107–0.143
<ul style="list-style-type: none"> • It controls many annual broadleaf and grass weeds but will not provide consistent control if grasses have already emerged. • It can be applied PRE thru POST; when applied in a planned PRE followed by POST programs better weed control usually can be expected and more modes of action can be incorporated for better resistance management. • The typical medium soil rate is 2.5 qt/ A Resicore. • Resicore does not contain atrazine, so it provides a non-atrazine alternative for triazine-sensitive areas. However, atrazine, glyphosate, 2,4-D, and other herbicides can be tank-mixed with Resicore to broaden the weed control spectrum. • It contains acetachlor, so be sure to follow acetachlor use restrictions for soil type, organic matter, and depth to water table. • Do not apply more than 0.24 lb ai mesotrione/A/year from any product or combination of products containing mesotrione. • When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds. • Adequate soil moisture is required for optimum herbicidal activity. If adequate soil moisture is not received within 7–10 days after a surface-applied treatment, a shallow cultivation is recommended. • Observe the rotational restrictions on the label. • If corn has received an at-plant phorate or terbufos insecticide application, POST applications of Resicore may cause severe injury. Refer to label for additional restrictions with insecticides. • Do not make POST applications of Resicore using liquid fertilizer carriers or tank-mixed with OP insecticides otherwise severe crop injury will occur. • Resicore can be applied to corn that is no more than 11 inches tall. Resicore XL can be applied to corn up to 24 inches tall. 					
Resolve 25DF	rimsulfuron	2	PRE	0.5–2.0 oz	0.0078–0.03
<ul style="list-style-type: none"> • Resolve can be applied pre and may be tank-mixed with full or reduced rates of other soil-applied corn herbicides. • Crop injury may occur following an application of Resolve if there is a prolonged period of cold weather and/or in conjunction with wet soil. • Corn stunting is commonly observed when Resolve is used on coarse-textured soils. • See additional comments about Resolve in Table 5.19 in the postemergence herbicides for corn section. 					

Table 5.13 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Corn (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
SureStart II 4.25SE or TripleFLEX II	acetochlor +	15			0.71–1.41
	flumetsulam +	2	EPP, PRE, or EPOST	1.5–3 pt	0.056–0.113
	clopyralid	4			0.022–0.045

- SureStart II or TripleFLEX II is intended to be used with Roundup Ready or LibertyLink field or silage corn hybrids.
- When applied PRE, it is designed to provide early season control of common annual grasses and broadleaf weeds to allow better timing of the in-crop application of glyphosate or glufosinate.
- The typical medium soil rate is 1.75 pt/ A SureStart II/TripleFLEX II. For longer residual control, use up to 3 pt/A.
- SureStart II/TripleFLEX II does not contain atrazine, so it provides a non-atrazine alternative for triazine-sensitive areas. However, atrazine, glyphosate, 2,4-D, and other herbicides can be tank-mixed with SureStart II/TripleFLEX II to broaden the weed control spectrum.
- It contains acetachlor, so be sure to follow acetachlor use restrictions for soil type, organic matter, and depth to water table.
- Adequate soil moisture is required for optimum herbicidal activity. If adequate soil moisture is not received within 7–10 days after a surface-applied treatment, a shallow cultivation is recommended.
- Observe the rotational restrictions on the label.
- Injury to corn has been observed when cool, wet soil conditions follow application.
- Apply soil insecticides in furrow, a T-band, or a band. To avoid serious crop injury if using OP insecticides, apply in a T-band or a band. Do not use if Counter or Thimet insecticide was applied. Refer to label for additional restrictions with soil insecticides.
- Corn must be planted at least 1.5 inches deep.
- Do not use as a soil treatment in fields with less than 1.5% organic matter unless the risk of crop injury is acceptable.

Verdict 5.57EC	saflufenacil +	14	EPP or PRE	10–16 fl oz	0.058–0.071
	dimethenamid	15			0.384–0.615

- Verdict can be used in a burndown program or in a planned PRE followed by POST herbicide system. In a burndown program it is best to include glyphosate and atrazine in addition to the necessary adjuvants (MSO plus AMS; substituting COC can result in reduced weed control) to improve control of emerged weeds including horseweed.
- The medium soil texture rate is 13 fl oz/A and will provide some initial residual weed control, but it will likely need to be followed by a POST application of glyphosate (RR-corn), glufosinate (LL-corn), or conventional herbicides as needed.
- The use of Verdict can follow a burndown application of Sharpen (1 fl oz/A).
- Do not apply Verdict to emerged corn or if OP or carbamate insecticides are being used.

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Table 5.13 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Corn (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Zidua SC 4.17L or Zidua 85WDG	pyroxasulfone	15	EPP or PRE	1.75–6.5 fl oz or 1.5–4.0 oz	0.05–0.21

- Zidua has annual grass activity similar to Dual, Harness, Outlook, Surpass, etc., but also provides good control of several annual broadleaves.
- Zidua can be applied preplant (surface or incorporated) up to 45 days before planting or preemergence.
- The typical use rate is 4 fl oz/A SC (2.5 oz WDG) on medium-texture soils. Rates can be adjusted for soil type or two-pass application programs.
- Corn must be planted at least 1 inch deep.
- Zidua does not control existing weeds and must be activated by at least 1/2 inch of rainfall prior to weed germination; otherwise, effectiveness may be reduced.
- Zidua can be tank-mixed with atrazine or other corn herbicides to broaden weed control spectrum.
- Zidua may be applied in a carrier of water (5 gal/A or more) or liquid nitrogen fertilizer solution (20 gal/A or more). Also, it may be impregnated and applied on certain dry bulk fertilizers.
- Zidua may be applied up to V8 corn stage, but tank-mix if weeds are emerged.
- Zidua may be applied in the fall.
- Other pyroxasulfone-containing products include Anthem Flex, Anthem Maxx, Fierce, Maverick, and Perpetuo. Maverick is a premix of pyroxasulfone, mesotrione (Callisto), and clopyralid (Stinger). Perpetuo is a premix of flumiclorac (Resource) plus pyroxasulfone and must be applied post. Storen is a premix of pyroxasulfone, S-metolachlor (Dual II Magnum), mesotrione (Callisto), and bicyclopyrone.
- *Water quality advisory.*

¹ See Tables 5.4 and 5.6 for additional formulations or trade names containing some of these same active ingredients.

Table 5.14 - Corn Herbicide Preplant or Preemergence Rates Per Acre Based on Soil Texture and Organic Matter¹

Trade Name	Site of Action Number	Unit	<3% Organic Matter			>3% Organic Matter			Inc. for No-till	Max rate on HEL, less than 30% residue
			Coarse	Medium ¹	Fine	Coarse	Medium	Fine		
Acuron 3.44SC	5/15/27/ 27	qt	2.5	2.5	2.5	3.0	3.0	3.0	no	N/A
Acuron Flexi 3.26SC	15/27/27	qt	2.0	2.0	2.0	2.25	2.25	2.25	no	—
Anthem Flex 4SC	14/15	fl oz	3.5	4.5	5.5	4.5	5.5	6.5	no	—
Anthem Maxx 4.3SC	14/15	fl oz	3.0	4.0	5.0	4.0	5.0	6.0	no	—
Atrazine 4L ²	5	qt	1.25	1.5	1.5	1.25	1.5	2.04	no	1.6
Atrazine 90DF ²	5	lb	1.4	1.67	1.67	1.4	1.67	2.24	no	1.8
Axiom 68DF	5/15	oz	13.0	16.0	20.0	15.0	18.0	22.0	1–2 oz	—
Balance Flexx 2SC	27	fl oz	3.0	6.0	6.0	4.0	6.0	6.0	no	—
Basis 75DF	2/2	oz	0.33	0.33	0.33	0.825	0.33	0.33	no	—
Basis Blend 30DF	2/2	oz	0.825	0.825	0.825	0.33	0.825	0.825	no	—
Bicep II Magnum 5.5SC/Cinch ATZ	5/15	qt	1.8	2.1	2.1	2.1	2.4	2.6	up to 25%	2.1

Table 5.14 - Corn Herbicide Preplant or Preemergence Rates Per Acre Based on Soil Texture and Organic Matter¹ (cont.)

Herbicide	Site of Action Number	Unit	<3% Organic Matter			>3% Organic Matter			Inc. for No-till	Max rate on HEL, less than 30% residue
			Coarse	Medium ¹	Fine	Coarse	Medium	Fine		
Bicep Lite II Magnum 6SC/Cinch ATZ Lite	5/15	qt	1.5	1.5	1.5	1.3	1.9	1.9	up to 20%	N/A
Bullet 4L	5/15	qt	2.5	3.0	3.75	3.0	3.75	4.0	20%	N/A
Corvus 2.63SC	2/27	fl oz	3.3 ³	5.6	5.6	5.6	5.6	5.6	no	—
Degree Xtra 4.04 ME	5/15	qt	2.0	3.0	3.2	2.0	3.2	3.7	up to 25%	N/A
Dual II Magnum 7.64E	15	pt	1.33	1.67	1.67	1.33	2.0	2.0	up to 20%	—
Fierce 76WDG	14/15	oz	3.0	3.0	3.0	3.0	3.0	3.0	no	—
FulTime 4.04CS	5/15	qt	2.5	2.9	3.1	2.5	3.0	4.0	no	4.0
Harness 7E	15	pt	1.5	2.0	2.0	1.75	2.0	2.25	up to 25%	—
Harness MAX	15/27	fl oz	55	64	64	60	64	75	no	—
Harness Xtra 6.0L	5/15	qt	1.8	2.0	2.3	2.0	2.3	2.3	up to 25%	N/A
Harness Xtra 5.6L	5/15	qt	1.8	2.0	2.3	1.8	2.3	2.6	up to 25%	2.5
Keystone LA NXT 6SE	5/15	qt	1.8	2.0	2.1	1.8	2.1	2.4	no	N/A
Keystone NXT 5.6 SE	5/15	qt	1.4	2.0	2.5	2.0	2.5	2.5	up to 20%	2.5
Lexar EZ 3.7SC	5/15/27	qt	3.0	3.0	3.0	3.5	3.5	3.5	no	N/A
Lumax EZ 3.67SC	5/15/27	qt	2.7	2.7	2.7	3.25	3.25	3.25	no	N/A
Maverick 2.04SC	4/15/27	fl oz	18	21	25	18	21	25	no	—
Outlook 6.0E	15	fl oz	14.0	16.0	18.0	16.0	16.0	18.0	add 1–2 oz	—
Princep 4L	5	qt	1.0	2.5	2.7	1.0	2.7	3.0		
Princep 90DF	5	lb	1.1	2.6	3.0	1.1	3.0	3.3	no	—
Prowl 3.3E	3	pt	2.0	3.6	4.0	3.6	4.0	4.2	no	—
Prowl H ₂ O 3.8CS	3	pt	2.5	3.0	3.0	3.0	4.0	4.0	no	—
Python 80WDG	2	oz	0.8	0.89	1.0	0.89	1.0	1.1	no	—
Resicore 3.29SE/ Resicore XL 3.26SE	4/15/27	qt	2.25	2.5	2.75	2.5	2.75	30	up to 0.25 qt/A	—
Sharpen 2.85SC	14	fl oz	2.0	2.5	3.0	2.0	2.5	3.0	no	—
Storen	15/27/15/27	qt	—	2.1	2.1	—	2.4	2.4	no	—
SureStart II 4.25SE/ TripleFLEX II	2/4/15	pt	1.5	1.75	2.0	1.75	1.75	2.0	no	—
Surpass NXT 7E	15	pt	1.5	2.0	2.25	2.0	2.5	2.5	up to 25%	—
Top Notch 3.2ME	15	qt	2.0	2.25	2.5	2.0	2.5	3.0	no	—
TriVolt 3.65SC	2/15/27	fl oz	10.75	20	20	10.75	20	20	no	—
Verdict 5.57EC	14/15	fl oz	10	13	16	11.0	13	16	no	—
Zidua 85WDG	15	oz	2.0	2.5	2.5	2.5	2.5	3.0	no	—
Zidua SC 4.17L	15	fl oz	3.5	4.0	4.0	4.0	4.0	5.0	no	—

¹ Average soil type in most Mid-Atlantic areas.

² On highly erodible ground with less than 30% residue, apply no more than 1.6 qt/A or 1.8 lb/A of 90 DF (i.e., 1.6 lb ai).

³ Reduce Corvus rate to 3.33 fl oz/A if soils are coarse and have < 2% organic matter.

Table 5.15 - Maximum Corn, Weed Sizes, and recommended adjuvants for Delayed Preemergence/Early Postemergence Herbicide Applications

See specific herbicide label(s) for additional information on application.

- This type of application generally is used when weather conditions preclude use of standard preemergence program.
- For most products, do not apply in liquid fertilizer if corn has emerged.
- Poor control from residual herbicides may result if annual grasses such as foxtail and panicum have emerged at time of application; tank-mix with product that controls emerged grasses.
- Delayed preemergence/early postemergence programs can work well with herbicide-resistant corn hybrids now available (e.g., Roundup Ready, LibertyLink).
- When tank-mixing with other pesticides, follow the most restrictive product label.

Trade Name	Maximum Corn Size	Maximum Weed Size
Acuron	12 inches	3-inch broadleaves; inconsistent on emerged grasses
Acuron Flexi	30 inches	3-inch broadleaves
Anthem Maxx	4 collars (V4)	2-inch broadleaves, before grass emergence
Atrazine	12 inches	1.5 inches
Axiom	before emergence	before emergence
Balance Flexx	2-leaf (V2)	1 true leaf stage
Bicep II Magnum	12 inches	1- to 2-leaf
Bicep Lite II Magnum, Cinch ATZ Lite	5 inches	2-leaf
Corvus	2-leaf (V2)	<2 inches (in general)
Dual, Dual II Magnum	40 inches	before emergence
Fierce	before emergence	2-inch broadleaves; by tank-mix partner for grasses
Halex GT/Acuron GT	30 inches (V8)	4 inches
Harness, Harness MAX, Harness Xtra ¹ , or Degree Xtra	11 inches or by tank-mix partner	before broadleaf emergence, 2-leaf grasses or by tank-mix partner
Lexar EZ	12 inches	3-inch broadleaves; before grass emergence
Lumax EZ	12 inches	3-inch broadleaves; inconsistent on emerged grasses
Maverick	18 inches (V6)	3-inch broadleaves; before grass emergence
Outlook	12 inches	before emergence or by tank-mix partner
Princep	before emergence	before emergence
Prowl H ₂ O	30 inches (V8)	before weed emergence
Python WDG	20 inches (V6)	before weed emergence
Resicore/Resicore XL	11 inches/24 inches	3-inch broadleaves
Resolve Q	20 inches	2-inch grasses; 3-inch broadleaves (in general)
Storen	V8 3-inch broadleaves	2-inch grasses
SureStart II/TripleFLEX II	11 inches	limited activity on 1-inch broadleaves; before grass emergence
Surpass NXT, FulTime NXT, TopNotch, or Keystone NXT ²	11 inches or by tank-mix partner	before emergence or by tank-mix partner
Surtain	3-leaf (V3)	before emergence
TriVolt	2-leaf (V2)	<2 inches (in general)
Verdict	before emergence	before emergence
Zidua SC	Postemergence up to V8	before emergence or by tank-mix partner

Table 5.15 - Maximum Corn, Weed Sizes, and recommended adjuvants for Delayed Preemergence/Early Postemergence Herbicide Applications (cont.)

¹ May be tank-mixed with Accent Q, Atrazine (Harness), Clarity, Permit, or Roundup (Roundup Ready corn).

² May be tank-mixed with a number of different products including Accent Q, Clarity, Prowl, etc. See an herbicide label for specific information.

Table 5.16 - Recommended Adjuvants when Preemergence Herbicides are Used Early Postemergence

Trade Name	Recommended if corn has emerged and weeds are present	Optional
Acuron ^{1,2}	NIS (0.25% v/v) or COC ⁴ (1% v/v)	AMS 8.5 lb/100 gal
Acuron Flexi	NIS (0.25% v/v) or COC ⁴ (1% v/v)	
Anthem ATZ / Anthem Flex / Anthem Maxx	NIS (0.25% v/v) or COC (1-2 pts/A) or MSO (1-2 pts/A)	
Atrazine	label only mentions COC	
Balance Flexx	label states "Do not use COC or MSO or fully loaded glyphosate formulation"	
Bicep II Magnum	label mentions only NIS when tankmixed with specific herbicides	
Corvus	label states "Do not use COC or MSO"	
FulTime NXT, TopNotch ¹ , or Keystone NXT ¹	not addressed on label	
Halex GT/Acuron GT	NIS (1-2 qt/100 gal)	
Harness MAX ^{1,3}	NIS (1 qt/100 gal) or COC (1 gal/100 gal)	
Harness Xtra or Degree Xtra	not addressed on label	
Lexar EZ ^{1,2}	NIS (0.25% v/v) or COC (1% v/v)	
Lumax EZ ^{1,2}	NIS (0.25% v/v) or COC (1% v/v)	
Maverick	NIS (1 qt/100 gal) or COC ³ (1 gal/100 gal)	AMS only allowed with glyphosate or glufosinate herbicides
Python WDG	NIS (1 qt/100 gal) or COC (1 gal/100 gal)	
Resicore/Resicore XL	NIS (1 qt/100 gal) or COC ⁴ (1 gal/100 gal)	
Storen		
TriVolt	Label states: "Do not use COC or MSO"	

¹ Do not use either NIS or COC if tank-mixed with Liberty (AMS is allowed).

² Do not use either NIS or COC if tank-mixed with a fully loaded glyphosate (AMS is allowed); if glyphosate label recommends an adjuvant, add NIS and AMS.

³ Label cautions about crop injury.

⁴ Do not use either NIS or COC if tank-mixed with glyphosate (AMS is allowed).

5-66 Weed Control in Field Crops: Corn

Table 5.17 - Relative Effectiveness of Postemergence Corn Herbicides¹

Weed control rating:		Crop tolerance:													
10 = 95–100%		E = excellent; almost never any crop injury observed													
9 = 85–95%		VG = very good; on rare occasion is crop injury observed													
8 = 75–85%		G = good; seldom is crop injury observed as long as proper management practices are followed (e.g., seedling depth, seed slit closure, herbicide rate and application timing, adjuvants)													
7 = 65–75%		FG = fair to good; occasionally crop injury is observed even with proper management practices; injury is often due to herbicide interactions with environmental conditions													
6 = 55–65%		F = fair; some crop injury is commonly observed													
N = less than 55% or no control															
+ = upper end of rating scale															
— = not applicable or no local data available															
Grasses	Site of Action	Barnyardgrass	Bermudagrass	Broadleaf Signalgrass	Crabgrass	Fall Panicum	Foxtail spp.	Goosegrass	Johnsongrass (Seedling)	Johnsongrass (Rhizome)	Quackgrass	Shattercane	Texas panicum	Wirestem Muhly	Yellow Nutsedge
Trade Name ¹ (rate/A)															
Accent Q (0.9 oz)	2	8+	N	9+	7	9	9	N	9	8+	8+	9	9	7	6
Atrazine (1 qt)	5	8	N	7	6	6	7+	9	N	N	7	6	N	6	7
Basagran (1.5 pt)	6	N	N	N	N	N	N	N	N	N	N	N	N	N	8
Callisto (3 fl oz)	27	N	N	N	8 ¹⁰	N	N	N	N	N	N	N	N	N	8
Glyphosate ^{3,4} (0.75 lb ae)	9	9+	9	10	9+	9+	9+	10	9+	9	9	9	9	9	7
Impact/Armezon (0.75 fl oz)/ Impact Core	27/15	7	N	N	8	8	8+	7	N	N	N	7	8	6	7
Laudis (3 fl oz)/DiFlexx Duo (32 fl oz)	27/4	8	N	8	8	N	8+	7	6	N	N	7+	8	6	7
Liberty ⁵ (32 fl oz)	10	8	N	7	8	7+	9 ⁴	N	8	6	6	8	8	7	6
Permit/Sandea (1 oz)	2	N	N	N	N	N	N	N	N	N	N	N	N	N	9+
Shieldex (1 fl oz)/Restraint	27/15	7	N	6	8	6	8	7	6	N	N	6	6	6	6
Mixtures															
Basis Blend (0.83 oz)/ Resolve Q (1.25 oz)	2/2	8	N	8	6	8+	8+	N	8+	7	7+	8+	7	6	6
Capreno (3 fl oz)	2/27	8	N	6	8	8	8+	7	8	7	6	8	9	6	7
Halex GT (3.6 pt)/Acuron GT (3.75 pt)	9/15/ 27	9+	N	10	9+	9+	9+	10	9+	9	9	9	9	9	8
Kyro (45 fl oz)	15/27/4	7	N	N	8	8	8+	7	N	N	N	7	8	6	7
Realm Q (4 oz)	2/27	8	N	8	8	8+	8+	N	8+	7	7+	8+	7	6	8
Revulin Q (4 oz)	2/27	8+	N	9	8	9	9	N	9	8+	8+	9	9	7	8
Sinate (28 fl oz)	10/27	8	N	7	8	8	9	7	8	6	6	8	8	7	7
Steadfast Q (1.5 oz)	2/2	8+	N	9+	7	9	9	N	9	8	9	9	9	6+	6
Stout (0.75 oz)	2/2	8+	N	9+	7	9	9	N	9	8+	8+	9	9	7	6
Yukon (4 oz) / Permit Plus (0.75 oz)	2	N	N	N	N	N	N	N	N	N	N	N	N	N	9+

Control of Roundup Ready Corn: Volunteers or Replanting

There are times when corn has to be removed from a field with the intention of replanting a corn crop. Tillage is one effective method, but it is not appropriate in no-tillage situations. Use of glyphosate is highly effective for non-Roundup Ready corn. But, the challenge is in removing

Weed Control in Field Crops: **Corn** 5-67

Roundup Ready hybrids. There are limited herbicides to consistently kill small corn plants. Gramoxone SL, Liberty, and Select are three products that have shown the most activity. Research conducted in this region with Gramoxone and Select demonstrated that Select was the most effective for corn 2 to 3 inches tall. For taller corn (4 to 6 inches tall), Gramoxone in combination with a photosystem II-inhibiting herbicide (metribuzin, Lorox, or atrazine) was the most effective. Liberty is a third option, but it will not control Liberty Link hybrids.

Select Max/clethodim: up to 6 fl oz of Select Max or 3 fl oz clethodim 2EC with a nonionic surfactant at 0.25% v/v plus AMS at 2.5 to 4 lbs/A. Do not use a COC or MSO. Wait a minimum of 6 days from time of application until planting corn due to risk of crop injury. (Select Max/clethodim will also control corn hybrids containing Roundup Ready and Liberty Link stacked traits.)

Gramoxone SL 2.0: 3 to 4.5 pt/A (2 to 2.7 pints of 3.0 SL formulation) in combination with metribuzin (4 to 6 oz/A), Lorox (1 pt/A) or atrazine (1 lb/A). These photosystem II inhibitors are not added to control the corn but are used to slow down the Gramoxone activity, which helps provide more consistent control.

Liberty 280: 22 to 29 oz Liberty has not been as consistent for control corn as Gramoxone and will not control varieties with LibertyLink traits.

¹ See Table 5.4 and 5.6 for additional products that contain these active ingredients.

² Large crabgrass only.

³ For use on Roundup Ready corn varieties only.

⁴ Glyphosate-containing products include Roundup, Durango, and many others; see Table 5.1.

⁵ For use on LibertyLink or glufosinate-resistant corn varieties only.

⁶ Herbicide is less effective on yellow foxtail: Balance-6, and Liberty-7.

Table 5.17 - Relative Effectiveness of Postemergence Corn Herbicides¹ (cont.)

Broadleaves	Site of Action Number	Burdock	Cocklebur	Jimsonweed	Lambs-quarters ²	Marestail/Horseweed ³	Annual Morning Glory	Eastern Black Nightshade	Palmer Amaranth / Waterhemp ^{8,9}	Pigweed ²	Common Ragweed ^{8,9}	Giant Ragweed	Prickly Sida	Smartweed	Spurred Anoda	Velvetleaf	Corn Tolerance
Trade Name (rate/A) ¹	Site of Action Number	Burdock	Cocklebur	Jimsonweed	Lambs-quarters ²	Marestail/Horseweed ³	Annual Morning Glory	Eastern Black Nightshade	Palmer Amaranth / Waterhemp ^{8,9}	Pigweed ²	Common Ragweed ^{8,9}	Giant Ragweed	Prickly Sida	Smartweed	Spurred Anoda	Velvetleaf	Corn Tolerance
2,4-D (1 pt)	4	6	9	8	9	7+	8	7	8	9	8+	7+	9	7	-	8	F ⁴
Accent Q (0.9 oz)	2	7	7	7	6	N	7	N	N	9	6	N	N	8	-	7	F-G
Aim (0.8) /Cadet (0.9)	14	N	N	N	9	N	8+	9	N	9	N	N	7	N	-	9+	G
Atrazine (1 qt)	5	8	9	9	N	N	9	9	9+	N	9	8	8+	10	-	8	VG
Basagran (1.5 pt)	6	N	9	9	8	6	N	N	N	6+	8	7	8	9	7	8+	G
Callisto (3 fl oz)	27	7+	8+	9	9	6	7+	9	8+	8+	8	8	6	9	8	9	G
Dicamba (0.25 lb ae)	4	7	9	9	9	8+	8	8	8+	9	8+	7+	8	9	-	8	F-G ⁴
DiFlexx (8 fl oz)/DiFlexx Duo (32 fl oz)	4	7	9	9	9	8+	9	8	8+	9	9	9	8	9	-	8	G
Glyphosate ^{5,6} (0.75 lb ae)	9	8+	9	9	8+	N	7	8	N	9	8+	8	7	8+	8	8	E
Harmony SG (0.125 oz)	2	7	7+	7	9	N	N	N	N	9	6	N	N	9	N	8+	G
Impact/Armezon (0.75 fl oz)/Impact Core	27/15	7+	8+	9	9	6	7+	9	8+	8+	8	8	6	9	-	9	VG
Laudis (3 fl oz)	27	7	8+	9	9	6	7	9	8+	8+	8	8	N	9	-	9	VG
Liberty ⁷ (32 fl oz)	10	8	9	9	8+	9	8	8	9	8	9	8+	8	8+	-	8	E
Maestro/Moxy (1 pt)	6	8	9	9	9	6	8	9	N	7	7+	8	N	9	-	8+	F-G ⁴
Peak (0.5 oz)	2	8+	8+	8	8	N	7	N	N	8+	9	6	6	7	-	8	G
Permit/Sandea (1 oz)	2	6	9	N	N	N	6	6	N	9	9 ⁹	8 ⁹	7	8	-	9	G
Resource (6 fl oz)/Perpetuo	14	7	6	7	7	N	N	8	7	7+	8	6	7	6	-	9+	G

Table 5.17 - Relative Effectiveness of Postemergence Corn Herbicides¹ (cont.)

Broadleaves																	
Trade Name (rate/A)¹	Site of Action Number	Burcucumber	Cocklebur	Jimsonweed	Lambs-quarters²	Marestail/Horseweed³	Annual Morning Glory	Eastern Black Nightshade	Palmer Amaranth / Waterhemp^{8,9}	Pigweed²	Common Ragweed^{8,9}	Giant Ragweed	Prickly Sida	Smartweed	Spurred Anoda	Velvetleaf	Corn Tolerance
Stinger (0.5 pt)	4	N	9	8	6	7	N	7	N	6	9+	9	7	7	-	6	VG
Mixtures																	
Basis Blend (0.83 oz)	2/2	N	7	7	8+	N	6	N	N	9	7 ⁹	N	N	9	-	9	F-G
Capreno (3 fl oz)	2/27	7	8+	9	9	6	7	9	8+	9	8	8	6	9	-	9	G
Curtail	4/4	6	9	8	9	7+	9	7	9	9	9	9+	9	7	-	8	F
Halex GT (3.6 pt)	9/15/ 27	8+	9	9	9+	6	7+	9+	8+	9	8+	8	7	9	-	9	G
Kyro (45 fl oz)	15/27/ 4	7+	8+	9	9	6	7+	9	8+	8+	8+	8	7	9	-	9	VG
Permit Plus (0.75 oz)	2/2	7	9	7	9	N	6	6	N	9	9 ⁹	8 ⁹	7	9	-	9	G
Realm Q (4 oz)	2/27	7+	8+	9	9	6	7+	9	8+	9	8	8	6	9	8	9	G
Resolve Q (1.25 oz)	2/2	N	7	7	8+	N	6	N	N	9	7 ⁹	N	N	9	-	9	G
Revulin Q (4 oz)	2/27	7+	8+	9	9	N	7+	9	8+	9	8	8	6	9	-	9	G
Shieldex (1 fl oz)/ Restraint	27/15	-	7	-	9	8	7	7	8+	9	8+	8	-	7	-	9	VG
Sinate (28 fl oz)	10/27	8	9	9	9	9	8	9	9	9	9	8+	8	9	-	9	VG
Status (5-8 oz)	4/19	7	9	9	9	9	9	9	8+	9	9	9	8	9	-	9	G
Steadfast Q (1.5 oz)	2/2	7	7	7	6	N	7	N	N	9	6	N	N	8	-	8+	F-G
Stout (0.5 oz)	2/2	7	7	7	9	N	7	N	N	9	6	N	N	8+	-	8	F-G
Tough 5EC (24 fl oz)	6	6	8	8	9	-	N	9	8+	9	7	7	-	7	-	6	F-G
Yukon (4-8 oz)	2/4	6	9	9	9	8+	9	8	7	9	9	8	8	9+	-	9	F-G

¹ See Table 5.4 and 5.6 for additional products that contain these active ingredients.

² Triazine-resistant (TR) biotypes of common lambsquarters and redroot/smooth pigweed are widespread in the region and thus triazine (Group 5) herbicides are not effective against these populations.

³ Most marestail populations in the region are glyphosate-resistant (Group 9); some populations are also resistant to ALS (Group 2) herbicides. For best management of marestail, control in the fall or with an effective burndown program before planting. There are several herbicides that provide effective residual activity. However, marestail control in-crop can be challenging since there are only a few herbicides that are effective postemergence. Make sure to apply herbicide before marestail reaches 8 inches tall.

⁴ See remarks in Table 5.16 and the herbicide label for specific management guidelines to maximize crop tolerance.

⁵ For use on Roundup Ready corn varieties only.

⁶ Glyphosate-containing products include Roundup, Durango, and many others; see Table 5.1.

⁷ For use on LibertyLink or glufosinate-resistant corn varieties only.

⁸ Glyphosate resistance has been confirmed for this species and is widespread in the region.

⁹ Group 2 (ALS) resistance is confirmed for this species and is widespread in the region.

Glyphosate resistant biotypes are common in the region; glyphosate will not control these biotypes

Triazine-resistant (Group 5) biotypes are common in the region; atrazine nor simazine will not control these biotypes.

ALS-resistant biotypes are present in the region, Group 2 herbicides will not control these biotypes.

Table 5.18 - Herbicide Effectiveness on Perennial Broadleaf Weeds

Performance ratings are based on seasonal control from early season application in corn.

Weed control rating:

10 = 95–100%

9 = 85–95%

8 = 75–85%

7 = 65–75%

6 = 55–65%

N = Less than 55% or no control

+ = upper end of rating scale

– = not applicable or no local data available

Crop tolerance:

E = excellent; almost never any crop injury observed

VG = very good; on rare occasion is crop injury observed

G = good; seldom is crop injury observed as long as proper management practices are followed (e.g., seedling depth, seed slit closure, herbicide rate and application timing, adjuvants)

FG = fair to good; occasionally crop injury is observed even with proper management practices; injury is often due to herbicide interactions with environmental conditions

F = fair; some crop injury is commonly observed

Trade Name	Site of Action Number	Canada Thistle	Dandelion	Dewberry Species	Dock Species	Hedge Bindweed	Hemp Dogbane	Horsenettle	Jerusalem Artichoke	Milkweed	Mugwort	Poison Ivy	Pokeweed	Corn Tolerance
2,4-D	4	7+	8	6	7+	8	7	6	7	6	6	7	7	F
Accent Q	2	6	N	8	N	7	6	6	6	6	N	–	7	F-G
Atrazine ¹	5	6	6	6	7	7+	6	6	N	N	N	6	6	VG
Callisto	27	8	7+	N	–	–	7	7+	–	7	?	–	7	G
Clarity/DiFlexx	4	8	7+	6	8	8+	7	7	8	6	7+	7+	7	F-G
Glyphosate ²	9	8+	7	8	8	7+	8	7	8	8	7	8	8	E
Liberty ³ (36 fl oz)	10	6	7	–	6	N	6	7	–	6	–	–	6	E
Starane Ultra	4	N	N	N	N	8	8+	N	N	N	N	N	N	VG
Stinger	4	9	7	N	8+	N	N	6	9	N	8	7	N	VG
Mixtures														
Curtail	4/4	9	8	6	8+	8	7	6	9	6	8	7	7	F
Spirit + Clarity or 2,4-D	2/4	8+	8	6	7	8	7	7+	8	7	7+	–	8	F-G
Status	4/19	8+	8+	6	8	8+	7	7	8	7	7+	7+	8	G
Yukon	2/4	8+	8	6	7	8	7	7+	7	8	7+	–	8	F-G

¹ Ratings based on 1.6–2 lb/A rate.

² For use on Roundup Ready corn varieties only. Glyphosate-containing products include Roundup, Durango, and many others; see Table 5.1.

³ For use on glufosinate-tolerant or LibertyLink corn varieties only.

5-70 Weed Control in Field Crops: Corn

Table 5.19 - Comments on Postemergence Herbicides for Corn

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
2,4-D amine 4S	2,4-D amine	4	0.5–1 pt	0.2–0.5
<ul style="list-style-type: none"> • Use from time corn emerges until approximately 36 inches. • Risk of 2,4-D injury increases as corn increases in size. • Use 0.5 pt rate with drop nozzles after corn exceeds 8 inches in height. • Corn is most susceptible to injury when growing rapidly. • Adjust sprayer to minimize drift in order to prevent injury to non-target plants. 				
Accent Q 54.4WG	nicosulfuron + safener	2	0.9 oz	0.031
<ul style="list-style-type: none"> • Accent Q contains nicosulfuron plus isoxadifen (corn safener) and has similar utility as Accent 75DF; however, it is a different formulation and rates must be adjusted. • The typical use rate of Accent Q is 0.9 oz/A and it controls many annual grasses and some broadleaves. Accent Q is weak on crabgrass. • Apply to corn broadcast or directed up to 20 inches tall (V6) or directed up to 36 inches tall (V10). • Include appropriate adjuvant in spray tank (see Table 5.23). • Accent Q may be tank-mixed with certain herbicides. Do not tank-mix with Basagran, 2,4-D, or certain foliar applied organophosphate insecticides. Refer to label for restrictions when soil-applied organophosphate insecticides are used (i.e. terbufos). There are no precautions for non-OP insecticides. Do not use Counter 15G. Do not use Counter 20CR in furrow or over the row at cultivation; may be banded, but may cause injury, especially on soils with less than 4% organic matter. The use of Dyfonate, Lorsban, Thimet may result in temporary injury. There are no precautions for Non-OP insecticides. • Revulin Q is a premix that contains nicosulfuron + mesotrione. • To prevent herbicide resistance, avoid repeated annual applications of soil-persistent ALS (group 2) herbicides. 				
Acuron GT 4.29SC	S-metolachlor +	15	3.75 pt	0.94
	mesotrione +	27		0.09
	bicyclopyrone	27		0.044
	glyphosate	9		0.94 ae
<ul style="list-style-type: none"> • Acuron GT is very similar to Halex GT and has a similar utility and can only be applied to glyphosate-resistant (RR) corn hybrids from emergence to 30 inches tall (8-leaf stage). • For best results, apply to weeds before they are 4 inches tall. • Include NIS and AMS in the spray mixture. • Tank-mix with 0.25 to 1 lb ai/A of atrazine for much improved control and to broaden the spectrum of control. Local university data supports at least 0.5 lb ai/A of atrazine. Do not apply the tank mixture of Acuron GT and atrazine to corn greater than 12 inches tall. • Do not apply another HPPD-inhibitor herbicide (Callisto, Capreno, Impact/Armezon, Laudis) postemergence in the same season. • See label for additional use restrictions. 				
Aim 2EC	carfentrazone	14	0.5–1.0 fl oz	0.008–0.016
<ul style="list-style-type: none"> • Apply to corn up to 8-leaf collar stage and when weeds generally are 1–4 inches tall. • Include a nonionic surfactant (2 pt/100 gal). • Tank-mix with other herbicides to increase weed control spectrum. 				
Armezon 2.8SC	topramezone	27	0.5–1 fl oz	0.011–0.022
<ul style="list-style-type: none"> • See Impact entry for more details • Tank-mix with 0.25 to 1 lb ai/A of atrazine for much improved control and to broaden the spectrum of control. Local university data supports at least 0.5 lb ai/A of atrazine. Do not apply the tank mixture of Armezon and atrazine to corn greater than 12 inches tall. • Armezon PRO is a premix containing topamazone plus dimethenamid-P (Outlook) and can be applied over-the-top of corn for additional residual weed control. Kryo is a premix containing topamazone, acetochlor (Harness), and clopyralid (Stinger) and can be applied over the top of corn for additional weed control. 				

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
Atrazine 4L	atrazine	5	1–2 qt	1–2
<ul style="list-style-type: none"> • Apply before weeds are 1.5 inches tall and before corn reaches 12 inches in height. • Add 1 qt crop oil concentrate/A to spray solution. Do not include oil if corn is under stress from prolonged cold, wet weather or other factors. • Provides good to excellent residual control of susceptible broadleaf weeds. 				
ATRAZINE USE RESTRICTIONS				
Postemergence				
<ul style="list-style-type: none"> • If no atrazine was applied prior to crop emergence, use a maximum rate of 2.0 lb of active ingredient per acre. • If a soil-applied application was made in the same calendar year, the combined preplant or preemergence and postemergence applications may not exceed 2.5 lb of active ingredient per acre. 				
Safety Precautions for Using Atrazine				
<ul style="list-style-type: none"> • Do not mix, load, or apply within 50 feet of drinking water wells, livestock wells, agricultural drainage wells, irrigation wells, abandoned wells, or sinkholes. • Do not mix or load within 50 feet of intermittent streams, perennial streams, rivers, lakes, or reservoirs. • Do not apply within 200 feet of lakes or reservoirs. • Do not apply within 66 feet of the points where surface water runoff enters intermittent streams, perennial streams, or rivers. The 66-foot buffers should be planted to a crop or seeded with grass on highly erodible land. • <i>Restricted-use pesticide and water quality advisory.</i> 				
Basagran 4S	bentazon	6	1.5–2.0 pt	0.75–1.0
<ul style="list-style-type: none"> • Apply when weeds are small and actively growing. • Split treatments may be required for yellow nutsedge and Canada thistle. • Include the appropriate adjuvant in the spray tank (see Table 5.20). • Basagran poses less threat to off-target plants from drift than 2,4-D or dicamba. • Basagran is weak on pigweed and the addition of atrazine improves control. 				
Basis Blend 30WDG	rimsulfuron +	2	0.825 oz	0.01
	thifensulfuron	2		0.005
<ul style="list-style-type: none"> • Basis Blend is a mixture of rimsulfuron (Resolve) and thifensulfuron (Harmony) (SG); however, its formulation is different from Basis 75DF; thus, the application rate has changed. • Apply 0.825 oz/A Basis Blend to corn from spike stage through 2 collars (about 6 inches tall). Do not apply to corn having 3 fully emerged collars or corn over 6 inches tall. • Basis Blend controls some small annual grasses and broadleaves. Will provide residual control of susceptible species. • Basis Blend must include an adjuvant including an ammonium nitrogen fertilizer. • Crop injury may occur following an application of Basis Blend if there is a prolonged period of cold weather and/or in conjunction with wet soil. • Do not tank-mix with Basagran. • Regardless of PRE and/or POST applications, do not apply more than a total of 1 oz/A/season active ingredient rimsulfuron. • Do not tank-mix Basis Blend with foliar-applied organophosphate insecticides such as Lorsban, malathion, etc., as severe crop injury may occur. To avoid crop injury or antagonism, apply these products at least 7 days before or 3 days after the application of Basis Blend. Do not apply Counter (terbufos) within 60 days of a preemergence or preplant application of Basis Blend since crop injury may result. Do not apply Basis Blend within 45 days of crop emergence where Counter was applied as a treatment since crop injury may occur. There are no precautions for Force and Fortress. • To prevent herbicide resistance, avoid repeated annual applications of soil-persistent ALS (Group 2) herbicides. 				

5-72 Weed Control in Field Crops: *Corn*

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
Cadet 0.91EC	fluthiacet	14	0.4–0.9 fl oz	0.0028–0.006
<ul style="list-style-type: none"> • Application timing to corn ranges from 2 visible collars (V2) until the corn is 48 inches tall (or prior to tasseling). • Apply 0.4 to 0.6 fl oz/A with glyphosate (RR-corn) or glufosinate (LL-corn) or 0.5 to 0.9 fl oz when applied alone. • Include the necessary spray additives (NIS or COC plus AMS or nitrogen solution). • Applications should be made when susceptible broadleaf weeds are small. • Cadet is very effective on velvetleaf (up to 36 inches tall), but other broadleaf weeds must be small to achieve control/suppression. • Cadet does not provide residual weed control. • Cadet can cause burning/speckling on the corn leaves. • Cadet is similar to Aim herbicide. 				
Callisto 4SC	mesotrione	27	3 fl oz	0.094
<ul style="list-style-type: none"> • Callisto can be applied postemergence at 3 fl oz/A to corn up to 30 inches tall (8-leaf stage). • Always include crop oil concentrate and UAN or AMS in the spray mixture. Do not use methylated seed oil (MSO). • Tank-mix with 0.25 to 1 lb ai/A of atrazine for much improved control and to broaden the spectrum of control. Local university data supports at least 0.5 lb ai/A of atrazine. Do not apply the tank mixture of Callisto and atrazine to corn greater than 12 inches tall. (Callisto Xtra is a premix of Callisto + atrazine.) • Do not apply more than a total of 7.7 oz/A of Callisto/A/season. (i.e., 0.24 lb ai/A mesotrione) from any product or combination of products containing mesotrione. • Callisto will provide residual control of susceptible weed species. • When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds. • Do not apply Callisto postemergence in a tank mix with emulsifiable concentrate grass herbicides. • Do not apply Callisto postemergence: (1) if the crop was previously treated with Counter (terbufos) or chlorpyrifos insecticide or Lorsban insecticide, (2) with any OP or carbamate insecticide, or (3) 7 days before or after an OP or carbamate insecticide was applied. • Small grains may be planted 4 months after application. Corn, soybeans, and sorghum can be planted the year after application, 10-month restriction for alfalfa and 18-month restriction for clover. See Table 5.3 for additional rotational crops. • Other postemergence premixes that contain mesotrione include: <ul style="list-style-type: none"> - Callisto GT (mesotrione + glyphosate) - Callisto Xtra (mesotrione + atrazine) - Halex GT (mesotrione + S-metolachlor + glyphosate) - Harness MAX (mesotrione + acetochlor) - Realm Q (mesotrione + rimusulfuron) - Revulin Q (mesotrione + nicosulfuron) 				

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
Capreno 3.45SC	tembotrione +	27		0.068
	thiencarbazone +	2	3 fl oz	0.013
	corn safener			

- Capreno is a premix of tembotrione (Laudis), thiencarbazone (ALS-inhibitor herbicide that improves control of annual weeds), and cyprosulfamide (corn safener) and can be applied postemergence up to V7 corn stage to provide control of annual broadleaves and grasses, especially when tank-mixed with atrazine.
- The use rate is 3 fl oz/A in addition to COC and UAN or AMS in the spray mixture. (Do not use NIS or MSO.)
- For best results, apply Capreno when broadleaf weeds are less than 4 to 6 inches tall and grasses are less than 3 inches tall and not tillering.
- Do not apply more than 0.164 lb ai tembotrione/A/year (6 fl oz/A total Capreno).
- Temporary stunting is occasionally observed with Capreno, corn recovers in 7 to 10 days and does not affect yield.
- When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds.
- Tank-mix with 0.25 to 1 lb ai/A of atrazine for much improved control and to broaden the spectrum of control. Local university data supports at least 0.5 lb ai/A of atrazine. Do not apply the tank mixture of Capreno and atrazine to corn greater than 12 inches tall.
- Capreno can be tank-mixed with glyphosate or glufosinate to broaden control spectrum.
- Capreno will provide residual control of susceptible weed species.
- Do not use Capreno in the same season as OP insecticides such as chlorpyrifos or terbufos. Refer to label for restrictions.

Clarity 4S	dicamba (DGA salt)	4	8–16 fl oz	0.25–0.5
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- May apply dicamba up to 1 pint before corn is 8 inches tall (5-leaf stage). Use 0.25 lb ae/A on corn between 8 and 36 inches.
- Take precautions to prevent drift of dicamba off the target site.
- Early postemergence applications are preferable for lambsquarters control.
- Applications should be made while annual weeds are small (4 inches) and actively growing.
- Spray droplet size plays an important role in minimizing off-target movement. Nozzles that produce extremely coarse or ultra coarse droplets while limiting the amount of driftable fine droplets are necessary to limit spray drift. Comply with guidelines for drift management (see label for details).
- Dicamba can be difficult to completely remove from spray equipment and residue is capable of injuring sensitive plants. Follow label instructions concerning sprayer cleanout.

Curtail 2.38L	clopyralid +	4	2 pt	0.095
	2,4-D	4		0.5 ae

- Curtail contains clopyralid (Stinger) and 2,4-D.
- Apply to corn less than 8 inches tall (V4).
- For increased control of Canada thistle, tank-mix Curtail with Stinger (2–6 fl oz).

DiFlexx 4SC	dicamba + safener	4	8–32 fl oz	0.25–1
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- This safened dicamba product contains cyprosulfamide which is the same safener used in Balance Flexx and Corvus.
- Can be applied to field corn from spike stage to V6 (36 inches tall)
- The lower use rates (8–16 fl oz) are recommended for annual broadleaf weeds that are small and actively growing; while the mid and higher rates are recommended for larger annual weeds and established biennial and perennial species.
- The addition of UAN or AMS plus NIS or COC/MSO is recommended to improve control.
- See label for additional use details and restrictions.

5-74 Weed Control in Field Crops: Corn

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
DiFlexx Duo 1.53SC	dicamba + safener +	4	24–40 fl oz	0.24–0.4
	tembotrione	27		0.051–0.085
<ul style="list-style-type: none"> • DiFlexx Duo contains the active ingredients in DiFlexx (dicamba) and Laudis (tembotrione) and has activity on both broadleaf and grassy weeds. • DiFlexx Duo can be applied from corn emergence to 36 inches tall or before V7 stage, whichever comes first. • For best results apply before annual broadleaf weeds reach 6 inches tall and grasses, 3 inches tall. • The addition of UAN or AMS plus MSO or COC is recommended to improve control. • Do not apply more than 0.164 lb ai tembotrione/A/year. • When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds. 				
Enlist One 3.8SL	2,4-D choline	4	1.5–2.0 pt	0.71–0.95 ae
Enlist Duo 3.3SL	2,4-D choline +	4	3.5–4.75 pt	0.7–0.95 ae
	glyphosate	9		0.74–1.0 ae
<ul style="list-style-type: none"> • Enlist Duo and Enlist One can only be applied post to corn with the Enlist trait and has activity on both broadleaf and grassy weeds. • Apply broadcast from corn emergence to 30 inches tall or before V8 stage, whichever comes first; use drop nozzles for corn heights 30 to 48" tall. • Make one or two applications with a minimum of 12 days between applications. • Apply in a broadcast spray volume from 10 to 15 gpa for best results and do not use nitrogen solutions as a carrier. • Spray droplet size plays an important role in minimizing off-target movement. Nozzles that produce extremely coarse or ultra coarse droplets while limiting the amount of driftable fine droplets are necessary to limit spray drift. Comply with guidelines for drift management (see label for details). 				
Engenia 5SL or XtendiMax 2.9SL	dicamba (BAPMA salt) dicamba (DGA salt with VaporGrip Technology)	4	6.4–12.8 fl oz 11–22 fl oz	0.25–0.5 lb ae
<ul style="list-style-type: none"> • Carefully read and follow product labels. • Refer to Clarity for comments • See label for additional use details and restrictions. • <i>Engenia/XtendiMax are restricted-use products; all dicamba formulations have a water quality advisory.</i> 				

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
Halex GT 4.39EC	S-metolachlor +	15		0.94–1.04
	mesotrione +	27	3.6–4.0 pt	0.09–0.1
	glyphosate	9		0.9–1.04 ae

- Halex GT contains S-metolachlor (Dual Magnum) + mesotrione (Callisto) + glyphosate and can only be applied to glyphosate-resistant (RR) corn hybrids from emergence to 30 inches tall (8-leaf stage).
- For best results, apply to weeds before they are 4 inches tall.
- Include NIS and AMS in the spray mixture.
- Tank-mix with 0.25 to 1 lb ai/A of atrazine for much improved control and to broaden the spectrum of control. Local university data supports at least 0.5 lb ai/A of atrazine. Do not apply the tank mixture of Halex GT and atrazine to corn greater than 12 inches tall.
- Do not apply another HPPD-inhibitor herbicide (Callisto, Impact/Armezon, Laudis, Capreno) postemergence in the same season.
- Do not apply more than 4 pt/A Halex GT per season (0.0105 lb mesotrione, 1.05 lb S-metolachlor, and 1.05 lb glyphosate) or make more than 1 application per year.
- Do not apply more than 0.24 lb ai mesotrione/A/year from any product or combination of products containing mesotrione.
- When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds.
- Halex GT will provide effective residual control of susceptible weed species.
- Halex GT is not recommended for use as a preplant or PRE application.
- Halex GT can be used in a planned PRE followed by POST herbicide program.
- Use caution if applying OP or carbamate insecticides 7 days before or after Halex GT application.
- See label for additional use restrictions.

Harmony SG 50WDG	thifensulfuron	2	0.125 oz	0.063 oz
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- Harmony SG can be applied to 2–6 leaf corn (1–4 collars, up to 12 inches tall) at a rate of 1/8 oz/A.
- Harmony SG can be used in a tank-mix to control velvetleaf, pigweed, smartweed, wild mustard, and lambsquarters (including triazine-resistant species).
- Include the necessary adjuvants in the spray solution.
- Corn treated with an organosphosate insecticide such as chlorpyrifos or terbufos can cause injury. Refer to label for restrictions.
- Harmony SG is an ALS (group 2) inhibitor herbicide. To prevent herbicide resistance, avoid repeated annual applications of soil-persistent ALS (group 2) herbicides.

5-76 Weed Control in Field Crops: Corn

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
Impact 2.8SC or Armezon 2.8SC	topramezone	27	0.5–2.0 fl oz	0.011–0.044

- Impact/Armezon is similar to Callisto but has more annual grass activity.
- Apply postemergence to corn up to V8 growth stage or 45 days prior to corn harvest, whichever is more restrictive (use drop nozzles when necessary).
- Always include methylated seed oil (MSO) or crop oil concentrate (COC) and UAN or AMS in the spray mixture.
- Tank-mix with 0.25 to 1 lb ai/A of atrazine for much improved control and to broaden the spectrum of control. Local university data supports at least 0.5 lb ai/A of atrazine. Do not apply the tank mixture with atrazine to corn greater than 12 inches tall.
- Impact is often used at 1 fl oz/A but the rate can be increased to 2 fl oz/A for larger or harder to control weeds such as fall panicum, yellow foxtail, or seedling Johnsongrass.
- Impact/Armezon will control/suppress crabgrass, foxtails, and other grass species but is weak on fall panicum.
- Impact/Armezon can be used in sequence after herbicides such as Balance, Lumax, Lexar, etc., but be cautious of rate restrictions. Impact/Armezon may be used after or in combination with all soil or foliar-applied insecticides registered for use in corn.
- Do not apply more than 0.022 lb ai topramezone/A/year.
- When HPPD-containing (Group 27) herbicides are used in both preemergence and postemergence (sequential applications), Impact must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds.
- Corn can be planted any time after Impact/Armezon application, 3-month restriction for small grains, 9-month restriction for alfalfa, potato, soybean, and sorghum and 18 months for other crops. See Table 5.4 for other rotational crops.
- ImpactZ is a premix containing topiramazone plus atrazine.
- Impact Core is a premix of topramezone plus acetochlor (Harness) and can be applied post.
- Sinate is a premix of topramezone plus glufosinate (Liberty).
- Armezon PRO is a premix containing topiramazone plus dimethenamid (Outlook) and can be applied over-the-top of corn for additional residual weed control. Kryo is a premix containing topiramazone, acetochlor (Harness), and clopyralid (Stinger) and can be applied over the top of corn for additional weed control.

Kryo	acetochlor (Group 15) +	35	35-60 fl oz	
	topramezone (Group 27)			
	+			
	clopyralid (Group 4)			

- Can be applied emergence up to 24-inch tall corn.
- Kryo is most effective when applied to actively growing weeds that are 4 inches or less in height.
- Use rate from 35-60 fl oz/A. Max use rate is 60 fl oz/A.
- 45 fl oz/A is a typical rate when post emergent control of grasses is required.
- Consider tank mixing with atrazine at .25 to 1 lb ai/A. (do not apply a tank mix containing atrazine on corn taller than 12 inches).
- Glufosinate and glyphosate can also be tank mixed to broaden control in glyphosate and glufosinate-resistant corn.
- Use a crop oil concentrate or methylated seed oil with Kryo when applied alone. Nonionic surfactant or oil type adjuvants may be used in tank mixtures containing Kryo unless the glyphosate or glufosinate product includes an adjuvant system. Do not add an oil-type adjuvant with glufosinate or atrazine containing tank mixtures. Ammonium sulfate may be used with Kryo alone or in tank mixtures.

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name¹	Common Name	Site of Action Number	Product/A	lb ai/A
Laudis 3.5SC (tembotrione)	tembotrione	27	3 fl oz	0.082
<ul style="list-style-type: none"> • For best results apply Laudis at 3 fl oz/A when weeds are small (i.e., 1 to 3 inches tall). • Methylated seed oil (MSO) or crop oil concentrate (COC) adjuvants are recommended by manufacturer. In addition, nitrogen fertilizer is required (UAN or AMS). • Tank-mix with 0.25 to 1 lb ai/A of atrazine for much improved control and to broaden the spectrum of control. Local university data supports at least 0.5 lb ai/A of atrazine. Do not apply the tank mixture of Laudis and atrazine to corn greater than 12 inches tall. • Laudis can be tank-mixed with other herbicides to improve weed control spectrum. • Laudis will control/suppress crabgrass, foxtails, and other grass species, but it will not control fall panicum. • Do not make more than two applications of Laudis in a growing season. • Do not apply more than 0.164 lb ai tembotrione/A/year. • When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds. • Be cautious of crop rotation restrictions; see Table 5.3. 				
Liberty 2.34L	glufosinate	10	22–32 fl oz	0.40–0.59
<ul style="list-style-type: none"> • Liberty controls most annual grasses and broadleaves. • Apply over the top to glufosinate-resistant (e.g., LibertyLink) corn only. • Up to three Liberty applications can occur during the growing season (one at burndown and two in-crop). • Two postemergence applications of Liberty can be applied at least 7 days apart. • Broadcast applications may be made from corn emergence until corn is in the V-5 stage of growth, whichever comes first. • For best results, apply 22 to 32 fl oz of Liberty when weeds are 2 to 6 inches tall. • Do not apply more than 87 fl oz/A/year. • Liberty herbicide should generally follow a soil residual herbicide program and/or be tank-mixed with an appropriate postemergence product to broaden the spectrum of control. • Applications should be made between dawn and 2 hours before sunset to avoid the possibility of reduced lambsquarters or velvetleaf control. • Weed control can be reduced if application is made when heavy dew, fog, or mist are present or when weeds are under environmental stress. • Liberty provides no soil residual activity. • See Table 5.20 for adjuvant information. Include ammonium sulfate (AMS) at 3 lb/A (17 lbs/100 gal) but a lower rate is recommended if temperatures exceed 85 degrees (8.5 lbs/100 gal) to reduce risk of leaf burn. Do not add any surfactants or crop oils. • Sinate is a premix of topramezone plus glufosinate (Liberty). 				
Maestro / Moxy 2E	bromoxynil	6	1–1.5 pt	0.25–0.375
<ul style="list-style-type: none"> • Apply to small actively growing weeds. • Maestro or Moxy pose less threat to off-target plants from drift than 2,4-D or dicamba. • Bromoxynil is weak on pigweed. 				
Metribuzin 75DF	metribuzin	5	2 oz	0.094
<ul style="list-style-type: none"> • Metribuzin may be applied postemergence at the 2-oz rate in tank-mix combination with atrazine, Banvel, Clarity, Basagran, Buctril, Marksman, and 2,4-D for improved control of certain broadleaf weeds (e.g., velvetleaf). • Observe precautions and limitations of tank-mix partners. • <i>Water quality advisory.</i> 				

5-78 Weed Control in Field Crops: Corn

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
Peak 57WG	prosulfuron	2	0.25–1.0 oz	0.009–0.036
<ul style="list-style-type: none"> • Peak is an ALS (group 2) herbicide and can be applied in field corn to control broadleaf weeds. • Include necessary adjuvants in the spray mixture. • Peak can be applied when corn is 4 to 30 inches tall; use drop nozzles when corn is >20 inches tall. • In university field trials, Peak at 0.5 oz/A provided season-long control of burcucumber, especially when applied to 25-30 inch tall corn. • Be cautious of interactions with certain OP insecticides. • Be cautious of long crop rotational intervals for many crops, see label for details. • Refer to label for additional information on use and restrictions. 				
Permit 75WG or Sandea	halosulfuron	2	0.67–1.33 oz	0.032–0.063
<ul style="list-style-type: none"> • Apply to corn from spike through layby (last cultivation). • The 0.67 oz rate is the standard rate for annual weed control. • Permit/Sandea is excellent on yellow nutsedge, but is weak on common lambsquarters. • Tank-mix with products such as dicamba or 2,4-D to increase the weed control spectrum. • Permit/Sandea will provide residual control of susceptible weed species. • Permit/Sandea has no insecticide use restrictions. • To prevent herbicide resistance, avoid repeated annual applications of soil-persistent ALS (group 2) herbicides. • Yukon is a prepackaged product containing halosulfuron (Permit) plus dicamba. 				
Permit Plus 74WDG	halosulfuron +	2	0.75 oz	0.031
	thifensulfuron	2		0.004
<ul style="list-style-type: none"> • The addition of thifensulfuron (Harmony SG) to halosulfuron (Permit) allows for a broader spectrum of control, especially at lambsquarter postemergence. • Apply 0.75 oz/A plus necessary adjuvants to corn with 2–6 leaves (but with no more than 5 collars). • Tank-mix to broaden control spectrum. • Permit Plus contains two ALS-type (Group 2) herbicides. To prevent herbicide resistance, avoid repeated annual applications of ALS herbicides. 				
Realm Q 38.8WDG	rimsulfuron +	2	4 oz	0.019
	mesotrione +	27		0.078
	corn safener			
<ul style="list-style-type: none"> • Realm Q contains the active ingredients in Resolve and Callisto and the postemergence corn safener isoxadifen. • For best results, apply Realm Q at 4 oz/A in a two-pass program and when weeds are small and prior to corn reaching 12 inches tall. • Realm Q requires use of nitrogen fertilizer (AMS or UAN) in addition to COC or NIS. • Make only one application per season. • The addition of atrazine will improve postemergence weed control and is strongly recommended. • Realm Q can be used alone, in combination with glyphosate on Roundup Ready corn or glufosinate on LibertyLink corn, or included in other POST herbicide programs to improve weed control spectrum. • Realm Q will provide some residual as well as foliar control. • Do not apply more than 0.063 lb ai rimsulfuron/A/year from any product or combination of products containing rimsulfuron. • Do not apply more than 0.24 lb ai mesotrione/A/year from any product or combination of products containing mesotrione. • When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds. • Refer to the Realm Q label for all restrictions concerning increased injury when used with corn treated with organophosphate insecticides (chlorpyrifos, terbufos etc). 				

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
Resolve 25DF	rimsulfuron	2	0.5–2.0 oz	0.0078–0.03
<ul style="list-style-type: none"> Resolve contains the single active ingredient rimsulfuron. Resolve can be applied pre or post in corn at 0.5–2.0 oz/A. Use the higher rate when applying as a tank-mix partner in a pre program. The typical use rate for post applications is 1 oz/A, plus the necessary adjuvants. Resolve alone will control small seedling weeds, grasses less than 2 inches and broadleaves less than 3 inches. Resolve will control crabgrass less than 0.5 inch tall. Resolve can be tank-mixed with glyphosate to provide residual control of broadleaf and grass weed species emerging after the application. Resolve may be tank-mixed with full or reduced rates of other corn herbicides as well. Do not apply Resolve to corn under stress due to crop injury. Refer to the Resolve label for all restrictions concerning increased injury when tank-mixed with organophosphate insecticides terbufos, chloryrifos, etc. Do not tank-mix with Basagran due to crop injury concern. Apply Resolve up to 12 inch tall corn or before the appearance of 6 or more collars, whichever is more restrictive. Resolve must be applied with a nonionic surfactant (NIS) and nitrogen fertilizer. Crop oil concentrate (COC) may be used in place of nonionic surfactant. When applying Resolve in tank-mixture with a glyphosate product that contains a “built-in” adjuvant system, the Resolve label does not recommend the use of extra adjuvants. To prevent herbicide resistance, avoid repeated annual applications of soil persistent ALS (group 2) herbicides. 				
Resolve Q	rimsulfuron +	2	1.25 oz	0.014
	thifensulfuron	2		0.003
<ul style="list-style-type: none"> Do not confuse Resolve with Resolve Q. Resolve Q contains rimsulfuron (Resolve) plus thifensulfuron (Harmony SG) and a postemergence corn safener. Apply 1.25 oz/A postemergence to corn up to 20 inches tall. Applications made after weed emergence will provide contact control of labeled weeds and limited residual control of later emergence. For control of emerged weeds, include a nonionic surfactant and an ammonium nitrogen fertilizer. If applied in combination with a glyphosate or glufosinate herbicide that contains a built-in adjuvant system, no additional surfactant needs to be added. Resolve Q may be tank mixed with glyphosate or glufosinate herbicides if applications are made to corn hybrids containing appropriate herbicide tolerance genes, and can be tank-mixed with full or reduced rates of other products registered for use in corn. Resolve Q may be tank- mixed with full or reduced rates of preemergence grass and broadleaf herbicides to provide added residual activity. Do not tank-mix Resolve Q with Basagran. Resolve Q may negatively interact with certain OP insecticides, see label for specific details. To prevent herbicide resistance, avoid repeated annual applications of soil-persistent ALS (Group 2) herbicides. 				
Resource 0.86EC	flumiclorac	14	4–6 fl oz	0.027–0.04
<ul style="list-style-type: none"> Apply to corn from 2-leaf to 10-leaf stage. Good on velvetleaf up to 30 inches tall. Tank-mix with other products such as dicamba or atrazine to increase the weed control spectrum. Perpetuo is a premix of flumiclorac plus pyroxasulfone (Zidua) and must be applied post. 				

5-80 Weed Control in Field Crops: Corn

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
Roundup PowerMax 4.5S or PowerMax3 4.8S Durango DMA Other glyphosate products	glyphosate	9	22 to 32 fl oz or 20 to 30 fl oz 24 to 36 fl oz	0.75 lb ae to 1.12 lb ae

- Apply over-the-top to Roundup Ready corn hybrids only.
- Apply from corn emergence through 48-inch tall corn in a 10–20 GPA spray solution.
- Do not apply more than 1.13 lb ae/A of glyphosate (Roundup PowerMax at 32 fl oz or PowerMax3 at 30 fl oz/A) in a single in-crop application. (Refer to current product label for other use restrictions.)
- For corn grain and silage corn, two in-crop applications of Roundup can be made; allow 10 days between applications.
- For best results, apply a pre residual herbicide followed by glyphosate when weeds are 4–6 inches tall (for best results tank mix with other post herbicides to improve weed control spectrum and to prevent glyphosate-resistant weed species.)
- Early postemergence programs that include glyphosate plus a residual herbicide also are an option, but may not be as consistent as the preemergence followed by the postemergence program.
- Be cautious of corn height restrictions for residual herbicides.
- Roundup WeatherMax does not require additional adjuvants in the spray tank under most conditions.
- Do not harvest silage for 50 days or grain for 7 days after last application.
- Refer to Table 5.1 for various glyphosate products and see specific product label for additional application information and restrictions.

Shieldex 400 3.33SC	tolpyralate	27	1–1.35 fl oz	0.026–0.035
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- For best results apply Shieldex before weeds reach 5 inches tall.
- Methylated seed oil (MSO) or crop oil concentrate (COC) adjuvants are recommended by manufacturer. In addition, nitrogen fertilizer is required (UAN or AMS).
- Tank-mix with 0.25 to 1 lb ai/A of atrazine for much improved control and to broaden the spectrum of control. Local university data supports at least 0.5 lb ai/A of atrazine. Do not apply the tank mixture of Laudis and atrazine to corn greater than 12 inches tall. Shieldex can be tank-mixed with other herbicides to improve weed control spectrum.
- Shieldex will control/suppress crabgrass, foxtails, and other grass species, but it will not control fall panicum. Also, it will provide control of several common annual broadleaf weeds found in our region.
- Do not make more than 2 applications of Shieldex in a growing season.
- Do not apply more than 0.07 lb ai (2.7 fl oz) tolpyralate per acre per year
- When HPPD-containing (Group 27) herbicides are used in both pre and post sequential applications, the post HPPD product must be tank-mixed with another herbicide that has a different and effective site of action on the target weeds.
- Be cautious of crop rotation restrictions; see Table 5.17.
- Other products that contain tolpyralate include: Empyros product line, Katagon, and Restraint.

Status 56WDG	dicamba +	4		0.063–0.25
	diflufenzopyr +	19	2.5–10 oz	0.025–0.1
	safener			

- Status contains dicamba (Clarity) plus another plant growth regulator (diflufenzopyr) and the postemergence corn safener isoxadifen.
- Apply Status at 5 oz/A to 4- to 36-inch-tall corn (V2–V8).
- Status can be tank-mixed with glyphosate at 2.5 oz/A. Use higher rates for more difficult to control weeds. Do not exceed a total of 12.5 oz/A per season.
- Include a non-ionic surfactant at 1 qt plus 5 qt of UAN (28–34% nitrogen) per 100 gallons of water (COC or MSO may be used instead of NIS).
- Status is effective on many broadleaf weeds.
- Do not tank-mix with products that contain 2,4-D, dicamba, or clopyralid.
- *Water quality advisory.*

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
Steadfast Q 37.7WG	nicosulfuron +	2	1.5 oz	0.02
	rimsulfuron +	2		0.012
	corn safener			

- Steadfast Q also contains a 2:1 ratio of nicosulfuron to rimsulfuron in addition to the postemergence corn safener isoxadifen.
- Apply Steadfast Q at 1.5 oz/A to corn up to 20 inches tall (6 collars) and while weeds are young and actively growing.
- Steadfast Q is weak on crabgrass, especially if >1 inch tall. Always include the necessary adjuvants in the spring mixture.
- Steadfast Q can be tank-mixed to improve control and increase weed spectrum.
- Steadfast Q may negatively interact with certain OP insecticides (i.e. chlopyrifos, terbufos, etc), see label for specific details.
- To prevent herbicide resistance, avoid repeated annual applications of soil-persistent ALS (Group 2) herbicides.
- See Table 5.3 for recrop restrictions.

Stinger 3S	clopyralid	4	0.25–0.66 pt	0.093–0.25
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- Apply to corn up to 24 inches tall. Use 0.25–0.5 pt/A for ragweed, cocklebur and Jerusalem artichoke and 0.33–0.66 pt/A for Canada thistle.
- Delay planting soybeans for 18 months following Stinger application.
- Other premix products containing clopyralid for postemergence use in corn include:
 - Kryo (clopyralid, topramazone, and acetochlor)
 - Curtail (clopyralid and 2,4-D)
 - Maverick (clopyralid, mesotrione, and pyroxasulfone)
 - Resicore (clopyralid, acetochlor, and mesotrione)
 - SureStart II and TripleFlex II (clopyralid, acetochlor, and flumetsulam)
- *Water quality advisory.*

Stout 72.5WDG	nicosulfuron +	2	0.5–0.75 oz	0.031
	thifensulfuron	2		0.002

- Stout contains nicosulfuron (Accent) and thifensulfuron (Harmony SG).
- The typical use rate for Stout is 0.75 oz/A and must include a crop oil concentrate (COC) or a non-ionic surfactant (NIS) in the spray mixture as well as a nitrogen fertilizer (UAN or AMS).
- Stout can be applied up to 16 inch tall corn or to corn with less than 6 collars, whichever is more restrictive.
- Stout will not control crabgrass species.
- Do not tank-mix Stout with Basagran due to crop safety concerns. Do not tank-mix with 2,4-D due to reduced grass control.
- Refer to Stout label for restrictions regarding OP insecticides such as terbufos, chlopyrifos, etc. Do not tank-mix with other ALS-inhibitor herbicides unless stated on herbicide label.
- To prevent herbicide resistance, avoid repeated annual applications of soil-persistent ALS (Group 2) herbicides.

5-82 Weed Control in Field Crops: Corn

Table 5.19 - Comments on Postemergence Herbicides for Corn (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
SureStart II 4.25SE or TripleFLEX II	acetochlor +	15	1.5–3.0 pt	0.71–1.41
	flumetsulam +	2		0.056–0.113
	clopyralid	4		0.023–0.045
Tough 5EC	pyridate	6	24 fl oz	0.94
Warrant 3CS	acetochlor	15	1.5–3.0 qt	1.13–2.25
Yukon 67.5WDG	halosulfuron +	2	4–8 oz	0.03
	dicamba	4		0.125

- SureStart II/TripleFLEX II can be applied up to the early POST stage (11-inch-tall corn) and is intended to be used with Roundup Ready or LibertyLink field or silage corn hybrids.
- When applied PRE, it is designed to provide early season control of common annual grasses and broadleaf weeds to allow better timing of the in-crop application of glyphosate or glufosinate.
- The use rate on medium-textured soils ranges from 1.5 to 1.75 pints/A, but for longer residual control, use up to 3 pt/A.
- SureStart II/TripleFLEX II does not contain atrazine, so it provides a non-atrazine alternative for triazine-sensitive areas. However, atrazine and other herbicides can be tank-mixed with SureStart II/TripleFLEX II to broaden the weed control spectrum.
- SureStart II/TripleFLEX II can be tank-mixed with glyphosate (in Roundup Ready corn) or glufosinate (LibertyLink corn) to provide broader spectrum of POST weed control.
- Applications should be made to weeds 2 inches or less in height.
- Make sure to plant corn 1.5 inches deep and be cautious of interactions with certain OP insecticides that may cause crop injury.

- Tough is good on common lambsquarters and pigweeds but should generally be tank-mixed with atrazine or another suitable foliar-applied product to broaden the control spectrum.
- Apply when broadleaves are in the one- to four-leaf stage of growth and before corn reaches V8 growth stage.
- Include NIS, COC, or MSO plus AMS or nitrogen fertilizer to improve weed control.
- Thorough spray coverage (15 to 20 gal/A) is necessary for optimal weed control.

- Warrant can be tank-mixed with glyphosate and post applied to emerged corn to provide residual control of annual weeds.
- Warrant does not control emerged weeds.
- The typical use rate is 1.5 qt/A.
- *Water quality advisory.*

- Yukon is a premix of halosulfuron (Permit) plus dicamba.
- Yukon can be applied at 4–8 oz/A to corn from spike to 36 inches tall; use drop nozzles when necessary. (The 4 oz/A Yukon rate equals 0.67 oz/A Permit plus 4 fl oz/A Clarity.)
- Include necessary adjuvants in the spray solution (Table 5-22).
- Yukon has no insecticide use restrictions.
- To prevent herbicide resistance, avoid repeated annual applications of soil-persistent ALS (Group 2) herbicides.

¹ See Table 5.4 and 5.6 for additional formulations or trade names containing some of these same active ingredients.

Table 5.20 - Weed Sizes for Postemergence Corn Herbicides

This table lists postemergence corn herbicides, their rates, and heights of weed species that are controlled or suppressed. This table is only a “quick reference”; refer to the herbicide label for additional information on application and timing.

Grasses	Barnyardgrass	Bermudagrass	Broadleaf Signal Grass	Crabgrass	Fall Panicum	Foxtail spp.	Goosegrass	Johnsongrass (Seedling)	Johnsongrass (Rhizome)	Quackgrass	Shattercane	Texas Panicum	Wirestem Muhly	Yellow Nutsedge
Herbicide (rate/A)	Height Range (inches) at Application													
Accent Q (0.9 oz)	<4	-	≤2	-	<4	<4	-	<12	<18	<10*	<12	≤3	<8*	-
Basis Blend (0.825 oz)	1-2	-	-	-	1-2	1-2	-	-	-	-	-	-	-	-
Callisto (3 fl oz)	-	-	-	≤2	-	-	-	-	-	-	-	-	-	-
Capreno (3 fl oz)	<5	-	≤5	<3	<5	<3	-	<5	-	-	<12	≤3	-	-
Glyphosate (0.75 ae)	4-6	L*	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6
Halex GT (3.6 pt)/ Acuron GT (3.75 pt)	<4	-	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Impact/Armezon (0.75 fl oz)/Impact Core	≤4	-	≤3*	≤3	≤3*	3-4 ¹	≤3	4*	-	-	-	≤3*	-	-
Laudis (3 fl oz) / DiFlexx Duo (32 fl oz)	1-5	-	1-4	1-3	-	1-3	1-3	1-5	-	-	1-6	1-3	-	-
Liberty ² (32 fl oz)	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3
Permit (1.0 oz)	-	-	≤2*	-	-	-	-	-	-	-	-	-	-	4-12
Realm Q (4.0 oz)	1-2	-	≤2*	≤0.5	1-2	1-2	-	1-2*	-	1-2*	1-4	-	-	1-2*
Require Q (4 oz)	1-2	-	-	0.5	1-2	1-2	-	*	-	*	1-4	-	-	*
Resolve (1 oz)	1-2	-	1-2*	≤0.5	1-2	1-2	-	1-2*	-	1-2*	1-4	-	-	1-2*
Resolve Q (1.25 oz)	1-2	-	1-2*	0.5	1-2	1-2	-	*	-	*	1-4	-	-	*
Revolin Q (4 oz)	1-4	-	≤2	≤2	<4	≤4	-	<12	<18	<10*	<12	<3	<6*	-
Roundup PowererMax (22 fl oz) ³	4-6	L*	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6
Shieldex (1 fl oz)/ Restraint	<5	-	<5	<5	-	<5	<5	-	-	-	<5	-	-	-
Sinate (28 fl oz)	≤4	-	≤4	≤4	≤4	≤4	-	≤4	-	-	≤4	≤4	*	*
Steadfast Q (1.5 oz)	<4	-	≤2	<1*	<4	<4	≤2	<12	<12	<8*	<6	≤4	<4*	-
Stout (0.75 oz)	≤4	-	≤2	-	≤3	≤4	-	≤12	≤18	≤10*	≤12	≤3	≤8*	-
Yukon (6-8 oz)	-	-	-	-	-	-	-	-	-	-	-	-	-	1-12

* Suppression only; additional control measures may be necessary.

¹ Yellow foxtail suppression only.

² For use on LibertyLink/GR corn hybrids only.

³ For use on Roundup Ready corn hybrids only.

5-84 Weed Control in Field Crops: Corn

Table 5.20 - Weed Sizes for Postemergence Corn Herbicides (cont.)

This table lists postemergence corn herbicides, their rates, and heights of weed species that are controlled or suppressed. This table is only a “quick reference”; refer to the herbicide label for additional information on application and timing.

Broadleaves	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters	Marestail/Horseweed	Annual Morning Glory	Eastern Black Night Shade	Palmer Amaranth/Waterhemp	Pigweed	Common Ragweed	Giant Ragweed	Smartweed	Spurred Anoda	Velvetleaf
	Maximum Height (inches) at Application													
2,4-D ¹	–	6	3	4	4	6	2	4	4	6	6	–	–	2
Accent Q (0.9 oz)	3	–	3	–	–	2	–	–	4	–	–	4	–	–
Aim (0.5 oz)	–	–	–	4	–	2–3 lvs	4	–	4	–	–	–	–	36
Atrazine ¹ (2 qt)	4	4	4	–	4*	4	4	4	–	4	4	4	–	2
Basagran (2 pt)	–	10	10	2*	–	–	–	–	–	3	6	10	4	5
Basis Blend (0.825 oz)	–	–	–	3	–	–	–	3	3	–	–	3	–	3
Cadet (0.9 fl oz)	3	–	2	3*	–	3	2	2*	4	–	–	2	4*	36
Callisto (3 fl oz)	–	5	5	5	3*	5*	5	3*	5	5*	5	5	–	5
Capreno (3 fl oz)	<6*	<6	<6	<6	–	<6*	<6	<6	<6	<6	<6	<6	–	<6
Clarity/Banvel ¹	4	4	4	4	4	4	4	4	4	4	4	6	–	2
DiFlexx (8 fl oz)	3	3	3	3	3	3	3	3	3	3	3	3	3	3
DiFlexx Duo (32 fl oz)	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6
Glyphosate (0.75 ae)	6	6	6	6	6*	6	6	6	6	6	6	6	3	6
Halex GT (3.6 pt)/Acuron GT (3.75 pt)	<4	<4	<4	<4	<4	<4	<4	<4*	<4	<4	<4	<4	<4	<4
Harmony SG (0.125 oz)	–	–	–	4	–	–	–	4	12	–	–	6	–	6
Impact/Armezon (0.75 fl oz)/Impact Core	–	8	6	6	–	6*	6	6*	6	6	8	3	–	8
Laudis (3 fl oz)	<6*	<6	<6	<6	–	<6*	<6	<6	<6	<6	<6	<6	–	<6
Liberty ² (32 fl oz)	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3
Maestro, Moxy (1.5–2 pt)	4	10	6	8	4*	4	6	–	2	6	6	6	–	5
Peak (0.5 oz)	3	6	4	3	3	3	–	3	3	6	3	3	–	4
Permit/Sandea (0.67 oz)	3*	9	–	2*	–	–	–	–	3	9	3	2	–	9
Permit/Sandea (1–1.33 oz)	12*	14	–	2*	–	3*	–	–	6	12	6	2	–	12
Permit Plus (0.75 oz)	3*	9	4*	4	–	3*	–	4	12	9	3	6	–	9
Perpetuo (8 fl oz)	4 lvs	4 lvs	4 lvs	3 lvs	–	–	–	4 lvs	3 lvs	3 lvs	–	–	–	6 lvs
Realm Q (4 oz)	5	5	5	5	5*	5*	5	5	5	5	5	5	–	5
Resolve (1 oz)	–	3*	–	3*	–	3*	–	–	3	3*	–	3*	–	3*
Resolve Q (1.25 oz)	–	1–3*	–	1–3*	–	1–3*	–	–	1–3	1–3*	–	1–3*	–	1–3
Resource ³ (6 oz)	–	–	–	3 lvs	–	–	–	3 lvs	3 lvs	3 lvs	–	–	–	6 lvs

Table 5.20 - Weed Sizes for Postemergence Corn Herbicides (cont.)

This table lists postemergence corn herbicides, their rates, and heights of weed species that are controlled or suppressed. This table is only a “quick reference”; refer to the herbicide label for additional information on application and timing.

Broadleaves	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters	Marestail/Horseweed	Annual Morning Glory	Eastern Black Night Shade	Palmer Amaranth/ Waterhemp	Pigweed	Common Ragweed	Giant Ragweed	Smartweed	Spurred Anoda	Velvetleaf
	Maximum Height (inches) at Application													
Revulin Q (4 oz)	<2	<5	<5	<5	–	<5	<5	<5	<5	<5	<5	<5	–	<5
Roundup PowerMax ⁴ (22 fl oz)	6	6	6	6	6*	6	6	6	6	6	6	6	3	6
Shieldex (1 fl oz)/Restraint	–	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	–	<5
Sinate (28 fl oz)	6	6	6	6	6	4	6	6	4-6	6	6	4	–	6
Status ¹ (5 oz)	4	4	4	4	4	4	4	4	4	4	4	4	–	4
Steadfast Q (1.5 oz)	4	4*	4	4*	–	4	–	–	4	–	–	4*	–	4*
Stout (0.75 oz)	3	–	3	4	–	2–3	–	–	4	–	–	4	–	4
Tough (24 fl oz)	4 lvs	4 lvs	4 lvs	4 lvs	–	–	4 lvs	4 lvs	4 lvs	–	–	–	–	–
Yukon (4–8 oz)	12*	14	4	6	4	6	6	3	12	12	6	3	–	12

*Suppression only, additional control measures may be necessary.

¹ No sizes given on label, sizes listed above are best estimates.

² For use on LibertyLink or glufosinate-resistant corn hybrids only.

³ Resource label refers to weed size by number of leaves (lvs).

⁴ For use on Roundup Ready corn hybrids only.

Table 5.21 - Postemergence Herbicide Application Restrictions for Corn

Trade Name	Over-the-Top Application	Use of Drop Nozzles	Comments
2,4-D	<8 inches tall	0.5 pt: 8–36 inches tall	Some 2,4-D formulations allow application up to tasseling.
Accent Q	20 inches tall (free-standing) or <6 collars (V6 stage)	20–36 inches tall or V6 to V10 stage	—
Aim	Up to 8-leaf collar stage (V8)	Up to 14-leaf collar stage	Use drop nozzles or directed sprayers that target weeds but spray away from the corn whorl.
Armezon PRO	Up to 30 inches tall (or 8-corn leaf stage)	When necessary	Do not make application within 45 days of corn harvest or after V8 corn growth stage
Atrazine	12 inches tall	—	—
Basagran	No restrictions	—	—
Basis Blend	Spike to 4 leaves (2 collars) or 0.5–6 inches tall	—	Do not apply to corn >6 inches tall or having 3 collars.
Cadet	Up to 48 inches tall	When necessary	Apply before tasseling.
Callisto, Callisto GT	Up to 30 inches tall (or 8-corn leaf stage)	—	—

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Table 5.21 - Postemergence Herbicide Application Restrictions for Corn (cont.)

Herbicide	Over-the-Top Application	Use of Drop Nozzles	Comments
Callisto Xtra	12 inches tall	—	—
Capreno	Up to V6 (6 collars)	to V7 (7 collars)	—
Clarity, Engenia or Xtendimax	1 pt: 8 inches tall or 5 leaves 0.5 pt: 8–36 inches tall or 15 days before tassel emergence	—	Do not apply dicamba near soybeans if corn is >24 inches tall, or if soybeans are >10 inches tall or have begun to bloom.
Curtail	<8 inches tall	—	—
DiFlexx/ DiFlexx Duo	Spike to V6 or 36 inches tall	V7-V10	Apply 15 days prior to tasseling.
Ensis Duo	Up to 30 inches tall (V8)	30–48 inches tall	Apply to Enlist corn hybrids only.
Enversa	Up to 30 inches tall	—	Does not control emerged weeds; tank-mix with glyphosate in Roundup Ready corn
Glyphosate products	Up to 30 inches tall (V8 stage)	30 – 48 inches tall	Apply to Roundup Ready hybrids only.
Halex GT/ Acuron GT	Emergence to 30 inches tall (8-leaf stage)	—	—
Harmony SG	2–6 leaves up to 12 inches tall (1 to 4 collars)	—	Do not apply to corn >12 inches tall or having 4 collars.
Harness MAX	Up to 11 inches tall	—	—
Impact/ Armezon	Up to V8 or 45 days prior to corn harvest (whichever is most restrictive)	When necessary	—
Impact Core	Up to 11 inches tall	—	—
Kyro	up to 24 inch	—	—
Laudis	Emergence up to V8 stage	—	—
Liberty	Emergence to V6	When necessary up to 36 inches tall	Apply to Liberty Link or GR corn hybrids only.
Maestro, Moxy	1 pt: emergence to tassel 1.5 pts: 4 leaves to tassel	—	Postemergence application before 3-leaf stage may result in corn leaf burn.
Metribuzin	Emergence to pretassel	When necessary	See tank-mix partner.
Peak	4–20 inches tall	20-30 inches tall (V6)	—
Permit	Spike to 48 inches tall	When necessary	If tank-mixed: with 2,4-D, apply to corn up to 8 inches tall; with Banvel or Clarity, apply to corn up to 36 inches tall.
Permit Plus	2- to 6-leaf corn (1–5 collars)	—	Do not apply to corn with more than 6 leaves (5 collars).
Perpetuo	2-leaf through V6 stage	—	—
Realm Q	Up to 20 inches tall but with no more than 6 collars	—	—
Resicore Resicore XL	Up to 11 inches tall Up to 24 inches tall	—	—
Resolve	Up to 12 inches tall (<6 collars)	—	—

Table 5.21 - Postemergence Herbicide Application Restrictions for Corn (cont.)

Herbicide	Over-the-Top Application	Use of Drop Nozzles	Comments
Resolve Q	Up to 20 inches tall (<6 collars)	—	—
Resource	2-leaf to 10-leaf stage (collars must be visible)	When necessary, to direct below corn leaves	—
Revulin Q	Up to 20 inches tall (<6 collars)	—	—
Roundup products	Up to 48 inches tall	—	Apply to Roundup Ready hybrids only.
Shieldex	Up to V6 or 20 inches tall	—	—
Sinate	Up to 24 inches tall (7 collars)	24-36 inches tall	Apply to LibertyLink or GR corn hybrids only.
Status	4–36 inches tall (V2–V8)	—	Do not apply within 15 days before tassel emergence.
Steadfast Q	Up to 20 inches tall (6 collars)	—	Best if applied when corn is <12 inches tall.
Stout	Up to 16 inches tall (<6 collars)	—	—
Sure Start II/ TripleFLEX II	Up to 11 inches tall	—	—
Surtain	Up to V3 growth stage	—	Does not control emerged weeds
Tough	Up to V8 growth stage	—	—
Warrant	Emergence to 30 inches tall	When necessary	Does not control emerged weeds; tank-mix with glyphosate in RR corn.
Yukon	Spike to 36 inches tall	When necessary	—

Table 5.22 - Spray Additives and Rainfastness for “Burndown” and Postemergence Corn Herbicides

Trade Name	Adjuvant(s) ¹	Rate	Rainfastness (hours)
2,4-D amine	none, except in certain tank-mixes	—	6–8
2,4-D LVE			1–2
Accent Q	crop oil concentrate or nonionic surfactant plus nitrogen solution or ammonium sulfate	1 gal/100 gal 1–2 qt/100 gal 2–4 qt/A or 2–4 lb/A	4
Aim/Cadet	nonionic surfactant or crop oil concentrate plus ammonium sulfate or nitrogen solution (optional)	2 pt/100 gal 1 gal/100 gal 2–4 lb/A 2–4 gal/100 gal	1
Atrazine	crop oil concentrate	1 gal/100 gal	1–2
Basagran ²	crop oil concentrate	2 pt/A	8
	plus nitrogen solution or ammonium sulfate	1 gal/A 2.5 lb/A	
Basis Blend	crop oil concentrate or nonionic surfactant plus nitrogen solution or ammonium sulfate	1–2 gal/100 gal 1–2 qt/100 gal 2–4 qt/A 2–4 lb/A	

Table 5.22 - Spray Additives and Rainfastness for “Burndown” and Postemergence Corn Herbicides (cont.)

Herbicides.	Adjuvant(s) ¹	Rate	Rainfastness (hours)
Callisto [#] , Callisto Xtra [#]	crop oil concentrate plus nitrogen solution or ammonium sulfate	1 gal/100 gal 2.5 gal/100 gal 8.5 lb/100 gal	1
Callisto GT	nonionic surfactant plus ammonium sulfate (optional)	1–2 qt/100 gal 8.5–17 lb/100 gal	1
Capreno [#]	crop oil concentrate plus nitrogen solution or ammonium sulfate	1 gal/100 gal 1.5 qt/A 1.5 lb/A or 8.5 lb/100 gal	1
Clarity ³	nonionic surfactant or crop oil concentrate plus nitrogen solution	1 qt/100 gal 1 gal/100 gal 2–4 qt/A	4
DiFlexx	nonionic surfactant or crop oil concentrate or methylated seed oil plus nitrogen solution or ammonium sulfate	1 qt/100 gal 1–2 pt/A 1–2 pt/A 2–4 qt/A 8.5–17 lb/100 gal	4
DiFlexx Duo [#]	methylated seed oil or crop oil concentrate plus nitrogen solution or ammonium sulfate	1 gal/100 gal 1 gal/100 gal 1.5 qt/A 8.5–17 lb/100 gal	4
Durango/Duramax DMA	no NIS/COC required ammonium sulfate (optional)	8.5–17 lb/100 gal	1
Enlist Duo, Enlist One	See label for details		1–4
Engenia	See label for details		4
Glyphosate (if not fully loaded with formulation adjuvants)	nonionic surfactant plus ammonium sulfate (optional)	2 qt/100 gal 8.5–17 lb/100 gal	6
Gramoxone SL	nonionic surfactant or crop oil concentrate or MSO	2 pt/100 gal 1 gal/100 gal	0.5
Halex GT/Acuron GT	nonionic surfactant plus ammonium sulfate	1–2 qt/100 gal 8.5–17 lb/100 gal	1–6
Harness MAX	non-ionic surfactant or crop oil concentrate plus ammonium sulfate (optional)	1 pt/100 gal 1 gal/100 gal 8.5–17 lb/100 gal	1–6
Harmony SG [#]	nonionic surfactant or crop oil concentrate plus nitrogen solution or ammonium sulfate	1 qt/100 gal 1 gal/100 gal 2–4 qt/A 2–4 lb/A	1
Impact/Armezon	methylated seed oil or crop oil concentrate plus nitrogen solution or ammonium sulfate	1.0–1.5 gal/100 gal 1.0–1.5 gal/100 gal 1.25–2.5 gal/100 gal 8.5 lb/100 gal	1
Impact Core	methylated seed oil plus nitrogen solution or ammonium sulfate	1–2 qt/100 gal 1.25–2.5 gal/100 gal 1.5–2.5 lb/100 gal	1–4
Kyro	methylated seed oil (MSO) or crop oil concentrate + nitrogen solution or ammonium sulfate	0.5–1 gal/100 gal 0.5–1 gal/100 gal 1.25–2.5 gal/100 gal 8.5–17 lb/100 gal	not specified

Table 5.22 - Spray Additives and Rainfastness for “Burndown” and Postemergence Corn Herbicides (cont.)

Herbicides.	Adjuvant(s) ¹	Rate	Rainfastness (hours)
Laudis [#]	methylated seed oil (MSO) or crop oil concentrate plus nitrogen solution or ammonium sulfate	1 gal/100 gal 1 gal/100 gal 1–5 qt/A 1.5 lb/A	1
Liberty	ammonium sulfate	3 lb/A	4
Maestro, Moxy ⁴	nonionic surfactant or crop oil concentrate or nitrogen solution	1 qt/100 gal 1 gal/100 gal 1–4 gal/100 gal	1
Peak	crop oil concentrate or non-ionic surfactant	1 gal/100 gal 1 qt/100 gal	4
Permit/Permit Plus	nonionic surfactant or crop oil concentrate	1–2 qt/100 gal 1 gal/100 gal	4
Perpetuo	crop oil concentrate or methylated seed oil or nonionic surfactant plus nitrogen solution or ammonium sulfate (optional)	1 gal/100 gal 1 gal/100 gal 1 qt/100 gal 1.25–2.5 gal/100 gal 1.5–2.5 lb/100 gal	1
Realm Q	crop oil or modified seed oil concentrate or nonionic surfactant plus nitrogen solution or ammonium sulfate	1 gal/100 gal 1 qt/100 gal 2 qt/A 2 lb/A	4
Resolve/Resolve Q	crop oil or modified seed oil concentrate or nonionic surfactant plus nitrogen solution or ammonium sulfate	1 gal/100 gal 1 qt/100 gal 2 qt/A 2 lb/A	4
Resource	crop oil concentrate plus nitrogen solution (optional)	1 pt/A	1
Revulin Q	crop oil concentrate plus nitrogen solution or ammonium sulfate	1 gal/100 gal 2 qt/A 2 lb/A	4
Roundup/Glyphosate	nonionic surfactant plus ammonium sulfate (optional)	2 qt/100 gal 8.5–17 lb/100 gal	6
Roundup PowerMax/Roundup WeatherMax	no NIS/COC required ammonium sulfate (optional)	— 8.5–17 lb/100 gal	<1
Shieldex	methylated seed oil (MSO) or crop oil concentrate plus nitrogen solution or ammonium sulfate	0.5 - 1 gal/100 gal 0.5 - 1 gal/100 gal 2.5 gal/100 gal 8.5 lb/100 gal	1
Sinate	methylated seed oil or crop oil concentrate plus nitrogen solution or ammonium sulfate	1 gal/100 gal 1 gal/100 gal 1.25–2.5 gal/100 gal 1.5–2.5 lb/100 gal	4
Status	nonionic surfactant or crop oil concentrate or methylated seed oil plus nitrogen solution or ammonium sulfate	1 qt/100 gal 1–2 pt/A 1–2 pt/A 5 qt/100 gal 5–17 lb/100 gal	4

Table 5.22 - Spray Additives and Rainfastness for “Burndown” and Postemergence Corn Herbicides (cont.)

Herbicides.	Adjuvant(s) ¹	Rate	Rainfastness (hours)
Steadfast Q	crop oil concentrate or nonionic surfactant plus nitrogen solution or ammonium sulfate	1 gal/100 gal 1–2 qt/100 gal 2 qt/A 2 lb/A	4
Stinger	none	—	6–8
Stout	crop oil or modified seed oil concentrate or nonionic surfactant plus nitrogen solution or ammonium sulfate	1 gal/100 gal 1 qt/100 gal 2 qt/A 2 lb/A	4
Tough	non-ionic surfactant or crop oil concentrate or methylated seed oil plus nitrogen solution or ammonium sulfate	1 qt/100 gal 1–2 pt/A 1–2 pt/A 2–4 qt/A 2–4 lb/A	1
Yukon	nonionic surfactant or crop oil concentrate plus nitrogen solution or ammonium sulfate (optional)	1–2 qt/100 gal 1 gal/100 gal 2–4 qt/A 2–4 lb/A	

* Refer to the label if tankmixing with glyphosate (Roundup Ready corn) or glufosinate (Liberty Link corn) for additional adjuvant precautions.

¹ In general, non-ionic surfactants should contain at least 80% surface active agent; crop or vegetable oil concentrates should be nonphytotoxic, containing at least 15% approved emulsifier; nitrogen solution is an ammonium-based fertilizer such as 28%, 30%, or 32% N; and ammonium sulfate should be spray-grade dry ammonium sulfate (21-0-0) or other equivalent liquid formulation of AMS (refer to product label for use rate information). 10-34-0 also may be used with some products.

² Use crop oil concentrate if lambsquarters, common ragweed, Canada thistle, yellow nutsedge, or field bindweed are present. Include nitrogen solution if velvetleaf is the primary target.

³ Do not use COC after corn exceeds 5 inches tall. Adjuvant addition depends on tank-mix partner.

⁴ When Maestro or Moxy is applied alone, spray additives generally are not needed and may cause excessive leaf burn.

⁵ Do not use COC if corn has emerged.

Spray Additives When Tank-mixed with Liberty (LibertyLink corn [LL]) or Glyphosate (Roundup Ready corn [RR])

Trade Name	Specific Adjuvant Comments
2,4-D	n/a*
Accent Q	n/a
Aim/Cadet	n/a
Atrazine	n/a
Basagran	n/a
Callisto/Callisto Xtra	LL: Do not use COC RR: Add AMS; if glyphosate calls for an adjuvant, add NIS (do not use UAN, COC or MSO)
DiFlexx/DiFlexx Duo	LL: Do not use MSO or COC; only add AMS at 8.5 lb/100 gal RR: Label allows for additional adjuvant if resistant weeds are present
Harmony SG	LL: n/a RR: Add AMS; if glyphosate calls for an adjuvant, add NIS (1–2 pt/100 gal) (do not use UAN, COC, or MSO)
Impact/Armezon	n/a

*n/a = adjuvants for LibertyLink or glyphosate not addressed.

Spray Additives When Tank-mixed with Liberty (LibertyLink corn [LL]) or Glyphosate (Roundup Ready corn [RR])	
Laudis	LL: Do not use MSO or COC; only add AMS at 8.5 lb/100 gal RR: Label recommends additional adjuvant if fully loaded glyphosate is used; label requires additional adjuvant if partially loaded glyphosate is used
Maestro/Moxy	n/a
Permit/Sandea	n/a
Resource	n/a
Stinger	n/a
Mixtures	
Basis Blend	n/a
Capreno	LL: Do not use MSO or COC; only add AMS at 8.5 lb/100 gal RR: Use of glyphosate compatible high surfactant oil concentrate (HSOC) is recommended with fully loaded glyphosate and required with partially loaded glyphosate; AMS is required; do not use COC or MSO
Curtail	n/a
Halex GT	LL: Not allowed
Permit Plus	n/a
Realm Q	LL: n/a RR: When tank-mixed with glyphosate, ensure total adjuvant load is equivalent to the label recommendation
Resolve Q	When tank-mixed with glyphosate or glufosinate, ensure total adjuvant load is equivalent to the label recommendation
Revulin Q	LL: n/a RR: When tank-mixed with glyphosate, ensure total adjuvant load is equivalent to the label recommendation
Status	n/a
Steadfast Q	n/a
Stout	n/a
Yukon	n/a
*n/a = adjuvants for LibertyLink or glyphosate not addressed.	

The following treatments are applied prior to harvest to control and help desiccate green weed tissue in established weeds in order to aid in the harvesting process. Contact herbicides are usually better at this process; however, it can vary by weed species and usually will require at least a week or more to desiccate weeds or make them more brittle. Some of these herbicides are not that effective on large weeds or certain species. Harvest aids are not intended to (and usually do not) help speed up crop maturity. If applied too early, they can interfere with the natural crop maturation process. Illegal herbicide residues in grain can result if specific application timing and other label guidelines are not followed. See specific product label to determine correct rate, timing, weed species controlled, and other restrictions with this type of application.

Table 5.23 - Comments on Harvest Aid Herbicides for Corn

Trade Name ¹	Common Name	Site of Action Number	Product/A	lb ai/A
2,4-D LV4	2,4-D ester	4	1–2 pt	0.5–1.0
<ul style="list-style-type: none"> • Apply 1–2 pt/A after the hard dough or dent stage to suppress large weeds that may interfere with harvest and to decrease production of weed seeds. • Use higher rate on larger weeds and those under stress. • Do not forage or feed corn fodder for 7 days after application. 				

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Table 5.23 - Comments on Harvest Aid Herbicides for Corn (cont.)

Herbicide Trade Name	Herbicide Common Name	Site of Action Number	Product/A	lb ai/A
Aim 2EC	carfentrazone	14	2 fl oz	0.031
<ul style="list-style-type: none"> • May be applied 3 days before harvest. • Use as a harvest aid to desiccate certain broadleaf weeds. • Apply in 10 gal/A water. • Include necessary adjuvants (MSO or COC plus AMS) and make sure spray coverage is sufficient (≥ 15 gpa), otherwise poor control will result. • Aim tends to be less injurious to surrounding crops compared to Gramoxone. 				
Defol 5 L	sodium chlorate	Not classified	4.8 qt	6
<ul style="list-style-type: none"> • Defol products are labeled for preharvest applications to desiccate problem weeds in early maturing corn. • Apply at least 14 days before anticipated harvest date. • Apply in 10 to 20 gal/A water with an appropriate adjuvant (NIS or COC). • Desiccation of morningglory and other vine-weeds may be erratic. • Do not graze treated fields or feed fodder, forage or residual grain within 14 days of application. • Some universities recommend tank mixing Defol with Aim or Gramoxone for improved activity. 				
Glyphosate	glyphosate	9	see Table 5.2	up to 0.75 lb ae
<ul style="list-style-type: none"> • Glyphosate products are labeled for preharvest applications in corn. • They can be applied from a week or more prior to harvest. • Apply when grain has 35% or less moisture and after maximum kernel fill is complete and corn is physiologically mature. • Adjuvants (NIS or COC plus AMS) can be added to the spray solution to improve performance. • Do not apply to corn for seed. • 0.75 lb glyphosate = 32 fl oz of a 3 lb ae/gal formulation or 22 fl oz of a 4.5 lb ae formulation 				
Gramoxone SL 2.0 Gramoxone SL 3.0	paraquat	22	1.2–2 pt 0.8–1.3 pt	0.3–0.5
<ul style="list-style-type: none"> • Apply after corn is mature and black layer has formed. • Make application at least 7 days before harvest. • Use lower rates in most cases as a harvest aid, otherwise the 0.5 lb ai/A rate can be used to desiccate mature broadleaves and grasses over 18 inches tall. • Include a nonionic surfactant (1 qt/100 gal) in the spray solution. 				
Sharpen 2.85SC	saflufenacil	14	1–2 oz	0.022–0.044
<ul style="list-style-type: none"> • Apply as broadcast spray after corn has reached physiological maturity. • Do not harvest until at least 3 days after application. • Do not apply on field corn grown for seed production. • Dessication-treated corn stover (stalks) may be grazed or fed to livestock. • Include methylated seed oil (MSO) at 1 gal/100 gal (1% v/v) plus ammonium sulfate (AMS) at 8.5 to 17 lb/100 gal. 				

Table 5.24 - Grazing and Forage Pre-harvest Intervals (PHI) and Restrictions for Corn Herbicides¹

These products restrict grazing and/or foraging (silage) following their use in corn.

Corn Herbicide	Graze (Days After Treatment)	Silage/Grain
2,4-D	7	7
Accent Q	30	45/70
Acuron	45	60
Acuron Flexi	45	60
Anthem Maxx	30	70
Atrazine	60	60
Basagran	12	12
Basis Blend	30	30
Cadet	30	70
Callisto	45	45
Callisto GT	45	45
Callisto Xtra	60	60
Capreno	45	45
Clarity, Engenia, Xtendimax	after milk stage	after milk stage
Corvus	45	45
DiFlexx/DiFlexx Duo	45	45
Enlist Duo	not specified	50
Enlist One	not specified	30
Enversa	40	40
Glyphosate (spot treatment)	7	7
Glyphosate ²	7	50/7
Gramoxone (harvest aid)	7	do not graze
Halex GT/Acuron GT	45	45
Harmony SG	30	7/45
Harness MAX	60	60
Impact/Armezon	45	45
Impact Core	45	45
Kyro	60	45
Laudis	45	45
Lexar	45	60
Liberty ³	70	70
Meastro, Moxy	30	30
Maverick	60	30
Metribuzin	60	60
Outlook	40	40
Peak	30	40/60
Permit/Sandea/Permit Plus/Yukon	30	30

Table 5.24 - Grazing and Forage Pre-harvest Intervals (PHI) Restrictions for Corn Herbicides¹ (cont.)

These products restrict grazing and/or foraging (silage) following their use in corn.

Corn Herbicide	Graze (Days After Treatment)	Silage/Grain
Prowl H ₂ O	21	21
Python	45	85
Realm Q	45	45/70
Resicore/Resicore XL	45	45
Resolve/Resolve Q	30	30
Resource/Perpetuo	28	28
Revulin Q	45	45
Sharpen	80	80
Shieldex	21	45
Sinate ³	60	60/70
Status	72	32/72
Steadfast Q	30	30
Stinger	40	40
Storen	45	45
Stout	30	30
SureStart II/TripleFlex II	not specified	not specified
Surtain	no restriction	no restriction
TriVolt	45	45
Tough	68	68
Verdict	80	80
Warrant	40	40
Zidua	not specified	not specified

¹ Products listed restrict grazing and/or foraging (silage) following their use in corn. Preharvest interval (PHI) is the minimum amount of time between applications and harvest. Refer to Tables 5.15 and 5.21 for additional applications restrictions in corn. Use the most restrictive interval that applies.

² For use only with Roundup Ready corn hybrids.

³ For use only with LibertyLink corn hybrids.

Table 5.25 - Corn Herbicide Half-Lives and Their Potential to Injure Fall Cover Crops

This table does not directly address preharvest establishment of cover crops such as interseeding or aerial seeding, which may be more restrictive. Cover crops that are harvested are subject to herbicide residue restrictions, which are not addressed in this table.

Trade Name	Common Name	Normal Rate/acre	Half life (days) ¹	Fall-established Cover Crops		Other
				OK to plant	Concern for	
2,4-D Amine 4 (2,4-D LV 4)	2,4-D	1-2 pt	7	All	Wait 30 days before planting sensitive broadleaves	Amine formulations more water soluble and can leach into seed zone

Table 5.25 - Corn Herbicide Half-Lives and Their Potential to Injure Fall Cover Crops (cont.)

This table does not directly address preharvest establishment of cover crops such as interseeding or aerial seeding, which may be more restrictive. Cover crops that are harvested are subject to herbicide residue restrictions, which are not addressed in this table.

Trade Name	Common Name	Normal Rate/acre	Half life (days) ¹	Fall cover crops		Other
				OK to plant	Concern for	
Accent Q Steadfast Q	nicosulfuron/ nicosulfuron+ rimsulfuron	0.66 oz/ 0.75 oz	21	Cereals, ryegrass	Small seeded legumes, mustards, sorghum	More persistent in high pH soils (> 7)
Armezon/Impact	topramezone	0.75 fl. oz	14	Wheat, barley, oats, and rye are allowed after 3 mo. Ryegrass should also be OK	Although many broadleaves are restricted, Impact does not have much soil activity	We have not seen this herbicide carryover in the Mid-Atlantic region. Clovers might be slightly suppressed.
Atrazine 4L	atrazine	1-2 qt	15-90	Cereals, ryegrass, sorghum species	Legumes and mustards	More persistent in high pH soils (> 7). Rates < 1 lb/acre can allow more flexibility. Half-life in Mid-Atlantic probably closer to 30
Balance Flexx	isoxaflutole	3 fl. oz 6 fl. oz	50-120	Fall cereals grains	Ryegrass, legumes, and mustards	15 inches of cumulative precipitation required from application to planting rotation crops except soybean, barely, wheat, sorghum, and sunflower
Callisto (includes Acuron, Acuron Flexi, Halex GT, Harness Max, Lexar EZ, Lumax EZ, Resicore, Revulin Q, Solstice, Storen, etc.)	mesotrione	3-6 fl. oz	10-50	All grasses	Small seeded legumes, mustards	Sequential applications (PRE fb POST) increase the potential for injury
Capreno	tembotrione + thiencazozone	3 fl. oz	15	Wheat, triticale, rye	Small-seeded legumes, mustards, sorghum	15 inches of cumulative precipitation required from application to planting rotation crops except wheat

Table 5.25 - Corn Herbicide Half-Lives and Their Potential to Injure Fall Cover Crops (cont.)

This table does not directly address preharvest establishment of cover crops such as interseeding or aerial seeding, which may be more restrictive. Cover crops that are harvested are subject to herbicide residue restrictions, which are not addressed in this table.

Trade Name	Common Name	Normal Rate/acre	Half life (days) ¹	Fall cover crops		Other
				OK to plant	Concern for	
Clarity (DiFlexx, Distinct, Engenia, Status, Xtendimax)	dicamba	16 to 24 fl. oz	5-14	All	Only at high rates or less than 120 days after application	Anything can be planted after 120 days with 24 fl. oz/acre or less
Corvus	isoxaflutole+ thiencazone	5.6 fl. oz	50-120	Wheat, triticale, rye	Small seeded legumes, mustards, sorghum	15 to 30 inches of cumulative precipitation from application to planting for sensitive crops
Dual II Mag	metolachlor	1.67 pt	15-50	Cereal grains, legumes	Annual ryegrass or other small seeded grasses	Higher rates and later applications more of a potential problem
Glyphosate 4 Plus	glyphosate	0.75 to 1.25 lb ae	47 ³	All	None	Glyphosate does not have soil activity at normal use rates
Gramoxone SL 2.0	paraquat	2 pt	1000 ³	All	None	Paraquat does not have soil activity at normal use rates
Harmony SG	thifensulfuron	1/8 oz	12	No restrictions for wheat, barley, and oats	None with 45 day waiting interval	Harmony Extra also contains tribenuron
Harness (Degree Xtra, Enversa, Surpass EC, Warrant)	acetochlor	2 pt	10-20	Most crops should be fine	Food or feed residues rather than crop injury may be a concern	Nonfood/feed winter cover crops are allowed after corn harvest
Laudis (Diflexx Duo)	tembotrione	3 fl. oz	14	Cereal grains after 4 mo.	Unknown - Small seeded legumes, mustards could be a problem	Other crops may be seeded after a successful field bioassay
Liberty 2.34L	glufosinate	22 - 36 fl. oz	7 ³	All	Any cover crop can be planted 7 days after application that is not used for food or feed.	Glufosinate does not have soil activity at normal use rates
Metribuzin 75DF (Metricor)	metribuzin	0.33 lb ai	14-60	Cereal grains and ryegrass	Slight risk for small seeded legumes and mustards	Nonfood/feed winter cover crops allowed

Table 5.25 - Corn Herbicide Half-Lives and Their Potential to Injure Fall Cover Crops (cont.)

This table does not directly address preharvest establishment of cover crops such as interseeding or aerial seeding, which may be more restrictive. Cover crops that are harvested are subject to herbicide residue restrictions, which are not addressed in this table.

Trade Name	Common Name	Normal Rate/acre	Half life (days) ¹	Fall cover crops		Other
				OK to plant	Concern for	
Outlook (Armezon Pro)	dimethenamid	16 fl. oz	20	Most crops should be fine	Food or feed residues rather than crop injury may be a concern	Nonfood/feed winter cover crops should be OK after corn harvest
Peak (& Spirit)	prosulfuron	1 oz	9-152	Cereal grains and sorghum are labeled, other grasses	Small seeded legumes, mustards	More persistent in high pH soils (> 7)
Permit/Sandea	halosulfuron	2/3 oz	9-27	Cereal grains and sorghum after 2 mo. and other grasses	Small seeded legumes, mustards	Halosulfuron also an ingredient in Yukon
Prowl H ₂ O	pendimethalin	3 pt	44	Cereal grains	Small seeded legumes and annual ryegrass	We have not seen this herbicide carryover in Mid-Atlantic; nonfood/feed winter cover crops should be OK
Python WDG (Hornet WDG and Surestart)	flumetsulam	1 oz	14-120	Cereal grains	Small seeded legumes, mustards, and annual ryegrass	Cover crops and forage grasses are restricted for 9 mo.
Resolve DF (Resolve Q)	rimsulfuron	2 oz	2-4	Based on the short half-life, most fall cover crops should be OK in Mid-Atlantic	None	More persistent in drought conditions
Sharpen (Verdict)	saflufenacil	3 fl. oz	7-35	All	None	Label has 30-day wait for cover crop.
Shieldex 400 3.33SC	Tolpyralate	1-1.35	1-2	Wheat, barley, oats, and rye are allowed after 3 months; ryegrass should also be OK	Although many broadleaves are restricted, Shieldex does not have much soil activity	Clovers might be slightly suppressed
Simazine 4L (Princep)	simazine	1-2 qt	60	Sorghum species	Cereals, ryegrass, legumes, and mustards	Soil pH > 7 increases persistence
Stinger 3S (Hornet WDG, Resicore, and Surestart)	clopyralid	5 oz	40	All grasses	Small seeded legumes	

Table 5.25 - Corn Herbicide Half-Lives and Their Potential to Injure Fall Cover Crops (cont.)

This table does not directly address preharvest establishment of cover crops such as interseeding or aerial seeding, which may be more restrictive. Cover crops that are harvested are subject to herbicide residue restrictions, which are not addressed in this table.

Trade Name	Common Name	Normal Rate/acre	Half life (days) ¹	Fall cover crops		Other
				OK to plant	Concern for	
Zidua (Anthem)	pyroxasulfone	2.5 oz	20	Most crops should be fine	Ryegrass	Nonfood/feed winter cover crops should be OK after corn harvest

¹ The herbicide half-life is defined the time it takes for 50% of the herbicide active ingredient to dissipate. See the Managing Herbicides Section for additional information. The herbicide half-life estimates are derived for the WSSA Herbicide Handbook and other scientific literature.

² Common small-seeded legumes include alfalfa, clovers, and hairy vetch.

³ This herbicide does not have soil residual activity at normal application rates.

Sorghum Weed Management

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Integrated Weed Management

An integrated approach to managing weeds in sorghum includes using cultural weed control, mechanical controls where applicable, and the judicious use of herbicides. Sorghum fields that are weed free for the first four to six weeks after planting will often yield the same as fields that are weed free for the entire growing season. This approach relies on starting with a clean seedbed and using residual soil-applied herbicides or mechanical control. Weeds that germinate with the crop but are controlled in a timely fashion (four to five weeks after planting) will also not impact final yields. This POST herbicide approach relies on effective and timely postemergence weed control. Also, it is not necessary to control all weeds in a field to achieve maximum yield.

Plant sorghum in a timely fashion to ensure the crop emerges uniformly and achieves rapid early growth. Seeding sorghum in narrow (15-inch) rows will improve overall weed control since the crop canopy will close the rows sooner and help to outcompete smaller weeds.

Chemical Weed Control

Herbicides are useful tools in most weed management programs. This chapter will focus on herbicides available for use in sorghum. They should be used to supplement, not replace, other methods or tools available. Definitions of terms you will find in this and similar publications on herbicides are provided below.

Early preplant (EPP). The herbicide is applied at least 14 days before planting. EPP applications are generally used in no-till systems to control existing vegetation and provide residual control of early emerging weed species.

Preplant. The herbicide is applied from zero to 14 days before planting. Preplant applications are generally used in no-till systems to control emerged weed species.

Preplant Incorporated (PPI). The herbicide is applied to the soil after primary tillage, but before planting, and mechanically mixed with the top 1 to 3 inches of soil with one of a variety of secondary tillage implements.

Preemergence (PRE). The herbicide is applied to the soil after the crop is planted but before emergence. Rainfall or irrigation is needed to move the herbicide into the zone of weed seed germination before weed emergence for maximum effectiveness. If adequate rainfall for herbicide activation does not occur, a shallow cultivation or rotary hoeing should be done to control weeds that have germinated.

Postemergence (POST). The herbicide is applied to the foliage of the crop and weeds after they have emerged.

Post-directed (or directed). Refers to use of special spray equipment to direct the spray at the weeds but avoid it coming in contact with as much of the crop as possible.

Residual activity. Herbicides that can be taken up by a plant's roots and shoots and injure or kill the plant. All soil-applied herbicides, as well as many postemergence herbicides, have residual activity. Herbicide degradation (breakdown) is the result of chemical and/or microbial activity, which can and be dependent on soil pH, soil temperature, and soil moisture levels. Since degradation is dependent on a number of factors, length of residual activity can vary for herbicides based on the specific environmental conditions. Length of residual activity ranges from a few weeks to the entire growing season.

Translocated herbicide. These herbicides move throughout the plant and can cause injury to parts of the plants that do not come in direct contact with the herbicide spray.

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Contact herbicide. These herbicides do not move throughout the plant. They cause injury only to those parts of the plant that come in contact with the spray. Spray coverage is more critical for contact than translocated herbicides.

Non-selective herbicide. This refers to herbicides that control a broad spectrum of plant species, including most crops and weeds. These herbicides are generally used with no-tillage production and sprayed prior to planting when control of all plants is required.

Herbicide-resistant hybrids. This refers to grain sorghum varieties that have been developed to withstand herbicide application that previously would have injured or killed sorghum. These enhanced varieties have been obtained through traditional breeding methods and exclusively include Inzen hybrids.

Inzen grain sorghum is non-GMO and tolerant to nicosulfuron. The companion nicosulfuron product is Zest, a sulfonylurea herbicide (Group 2). Weed biotypes resistant to Group 2 herbicides are widespread in the region. Zest is labeled for use in DE and VA only.

Igrowth grain and forage sorghum is non-GMO and imidazolinone tolerant, which allows the companion herbicide, ImiFlex (imazamox), to be applied PRE or POST for weed control. ImiFlex is a sulfonylurea herbicide (Group 2). Weed biotypes resistant to Group 2 herbicides are widespread in the region. ImiFlex is not labeled for use in NJ. This technology has not been evaluated by universities in the mid-Atlantic region.

Double Team grain sorghum is non-GMO and tolerant to quizalofop. The companion quizalofop product is FirstAct. This technology has not been evaluated by universities in the mid-Atlantic region.

Herbicide-resistant Weeds in Sorghum

Herbicide-resistant weeds are common in sorghum in the Mid-Atlantic region. Populations of herbicide-resistant weeds are selected for by repeated use of the same or similar herbicide over a period of time. Resistance is most likely to occur with residual herbicides having one specific mode of action. Weed species with a very high amount of seed production and a variable genetic pool are more likely to develop resistant populations—for example, common lambsquarters and pigweed species. Resistance management requires using herbicides with multiple modes of action and integrating mechanical (tillage and cultivation) and cultural weed control (cover crops, narrow row spacing, proper crop fertility, etc.) with chemical weed control.

Triazine-resistance (TR). Weeds resistant to the Group 5 herbicides in the Mid-Atlantic region include common lambsquarters, redroot and smooth pigweed, and scattered populations of barnyardgrass, giant foxtail, goosegrass, and suspected populations of common ragweed and velvetleaf. Atrazine is the primary product that is problematic in sorghum. Careful selection of soil-applied and/or POST herbicides can provide good control of triazine-resistant (TR) weeds in sorghum.

For TR pigweed control, include a Group 15 herbicide for residual control (acetochlor, dimethenamid, or metolachlor) at planting. The Group 15 herbicides will suppress initial TR pigweed, but in most years a postemergence application of a non-triazine herbicide will be needed for full-season control.

For TR lambsquarters, some of the Group 15 herbicides will help suppress emergence (acetochlor), but they are not as active on lambsquarters as they are on pigweed. In addition, residual control can be obtained with products such as mesotrione.

ALS-resistance. Weeds resistant to the Group 2 (ALS) herbicides in the Mid-Atlantic region include several pigweed species, common and giant ragweed, common chickweed, horseweed, Italian ryegrass, giant foxtail, Johnsongrass, and shattercane. The principal issue with most ALS-resistant weeds in sorghum is lack of efficacy with POST ALS-inhibitor products. ALS-resistant broadleaves will not be controlled with halosulfuron or prosulfuron, other Group 2 herbicides. Group 2 herbicides can be used in a wide range of crops and application timings. Be sure to consider all herbicide applications when developing an herbicide-resistance management strategy.

Glyphosate-resistance. Weeds resistant to the Group 9 herbicide glyphosate in the Mid-Atlantic region include Palmer amaranth and waterhemp, common and giant ragweed, goosegrass, and horseweed. In sorghum, this could pose a problem in no-till if these biotypes are present at the time of burndown applications. If they are, be sure to include an alternate herbicide group to ensure these species are controlled prior to planting.

No-till Weed Management

Successful production of no-till sorghum requires control of existing vegetation (cover crops and weeds) at planting and summer annual weeds that emerge after planting. Existing vegetation is traditionally controlled by the nonselective herbicides, which are often tank-mixed with residual herbicides. However, in many fields the presence of winter annual weeds, such as horseweed, requires an application while these plants are small and more susceptible to nonselective herbicides; this may require an application three to five weeks prior to planting. Some residual herbicides, such as Lumax or Bicep, can enhance burndown weed control. However, when the products are applied 14 to 28 days before sorghum planting, they provide residual weed control for only a week or two after planting sorghum. In fields with weeds that are difficult to control, an application of a nonselective herbicide and 2, 4-D should be used early to control winter annuals weeds, and a second application of the residual herbicides may be needed at the time of sorghum planting. This second application will improve overall weed control.

Management of Johnsongrass and Shattercane

Johnsongrass, shattercane, and sorghum are closely related, and there are no satisfactory broadcast treatments currently available for controlling either species in grain sorghum. The only alternative available for rhizome Johnsongrass control is spot spraying glyphosate. Grain sorghum should not be planted in fields infested with Johnsongrass or shattercane.

Table 5.26 - Sorghum Herbicides and Their Restrictions

Trade Name	Common Name	Site of Action Number	Manufacturer	Restricted-Use Pesticide ¹	Water Quality Advisory ²	Worker Reentry (Hours) ³
2,4-D amine 4S	2,4-D amine	4	several	—	—	48
2,4-D LV4 4E	2,4-D LVE	4	several	—	—	12
Aatrex, Atrazine 4L/90DF	atrazine	5	Syngenta, others	yes	yes	12
Aim 2EC	carfentrazone-ethyl	14	FMC	—	—	12
Basagran 4S	bentazon	6	Arysta LifeScience	—	yes	12
Bicep II Magnum 5.5SC/Bicep Lite II Magnum 6SC	S-metolachlor + atrazine + safener	15/5	Syngenta/Corteva	yes	yes	24
Callisto 4SC	mesotrione	27	Syngenta	—	—	12
Clarity 4S	dicamba	4	Arysta LifeScience/BASF	—	yes	24
Coyote 3.67SC ⁴	S-metolachlor + mesotrione	15/27	UPL	—	yes	24
Degree Xtra 4.04ME/ FulTime NXT 4.04EC	acetochlor + atrazine	15/5	Bayer CropScience/ Corteva	yes	yes	12
Dual Magnum 7.62EC	S-metolachlor	15	Syngenta	—	yes	24
Dual II Magnum 7.64EC	S-metolachlor + safener	15	Syngenta/Corteva	—	yes	24
Durango DMA/ DuraMax 4S	glyphosate	9	Corteva	—	—	4
Engenia 5SL	dicamba (BAPMA salt)	4	BASF	yes	yes	24
Facet L 1.5L	quinclorac	4	BASF	—	—	12
FirstAct 0.83EC ⁵	quizalofop	1	ADAMA	—	—	12
Gramoxone SL 2.0/3.0	paraquat	22	Syngenta	yes	—	12–24

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Table 5.26 - Sorghum Herbicides and Their Restrictions (cont.)

Trade Name	Common Name	Site of Action Number	Manufacturer	Restricted-Use Pesticide ¹	Water Quality Advisory ²	Worker Reentry (Hours) ³
Halex GT 4.39EC	S-metolachlor + mesotrione + glyphosate	15/27/9	Syngenta	—	yes	24
Huskie 2.06EC	pyrasulfotole + bromoxynil	27/6	Bayer CropScience	—	yes	24
ImiFlex 1SL ⁶	imazamox	2	UPL	—	yes	4
Lorox 50DF/Linex 4L	linuron	5	Nova Source	—	—	24
Lumax EZ 3.67SC/ Lexar EZ 3.7SC	S-metolachlor + mesotrione + atrazine	15, 27, 5	Syngenta	yes	yes	24
Maestro 2EC	bromoxynil	6	NuFarm	—	—	24
Outlook 6EC	dimethenamid	15	BASF	—	yes	12
Peak 57WG	prosulfuron	2	Syngenta	—	yes	12
Permit 75WG/ Sanda 75WG	halosulfuron	2	Gowan	—	—	12
Prowl H ₂ O 3.8CS/ Prowl 3.3E	pendimethalin	3	BASF	—	—	24
Roundup WeatherMax 4.5S/ PowerMax 4.5S	glyphosate	9	Bayer CropScience	—	—	4
Sequence 5.25EW	glyphosate + S-metolachlor	9/ 15	Syngenta	—	yes	24
Sharpen 2.85SC	saflufenacil	14	Corteva	—	yes	12
Starane Ultra 2.8L	fluroxypyr	4	Dow AgroSciences	—	—	24
Verdict 5.57EC	saflufenacil + dimethenamid	14/15	BASF	no	yes	12
Warrant 3CS	acetochlor	15	Bayer CropScience	—	yes	12
Yukon 67.5WDG	halosulfuron + dicamba	2/4	Gowan	—	—	12
Zest 75WDG ⁷	nicosulfuron	2	Corteva	—	yes	4

¹ Only licensed applicators may purchase and apply restricted-use pesticides. To become licensed, contact your state Department of Agriculture.

² These herbicides have properties that may result in groundwater or surface water contamination. Do not apply them in areas where soils are permeable or coarse and groundwater is near the surface. Practices should be followed to minimize the potential for dissolved runoff and/or runoff erosion. See the herbicide label for specific restrictions.

³ If soil-applied products are injected or incorporated at application time, under certain circumstances the Worker Protection Standard allows workers to enter the treated area if they will have no contact with anything that has been treated. Personal protective equipment is required for early entry to treated areas if contact with treated soil, plants, or water is involved.

⁴ Not labeled in MD and NJ.

⁵ For use on grain sorghum containing the Double Team herbicide tolerance trait only.

⁶ For use on grain and forage sorghum containing the igrowth herbicide tolerance trait only. Not labeled in NJ.

⁷ For use on grain sorghum containing the Inzen herbicide tolerance trait only. Labeled in DE and VA only.

Table 5.27 - Sorghum Herbicide Prepackaged Mixes or Co-Packs, and Equivalents

Trade Name	Components (ai/gal or lb)	If you apply (per acre)	You have applied (ai)	Site of Action Number	An equivalent tank-mix of
Bicep II Magnum 5.5SC	2.4 lb S-metolachlor	2.1 qt	1.26 lb S-metolachlor	15	1.33 pt Dual II Magnum 7.64EC
	3.1 lb atrazine		1.63 lb atrazine	5	1.63 qt atrazine 4L
Bicep Lite II Magnum 5.5SC	.33 lb S-metolachlor	1.5 qt	1.25 lb S-metolachlor	15	1.31 pt Dual II Magnum 7.64EC
	2.67 lb atrazine		1 lb atrazine	5	1 qt atrazine 4L
Degree Xtra 4.04ME	2.7 lb acetochlor	2.5 qt	1.67 lb acetochlor	15	31.8 qt Degree 3.8ME
	1.34 lb atrazine		0.83 lb atrazine	5	0.8 qt atrazine 4L
Coyote 3.67SC	0.33 mesotrione	2 qt	0.168 lb mesotrione	27	5.36 fl oz Callisto 4SC
	3.34 S-metolachlor		1.67 lb S-metolachlor	15	1.75 pt Dual II Magnum 7.64 EC
FulTime NXT 4.04CS	2.7 lb acetochlor	3 qt	2 lb acetochlor	15	2.1 qt TopNotch 3.2ME
	1.34 lb atrazine		1 lb atrazine	5	0.8 qt atrazine 4L
Halex GT 4.39EC	2.09 lb S-metolachlor	4 pt	1.05 lb S-metolachlor	15	1.11 pt Dual II Magnum 7.64EC
	0.209 lb mesotrione		0.11 lb mesotrione	27	3.33 oz Callisto 4SC
	2.09 lb glyphosate		1.05 lb ae glyphosate	9	30 fl oz Roundup PowerMAX 4.5S
Huskie 2.06EC	0.31 lb pyrasulfotole	13 fl oz	0.031 lb pyrasulfotole	27	0.031 lb pyrasulfotole
	1.75 bromoxynil		0.178 bromoxynil	6	11.4 fl oz Maestro 2EC (Buctril)
Lexar EZ 3.7SC	1.74 lb S-metolachlor	3 qt	1.3 lb S-metolachlor	15	1.36 pt Dual II Magnum 7.64EC
	0.224 lb mesotrione		0.168 lb mesotrione	27	5.36 oz Callisto 4SC
	1.74 lb atrazine		1.3 lb atrazine	5	1.3 qt atrazine 4L
Lumax EZ 3.67SC	2.49 lb S-metolachlor	2.7 qt	1.67 lb S-metolachlor	15	1.75 pt Dual II Magnum 7.64EC
	0.249 lb mesotrione		0.168 lb mesotrione	27	5.36 oz Callisto 4SC
	0.935 lb atrazine		0.625 lb atrazine	5	0.625 qt atrazine 4L
Verdict 5.57EC	5.0 lb dimethenamid	10 fl oz	0.38 lb dimethenamid	15	8.5 fl oz Outlook 6EC
	0.57 lb saflufenacil		0.045 lb saflufenacil	14	2.0 fl oz Sharpen 2.85L
Yukon 67.2WDG	0.125 lb halosulfuron	4 oz	0.03 lb halosulfuron	2	0.67 Permit/Sandea 75 WG
	0.55 lb dicamba		0.125 lb ae dicamba	4	4 fl oz Clarity 4S

Table 5.28 - Relative Effectiveness of “Burndown” Herbicides for No-Till Sorghum

This table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rates and weed size or growth stage. Delaying applications, thus treating larger weeds, will result in reduced control. Treatments are rated only for control of vegetation existing at the time of application. Add preemergence herbicides as required for the specific situation.

Weed control rating: 10 = 95–100% 9 = 85–95% 8 = 75–85% 7 = 65–75% 6 = 55–65% N = less than 55% or no control
 -- = no local data available

Trade Name ¹	Site of Action Number	Alfalfa	Brome, Downy	Burdock, Common	Canada Thistle	Chickweed	Dandelion	Dock, Curly	Field Violet/Pansy	Fleabanes, Annual	Foxtail, spp	Garlic, Wild	Geranium, Carolina	Groundsel, Common ²	Hemp, Dogbane, Dewberry, Milkweed, etc.	Henbit/Deadnettle	Horseweed/ Marestail ³	Lambsquarters	Mustards spp.	Quackgrass	Ragweed, Common	Smartweed	Canada Thistle	
Atrazine	5	6	7	6	6	8	N	6	8	7+	7	N	8+	9	N	8	8	9	8	8	9	9	9	6
Dicamba	4	9	N	7	8	6	8	6	6	6	N	7	7	6	N	N	8+	9	N	N	9	7	8	
Glyphosate ⁴	9	7	9	7	8	9	6	6	6	7+	9+	7	8	9	7	6	8	9	9	8	9	7	8	
Glyphosate + Atrazine	5/9	7+	9	7+	8	9	7	6	8	7+	9	6	8+	9	N	9	9	9	9	9	9	9	8	
Glyphosate + dicamba	9/4	8+	9	7+	8+	9	8	7	8	8	9+	8	7	9	7+	8+	9	9	9	9	9	9	8+	
Gramoxone	22	N	7	N	6	8+	N	N	8	6	9	6	8	8+	6	7	7	8	9	6	8	9	6	
Gramoxone + Atrazine	22/5	7	8	6	7	9	N	6	8	7	9	6	9	8+	6	9	8+	9	8	8	9	7	7	
	5/15/																							
Lumax / Lexar	27	6	N	8	7	9	8	8	7	8	6	N	8+	9	N	8	8	9	9	N	8+	7	7	
Sharpen	14	N	N	N	6	6	7	-	N	7+	N	-	-	8	N	6	8	8	9	N	8	9	6	
Sharpen + glyphosate	14/9	7	9	7	8	9	8	6	6	8	9+	-	8	9	7	6	9	9	8	8	9	9	8	

¹ See generic herbicide table for additional formulations or trade names containing some of these same active ingredients; see Table 5.1 (glyphosates table) and Table 5.4 (generics table).
² Certain populations of common groundsel in the northeastern U.S. are resistant to triazine herbicides. Herbicide programs that contain Maestro (Buctril) provide good control of groundsel in-crop.
³ Roundup and other glyphosate products are not effective on glyphosate-resistant horseweed biotypes.
⁴ Activity is reduced if applied in certain tank-mixes; Roundup with photosynthesis inhibitors such as triazine herbicides; dicamba with Gramoxone. May still be tank-mixed for convenience, but burndown is improved if applied separately.

Table 5.29 - Comments on “Burndown” Herbicides for No-Till Sorghum

May need to be combined with residual treatment or postemergence program for complete no-till weed control program.

Trade Name ¹	Common Name	Site of Action Number	Sorghum Type	Product/A	lb ai/A
Atrazine 90DF or 4L	atrazine	5	grain, forage	1.8–2.2 lb or 1.6–2 qts	1.6–2

- Labeled for grain and forage sorghum.
- Sorghum is not as tolerant as corn to atrazine; labels do not recommend use on coarse-textured soils and has precautions for use on medium and fine-textured soils with less than 1% organic matter.
- Controls small emerged annual broadleaves and some grasses.
- Can be applied in liquid nitrogen as the carrier to improve burndown characteristics.
- Tank-mixing with paraquat improves burndown control; however, this can antagonize glyphosate activity on some species.
- Premixes containing atrazine include Bicep II Magnum, Bullet, Degree Xtra, Lumax, Lexar and others; atrazine rates differ among these products, refer to their labels for amount of atrazine.
- Observe atrazine use restrictions; see atrazine entry in the soil-applied comments table.
- *Restricted-use pesticide and water quality advisory.*

Gramoxone SL 2.0				2–4 pt	0.48–1.0
Gramoxone SL 3.0	paraquat	22	grain	1.3–2.7 pt	0.49–1.0

- Apply in 20–60 gal/A for control of emerged annual weeds.
- Addition of atrazine will often improve paraquat performance.
- Adding dicamba improves control of large annual broadleaf weeds and alfalfa. Alfalfa control is improved by applying dicamba separately at least 1 day ahead of paraquat.
- Can be tank-mixed with residual herbicides; adding atrazine to paraquat can improve control of fescue and certain other perennial sods.
- Phosphate-containing liquid fertilizer solutions diminish paraquat activity if used as a carrier.
- Do not use flood jet tips larger than size 20 or spacing greater than 40 inches.

Paraquat Use Restrictions

- *Restricted-use pesticide.*
- Only certified applicators, who successfully complete the paraquat-specific training, can mix, load or apply paraquat.
- Application of paraquat "under the direct supervision" of a certified applicator is no longer allowed, registered technicians cannot apply.
- Required training link (<http://usparaquattraining.com>); certified applicators must repeat training every three years.

Glyphosate²	glyphosate	9	grain, forage	varies with formulation	0.75–1.5 ae
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Use at least 1.13 lbs ae glyphosate or higher, especially if tank-mixing with residual herbicide.

- Spring applications may be used for control of annual weeds.
- Using low-volume sprays may allow for a reduced rate.
- Can be tank-mixed with residual herbicides such as atrazine. When tank-mixing glyphosate with residual herbicides, apply in 10–20 gal water/A or 10–60 gal liquid fertilizer nitrogen/A.
- Adding dicamba improves control of large annual broadleaf weeds, dandelion, and alfalfa.
- Glyphosate may be applied in clear liquid nitrogen fertilizers and clear liquid complete-analysis fertilizers, but may be less effective on certain annual grasses and perennials.
- Do not use glyphosate with suspension-type liquid fertilizers.

Table 5.29 - Comments on “Burndown” Herbicides for No-Till Sorghum (cont.)

May need to be combined with residual treatment or postemergence program for complete no-till weed control program.

Herbicide Trade Name ¹	Herbicide Common Name	Herbicide group # (site of action)	Sorghum type	product/A	lb ai/A
Lexar EZ 3.67SC	mesotrione +	27	grain	3 qt	0.168
	S-metolachlor +	15			1.3
	atrazine	5			1.3
Lumax EZ 3.7SC	mesotrione +	27	grain	2.7 qt	0.168
	S-metolachlor +	15			1.68
	atrazine	5			0.63

- Labeled for grain sorghum only.
- Use sorghum seed treated with an approved seed safener for chloroacetamide herbicides (group 15).
- Apply prior to sorghum emergence; application to emerged sorghum will result in severe injury.
- Applying either product less than 7 days before sorghum planting will increase the risk of crop injury, especially if irrigation or rainfall is received following the application.
- Injury symptoms include temporary bleaching of newly emerging sorghum leaves or in extreme conditions, stunting or partial stand loss.
- Lexar or Lumax will improve performance of paraquat but can antagonize glyphosate on some weed species.
- *Restricted-use pesticides and water quality advisory*

Sharpen 2.85SC	saflufenacil	14	grain	1–2 fl oz	0.022– 0.044
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- Labeled for grain sorghum only.
- Sharpen may be applied as a preplant/burndown treatment from 14 days early preplant through preemergence timings. Do not apply to emerged sorghum.
- Apply Sharpen in a typical glyphosate burndown herbicide program to increase weed spectrum control including glyphosate-resistant horseweed.
- Include necessary additives methylated seed oil (MSO) plus nitrogen solution or ammonium sulfate (AMS) to the spray mixture.
- Verdict is a prepackaged mixture containing Sharpen.
- Sharpen will provide very short residual activity at the rates labeled for sorghum.
- Do not apply Sharpen at more than 1.0 fl oz/A within 30 days of planting if organophosphate or carbamate insecticide(s) is used at planting.

¹ See Table 5.3 (generics table) for additional herbicides that contain these active ingredients.

² Consult specific product label for active ingredient concentration and application rate; various formulations of this herbicide are available (e.g., 1 qt/A glyphosate = 22 fl oz/A WeatherMAX); see Table 5.1 (glyphosates table).

Solubility (parts per million; ppm) refers to how many microliters of the herbicide will dissolve in 1 liter of water. The less soluble the herbicide, the more moisture (rain or irrigation) is needed to activate the herbicide and move it into the root zone. Solubility is used as a guideline for rainfall or irrigation required within a short time after application. Moisture needed also depends on the soil moisture at time of application.

Relative moisture levels to move herbicide into the soil to achieve optimum level of control

Relative Moisture to Activate	ppm	Estimate Water to Activate*
Low	>500 ppm (very soluble)	0.33 inch
Medium	250-500 ppm	0.33-0.5 inch
High	100-250 ppm	0.5-0.75 inch
Very High	<100 ppm	>0.75 inch

*More water (additional irrigation) maybe necessary if soil is dry at time of application, soils with higher clay content, or high plant residues are present.

Relative duration of residual control is for comparison only based on herbicide half-life (length of time it takes for half the herbicide to break down). Herbicide breakdown results from chemical and/or microbial activity. Since the speed of breakdown is affected by a number of factors, including soil pH, soil temperature, and soil moisture, duration can vary for herbicides based on the specific conditions. Residual activity is not the same as herbicide carryover.

Duration of residual control assumes 1) good activation; 2) no excessive rain or irrigation; and 3) weed species are sensitive to the herbicide(s) applied

Table 5.30 - Water Solubility and Longevity of Soil-Applied Herbicides

Trade Name	Solubility (ppm)	Relative moisture required to activate	Duration of Residual Weed Control
Atrazine	33	Very High	4-5 weeks
Callisto	1500	Low	2-4 weeks
Dual II Magnum	488	Medium	4-5 weeks
ImiFlex	4,160	Low	2-4 weeks
Linex / Lorox	75	Very High	4-5 weeks
Outlook	1,174	Low	2-4 weeks
Sharpen	pH 5: 30 pH 7: 2,100	Very High Low	1-3 weeks
Warrant/TopNotch	223	High	2-4 weeks
Premixes			
Bicep II Magnum	Dual II Magnum, atrazine		
Bicep Lite II Magnum	Dual II Magnum, atrazine		
Coyote	Dual II Magnum, Callisto		
FulTime NXT	Topnotch, atrazine		
Halex GT	Dual II Magnum, Callisto, glyphosate		
Lumax EZ / Lexar EZ	Dual II Magnum, Callisto, atrazine		
Verdict	Outlook, Sharpen		

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Ratings are based on labeled application rates for the soil type and timely rainfall or irrigation to incorporate the herbicides. Ratings are also based on control 3 to 4 weeks after application. Length of effective control (residual control) beyond 4 weeks after application often declines. Results may differ with variations in soil type, temperature, rainfall, soil moisture, soil organic matter, and soil pH. For ratings on herbicide combinations not listed, see the component parts.

Table 5.31 - Relative Effectiveness of Soil-Applied Herbicides on Individual Species*

Weed control rating:		Crop tolerance:													
10 = 95–100%		E = excellent; almost never any crop injury observed													
9 = 85–95%		VG = very good; on rare occasion is crop injury observed													
8 = 75–85%		G = good; seldom is crop injury observed as long as proper management practices are followed (e.g., seedling depth, seed slit closure, herbicide rate and application timing, adjuvants)													
7 = 65–75%		FG = fair to good; occasionally crop injury is observed even with proper management practices; injury is often due to herbicide interactions with environmental conditions													
6 = 55–65%		F = fair; some crop injury is commonly observed													
N = less than 55% or no control															
– = no local data															
Grasses															
Trade Name*	Site of Action Number	Barnyardgrass	Bermudagrass	Broadleaf Signalgrass	Crabgrass	Fall Panicum	Foxtail spp.	Goosegrass	Johnsongrass (Seedling)	Johnsongrass (Rhizome)	Quackgrass	Shattercane	Texas panicum	Wirestem Muhly	Yellow Nutsedge
Atrazine	5	7	N	N	7	6	6+	7	N	N	7+	6	N	6	6
Bicep Products	5/15	9	N	8	9	9	9	9+	6	N	6	6	N	6	8+
Degree Xtra, FulTime NXT	5/15	9	N	8	8+	9	9	9+	7	N	6	6	N	6	8+
Dual Products, Cinch	15	9	N	8	9	8+	9	9+	6	N	N	6	N	N	8
Halex GT	15/27/9	9	N	10	9+	9+	9+	10	9+	9	9	9	9	9	8
ImiFlex ¹	2	8	N	N	7	7	8	N	6	N	N	6	N	N	7
Linex / Lorox	7	6	N	N	6	6	6	6	N	N	N	N	N	N	N
Lumax/Lexar	5/15/27	9	N	8	9	9	9	9+	6	N	6	6	N	6	8+
Outlook	15	9	N	8	8	8+	9	9	6	N	N	6	N	N	7+
Verdict	14/15	8	N	N	8	8	8	9	N	N	N	N	N	N	6
Warrant	15	9	N	8	8+	8+	9	9+	7	N	N	6	N	N	7+

* Performance ratings based on full labeled rates. See Table 5-3 (generics table) for additional herbicides that contain these active ingredients.

¹ For use on grain and forage sorghum containing the igrowth herbicide tolerance trait only. Not labeled in NJ.

Table 5.31 - Relative Effectiveness of Soil-Applied (Premergence) Sorghum Herbicides on Individual Weed Species¹ (cont.)

Weed control rating:	Crop tolerance:
10 = 95–100%	E = excellent; almost never any crop injury observed
9 = 85–95%	VG = very good; on rare occasion is crop injury observed
8 = 75–85%	G = good; seldom is crop injury observed as long as proper management practices are followed (e.g., seedling depth, seed slit closure, herbicide rate and application timing, adjuvants)
7 = 65–75%	FG = fair to good; occasionally crop injury is observed even with proper management practices; injury is often due to herbicide interactions with environmental conditions
6 = 55–65%	F = fair; some crop injury is commonly observed
N = less than 55% or no control	
– = no local data	

Broadleaves

Trade Name ¹	Site of Action Number	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters ³	Horseweed/Marestail	Morningglory, Annual	Nightshade, Eastern Black	Palmer amaranth / Waterhemp ²	Pigweed	Ragweed, Common	Ragweed, Giant	Sida, Prickly	Smartweed	Spurred Anoda	Velvetleaf	Sorghum Tolerance, Medium Soils	Sorghum Tolerance, Coarse Soils
Atrazine	5	6	8+	9	9+	9	8+	9	9+	N	9	8	9	9+	8	8	E	G
Bicep Products	5/15	6	8+	9	9	8+	8+	9	9+	8+	8+	8	9	9	9	8+	G	G
Degree Xtra ⁴ / Fultime NXT	5/15	6	8+	9	9	N	8+	9	9+	9	8+	8	9	9	9	8+	G	FG
Dual Products, Cinch	15	N	N	N	6	N	N	7+	8+	8	6	N	N	N	N	N	G	G
Halex GT	15/27/9	8+	9	9	9	9	7+	9+	8+	9	8+	8	9	9	–	9	G	F
Imiflex	2	6	8	8	8	–	7	8	N	9	7+	6	8	9	N	8	– ⁵	– ⁵
Lexar	5/15/27	7	9	9	9	9	9	9	9	8+	8+	8+	9	9	9	9	G	F
Linex / Lorox	7	6	7	7	8+	–	6	6	9	9	7+	6	7+	8	6	7	G	G
Lumax	5/15/27	6	8+	9	9	9	8+	9	9	8+	9	8	7+	9	9	9	G	F
Outlook	15	N	N	N	6	N	N	7+	8	8	6	N	N	6	N	N	G	G
Verdict	14/15	6	8	8	9	7+	8	9	9	9	8	8	7	9	–	8	G	G
Warrant	15	N	N	N	7	N	N	8+	8	9	7+	N	N	7	N	6	G	FG

¹ See Table 5.3 (generics table) for additional herbicides that contain these active ingredients.

² Biotypes resistant to Group 2 herbicides are common in the region; do not rely on Group 2 herbicides to provide effective control.

³ Triazine-resistant (TR) biotypes of common lambsquarters and redroot/smooth pigweed are widespread in the region, and thus triazine (Group 5) herbicides are not effective against these populations.

⁴ Degree Xtra may be less consistent on TR lambsquarters control compared to other acetochlor products.

⁵ For use on sorghum containing the igrowth herbicide tolerance trait only.

Table 5.32 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Sorghum

See specific herbicide label to determine correct rate for soil type and weed species found in each field.

These treatments may be used in conventional, reduced-till, and no-till systems; treatments may be applied preplant-incorporated or preemergence, unless stated otherwise.

Incorporation reduces the need for timely rainfall after application and may improve control of certain weeds.

Higher rates for a given soil may be required for no-till.

In no-till situations, “burndown” herbicides may be required to control weeds or cover crops present at time of application.

EPP= early preplant means application prior to plant (in most cases it’s 7-14 days before planting); PPI= applied to conventionally tilled soil than mechanically incorporated; PRE= preemergence (applied before the crop has emerged); EPOST=early postemergence (during the early stages of crop and weed growth)

Trade name ¹	Common name	Site of Action Number	Application	Product/A	lb ai/A
Atrazine 4L	atrazine	5	EPP, PPI, PRE	1–2 qt	1–2
Atrazine 90DF	atrazine	5	EPP, PPI, PRE	1.1–2.2 lb	1–2

- Sorghum is not as tolerant to atrazine as corn.
- Labeled for grain and forage sorghum.
- Atrazine may be used at 1–2 qt/A. Usually used in combination with other herbicides at 1–1.5 qt.
- Can be applied to emerged sorghum up to 12 inches tall.
- On highly erodible ground with less than 30% surface residue, no more than 1.6 qt may be applied prior to crop emergence.
- Heavy rain immediately following application tends to cause excessive concentrations in seed furrow, result in higher risk of injury.
- Do not apply to coarse-textured soils (i.e. sand, loamy sand, and sandy loam), or injury may occur.
- Do not apply to medium- or fine-textured soils having less than 1% organic matter or injury may occur.
- *Restricted-use pesticide and water quality advisory.*

ATRAZINE USE RESTRICTIONS

Preplant or Preemergence

- On highly erodible soils (as defined by the U.S. Natural Resources Conservation Service):
 - Fields where more than 30 percent of the soil surface is covered with plant residue at planting, apply a maximum of 2.0 lb of active ingredient per acre as a broadcast spray.
 - Fields where less than 30 percent of the soil surface is covered with plant residue at planting, apply a maximum of 1.6 lb of active ingredient per acre as a broadcast spray.
 - Apply a maximum of 2.0 lb of active ingredient per acre as a broadcast spray.

Safety Precautions for Using Atrazine

- Do not mix, load, or apply within 50 feet of drinking water wells, livestock wells, agricultural drainage wells, irrigation wells, abandoned wells, or sinkholes.
- Do not mix or load within 50 feet of intermittent streams, perennial streams, rivers, lakes, or reservoirs
- Do not apply within 200 feet of lakes or reservoirs.
- Do not apply within 66 feet of the points where surface water runoff enters intermittent streams, perennial streams, or rivers. The 66-foot buffers should be planted to a crop or seeded with grass on highly erodible land.

Table 5.32 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Sorghum (cont.)

Trade name ¹	Common name	Site of Action Number	Application	Product/A	lb ai/A
Bicep II Magnum 5.5L	S-metolachlor +	15	EPP, PPI, PRE, EPOST	1.3–2.1 qt	0.78–1.26
	atrazine	5			0.99–1.6
Bicep Lite II Magnum 6SC	S-metolachlor +	15	EPP, PPI, PRE	1.1–1.5 qt	0.92–1.25
	atrazine	5			0.73–1

- Labeled for grain or forage sorghum.
- Use sorghum seed treated with an approved seed safener for chloroacetamide herbicides (group 15).
- Not labeled for use on coarse-textured soils with less than 1% organic matter.
- Bicep Lite II Magnum and Cinch ATZ Lite are premixes of reduced-atrazine-rate ratios. .
- See individual component sections in this table and atrazine use restrictions for additional information.
- *Restricted-use pesticides and water quality advisory.*

Callisto 4SC	mesotrione	27	EPP, PRE	6.0–6.4 fl oz	0.188–0.2
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- Labeled for grain sorghum only.
- Do not apply to sorghum grown on sand, loamy sand, or sandy loam soils due to risk of sorghum injury.
- Do not apply to emerged sorghum or injury will occur.
- Applying Callisto less than 7 days before planting will increase risk of crop injury, especially if irrigation or rainfall is received following application. Applying more than 7 days prior to planting will reduce risk of injury.
- Do not apply more than 21 days prior to planting.
- If applied prior to planting, minimize disturbance of the herbicide treated soil during planting process.

Coyote 3.67SC	S-metolachlor +	15	EPP, PRE	2 qt	1.67
	mesotrione	27			0.165

- Labeled for grain sorghum only.
- Do not apply to sorghum grown on sand, loamy sand, or sandy loam soils due to risk of sorghum injury.
- Use sorghum seed treated with an approved seed safener for chloroacetamide herbicides (Group 15).
- Do not apply to emerged sorghum, or injury will occur.
- Applying Coyote less than 7 days before planting will increase risk of crop injury, especially if irrigation or rainfall is received following application. Applying more than 7 days prior to planting will reduce risk of injury.
- Do not apply more than 21 days prior to planting.
- *Water quality advisory.*

Degree Xtra 4.04 ME/ FulTime NXT 4.04CS	acetochlor +	15	EPP, PPI, PRE	2.0–3.7 qt	1.3–2.4
	atrazine	5			0.6–1.23

- Labeled for grain sorghum only.
- Use sorghum seed treated with an approved seed safener for chloroacetamide herbicides (group 15).
- Do not apply pre-plant incorporated on coarse- or medium-textured soils.
- These products can be applied to emerged sorghum up to 11 inches in height
- See individual component sections in this table and atrazine use restrictions and acetochlor restrictions.
- *Restricted-use pesticides and water quality advisory.*

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Table 5.32 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Sorghum (cont.)

Trade name ¹	Common name	Site of Action Number	Application	Product/A	lb ai/A
Dual II Magnum 7.64EC	S-metolachlor	15	EPP, PPI, PRE	1–1.67 pt	0.96–1.6

- Labeled for forage and grain sorghum.
- Use sorghum seed treated with an approved seed safener for chloroacetamide herbicides (group 15).
- Dual II Magnum/Cinch are similar in activity to Outlook or Warrant.
- Dual II Magnum/Cinch contains a crop-safening agent.
- Incorporation improves control of yellow nutsedge.
- A prepackaged mixture with glyphosate is available as Sequence: label mention preplant or preemergence application only.
- *Water quality advisory.*

Halex GT 4.39EC	S-metolachlor +	15	EPP, PRE	4–6 pt	1.05–1.57
	mesotrione +	27			0.105–0.157
	glyphosate	9			1.05–1.57

- Labeled for grain sorghum only; do not use in production of forage sorghum, sudangrass, or sorghum-sudangrass hybrids.
- Use sorghum seed treated with an approved seed safener for chloroacetamide herbicides (Group 15).
- For best results, apply to weeds before they are 4 inches tall and from 21 days before planting up through planting but prior to crop emergence.
- Include NIS and AMS in the spray mixture.
- Atrazine can be tank-mixed with Halex GT.
- Not labeled for use on coarse-textured soils.
- Do not apply Halex GT to ground that has been or will be treated with Callisto in the same season.
- Do not apply more than 6 pt/A Halex GT per season (0.0157 lb mesotrione, 1.57 lb s-metolachlor, and 1.57 lb glyphosate).
- Use caution if applying OP or carbamate insecticides 7 days before or after Halex GT application.
- See label for additional use restrictions.
- *Water quality advisory.*

ImiFlex 1SL	imazamox	2	PRE	6–9 fl oz	0.047–0.07
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- Labeled on igrowth grain and forage sorghum only; conventional sorghum hybrids will be killed if treated with ImiFlex.
- ImiFlex is not labeled for use in NJ.
- Do not plant igrowth sorghum in fields known to have ALS-resistant johnsongrass or shattercane and do not replant igrowth sorghum in consecutive years.
- For best results, apply to weeds before broadleaf weeds exceed a height of 3 inches and grass weeds exceed 4 to 5 leaves.
- ImiFlex should be applied with non-ionic surfactant (NIS), or crop oil concentrate (COC) except when mixed with 2,4-D or dicamba.
- Do not tank mix Huskie or Peak as significant injury can occur.
- ALS-resistant biotypes of marestail/horseweed are found in the region and thus Group 2 herbicides will not be effective against these populations. To prevent herbicide resistance, avoid repeated annual applications of ALS (Group 2) herbicides.
- Regional data suggest that utility of ImiFlex is primarily for postemergence weed control.
- Refer to label for additional information on use and restrictions.
- *Water quality advisory.*

Table 5.32 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Sorghum (cont.)

Trade name ¹	Common name	Site of Action Number	Application	Product/A	lb ai/A
Linex 4L Lorox 50DF	linuron	7	PRE	0.625–2.0 pts 0.5–2.0 lbs	0.25–1.0
<ul style="list-style-type: none"> • Label does not specify sorghum type. • Apply as tank mixture with other labeled herbicides. • Apply after planting, but before crop emergence. • Plant seed at least 1 inch deep or crop injury may occur. 					
Lexar EZ 3.7SC	S-metolachlor + mesotrione + atrazine	15, 27, 5	EPP, PRE	3.0 qt	1.3 0.168 1.3
Lumax EZ 3.67SC	S-metolachlor + mesotrione + atrazine	15, 27, 5	EPP, PRE	2.7 qt	1.68 0.168 0.63
<ul style="list-style-type: none"> • Labeled for grain sorghum only; do not use in production of forage sorghum, sudangrass, or sorghum-sudangrass hybrids. • Applying less than 7 days before sorghum planting will increase the risk of crop injury, especially if irrigation or rainfall is received shortly after application. • The label does not recommend application to sorghum grown on sandy soils (sand, sandy loam, or loamy sands). • Use sorghum seed treated with an approved seed safener for chloroacetamide herbicides (group 15). • Do not apply to emerged sorghum or severe injury will occur. See individual component sections in this table and atrazine use restrictions. • <i>Lexar and Lumax are restricted-use pesticides and have a water quality advisory.</i> 					
Outlook 6.0EC	dimethenamid	15	EPP, PPI or PRE	12–21 fl oz	0.56–0.98
<ul style="list-style-type: none"> • Labeled for grain sorghum only; sorghum forage may be grazed or fed to livestock 60 days after application. • Outlook is similar in activity to Dual II Magnum. • Use sorghum seed treated with an approved seed safener for chloroacetamide herbicides (group 15). • Outlook may be applied to sorghum up to 12-inch-tall; Outlook will not control weeds that have emerged. • Outlook is not recommended for coarse-textured soils due to limited residual control. • For early preplant applications or fields with heavy surface plant residue, increase Outlook rate, see label. • Verdict contains dimethenamid, but will need additional Outlook added to provide consistent residual control; see Verdict label. • Incorporation improves control of yellow nutsedge. • <i>Water quality advisory.</i> 					

Table 5.32 - Comments on Preplant or Preemergence Herbicides for Conventional, Min-, or No-Till Sorghum (cont.)

Trade name ¹	Common name	Site of Action Number	Application	Product/A	lb ai/A
Verdict 5.57EC	saflufenacil + dimethenamid	14, 15	EPP, PPI, or PRE	10 fl oz	0.38 + 0.045
<ul style="list-style-type: none"> • Labeled for grain sorghum only; sorghum forage can be harvested, fed or grazed 70 days after application. • Use sorghum seed treated with an approved seed safener for chloroacetamide herbicides (group 15). • Verdict can be used in a burndown program or as a preemergence treatment. If used in a burndown program, it is best to include glyphosate and atrazine in addition to the necessary adjuvants (methylated seed oil [MSO] plus ammonium sulfate [AMS] or nitrogen solution) to improve control of emerged weeds including horseweed. • Amount of dimethenamid in Verdict is low, additional Outlook can be included to improve residual control, refer to label for additional Outlook rates. • Do not apply Verdict to emerged sorghum, or severe injury will occur. • The use of Verdict can follow a burndown application of Sharpen (1 fl oz/A). • <i>Water quality advisory</i> 					
Warrant 3CS	acetochlor	15	EPP, PPI, or PRE	1.5–3.0 qt	1.125–2.25
<ul style="list-style-type: none"> • Labeled for forage and grain sorghum • Use sorghum seed treated with an approved seed safener for chloroacetamide herbicides (group 15). • Acetochlor is similar in activity to Dual II Magnum or Outlook but is more active on certain broadleaf weeds. • Warrant may be applied on up to 11-inch-tall corn depending on the tank-mix partner but Warrant alone will not control emerged weeds. • For early preplant applications or fields with heavy surface plant residue, the rate of acetochlor may need to be increased, refer to label. • <i>Water quality advisory.</i> <p>Acetochlor Use Restrictions</p> <ul style="list-style-type: none"> • Do not apply within 50 feet of any well where depth to groundwater is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter • Do not mix or load within 50 feet of any wells, streams, rivers, lakes, or reservoirs • Do not apply under conditions that favor runoff or wind erosion of soil containing this product to non-target areas. 					
¹ See Table 5.3 (generics table) for additional herbicides that contain these active ingredients.					

Table 5.33 - Sorghum Herbicide Preplant or Preemergence Rates Per Acre Based on Soil Texture and Organic Matter

This table shows application rates for products applied alone. Rates may vary if tank-mixed with other products, if weed infestations are heavy, or if used in conservation tillage situations. See specific product label for additional information on application rates and use.

Trade Name	Site of Action Number	Unit	< 3% Organic Matter			>3% Organic Matter			Inc. for No-till
			Coarse	Medium	Fine	Coarse	Medium	Fine	
Atrazine 4L	5	qt	Not recommended	1.6	1.6	Not recommended	1.6	1.6	yes
Atrazine 90DF	5	lb	Not recommended	1.8	1.8	Not recommended	1.8	1.8	yes
Bicep II Magnum 5.5SC	5/15	qt	Do not use	2.1	2.1	Do not use	2.1	2.1	yes
Bicep II Lite Magnum 6SC	5/15	qt	Do not use	1.5	1.5	Do not use	1.5	1.5	yes
Callisto 4SC	27	fl oz	Do not use	6.0	6.0	Do not use	6.0	6.0	no
Coyote 3.67SC	15/27	qt	Do not use	2.0	2.0	Do not use	2.0	2.0	no
Degree Xtra 4.04 ME	5/15	qt	2.0	2.5	2.75	2.3	3.0	3.7	no
Dual II Magnum 7.64EC	15	pt	1.33	1.67	1.67	1.3	1.67	1.67	yes
FulTime 4.04CS	5/15	qt	2.0	2.5	2.9	2.5	3.0	3.2	no
Halex GT 4.39EC	15/27/9	qt	Do not use	4.0	4.0	Do not use	4.0	4.0	no
ImiFlex ¹	1	fl oz	Do not use	9.0	9.0	9.0	9.0	9.0	no
Lexar EZ 3.7SC	5/15/27	qt	Do not use	3.0	3.0	Do not use	3.0	3.0	no
Linex 4L	7	pt	1.0	1.25	1.5	1.25	1.5	1.75	no
Lorox 50DF	7	lb	1.0	1.25	1.5	1.25	1.5	1.75	no
Lumax EZ 3.67SC	5/15/27	qt	Do not use	2.7	2.7	Do not use	2.7	2.7	no
Outlook 6.0EC	15	fl oz	14	18	18	16	18	20	yes
Sequence 5.25EW	9/15	pt	3.5	3.75	3.75	3.5	3.75	4.0	no
Verdict 5.57EC	14/15	fl oz	10	10	10	10	10	10	yes
Warrant 3CS	15	qt	1.5	1.75	3.0	2.0	2.5	2.75	no

¹ For use on sorghum containing the igrowth herbicide tolerance trait only. ImiFlex is not labeled for use in NJ.

Table 5.34 - Relative Effectiveness of Postemergence Herbicides on Individual Weed Species

Ratings are based on labeled application rates and weeds at 4-inch height. Results may differ with variations in weed size, temperature, rainfall soil moisture, and good spray coverage. Ratings are based only on postemergence activity and do not reflect possible residual activity. For ratings on herbicide combinations not listed, see the component parts.

Weed control rating:	Crop tolerance:
10 = 95–100%	E = excellent; almost never any crop injury observed
9 = 85–95%	VG = very good; on rare occasion is crop injury observed
8 = 75–85%	G = good; seldom is crop injury observed as long as proper management practices are followed (e.g., seedling depth, seed slit closure, herbicide rate and application timing, adjuvants)
7 = 65–75%	FG = fair to good; occasionally crop injury is observed even with proper management practices; injury is often due to herbicide interactions with environmental conditions
6 = 55–65%	F = fair; some crop injury is commonly observed
N = less than 55% or no control	
– = no data available for this area	

Grasses

Trade Name* (rate/A)	Site of Action Number	Barnyardgrass	Bermudagrass	Broadleaf signalgrass	Crabgrass	Fall Panicum	Foxtail spp.	Goosegrass	Johnsongrass (Seedling)	Johnsongrass (Rhizome)	Quackgrass	Shattercane	Texas panicum	Wirestem Muhly	Yellow Nutsedge
Atrazine (1 qt)	5	7+	N	7	6	6	7+	6	N	N	7	6	N	6	7
Basagran (1 qt)	6	N	N	N	N	N	N	N	N	N	N	N	N	N	8
Facet (>26 fl oz)	4	8	N	8	7	6	7	N	N	N	N	N	–	N	N
FirstAct (8 fl oz) ²	1	9	9	9	8+	9	9+¹	9	9	9	9	9+	8+	6	N
ImiFlex (6 fl oz) ³	2	8+	N	8	7	8+	8+	N	8+	7	N	8+	6	N	6
Linex/Lorox (POST directed)	7	7	–	8	8	8	8	8+	8	–	–	–	8	–	6
Permit/Sandea (0.67 oz)	2	N	N	N	N	N	N	N	N	N	N	N	N	N	9+
Yukon (4 oz)	2	N	N	N	N	N	N	N	N	N	N	N	N	N	9+
Zest (1.33 oz) ⁴	2	8+	N	9+	7	9	9	N	9	8+	8+	9	9	7	6

* See Table 5.3 (generics table) for additional herbicides that contain these active ingredients.

¹ Herbicide is less effective on yellow foxtail compared to giant foxtail. FirstAct rating for yellow foxtail = 7.

² For use on sorghum containing the Double Team herbicide tolerance trait only.

³ For use on sorghum containing the igrowth herbicide tolerance trait only. ImiFlex is not labeled for use in NJ.

⁴ For use on sorghum containing the Inzen herbicide tolerance trait only. Zest is labeled for use in DE and VA only.

Table 5.34 - Relative Effectiveness of Postemergence Herbicides on Individual Weed Species (cont.)

Broadleaves																
Trade Name* (rate/A)	Herbicide Group (Mode of Action)	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters	Annual Morning Glory	Eastern Black Nightshade	Palmer amaranth / Waterhemp ¹	Pigweed ¹	Common Ragweed ²	Giant Ragweed	Prickly Sida	Smartweed	Spurred anoda	Velvetleaf	Sorghum Safety
2,4-D (1pt)	4	6	9	8	9	9	7	9	9	9	9	9	7	-	8	F
Aim (0.5 oz)	14	N	N	N	6	6	8	7	7	N	N	6	N	-	9	FG
Atrazine (1 qt)	5	8	9	9	9+	9	9	9+	N	9	8	8+	9+	-	8	FG
Basagran (1 qt)	6	N	9	9	8	N	N	N	6+	8	7	8	9	7	8+	FG
Clarity (8 fl oz)	4	7	9	9	9	9	8	9	9	9	9	8	9+	-	8	F
Facet (>26 fl oz)	4	-	-	-	6**	7	-	N	N	6**	6**	-	N	-	6**	G
Huskie (12.8 fl oz)	6/27	-	8+	7+	9	8	8+	8	8	8	7	-	8+	-	8	G
Imiflex (6 fl oz)	2	6	9	8	8+	7	8+	N	9	8	8	6	8	7	9	- ³
Linex / Lorox (POST-directed)	7	-	8+	8+	8+	8	-	9	9	9	-	8	7	-	8+	FG
Maestro (1.5 pt)	6	8	9	9	9	8	9	N	7	7+	8	N	9	-	8+	F
Peak (0.75 oz)	2	-	N	8	8	7	-	9	9	9	6	6	7	-	8+	G
Permit / Sandea (0.67 oz)	2	6	9	N	N	6	6	9	9	9	8	7	8	-	9	G
Starane Ultra (6.4 fl oz)	4	-	8+	-	-	8+	6	7+	7+	8+	8+	-	-	-	8+	G
Yukon (4 oz)	2/4	6	9	9	9	9	8	9	9	9	8	8	9+	-	9	FG
Zest (1.33 oz)	2	7	7	7	6	7	N	N	9	6	N	N	8	-	7	- ⁴

* See Table 5.3 (generics table) for additional herbicides that contain these active ingredients.

** Facet is labeled for suppression of this species on weeds less than 2-inches tall.

¹ Group 2 resistance has been confirmed for this species and widespread in the region

² Common ragweed biotypes resistant to Groups 2 and 14 herbicides have been confirmed in the region. Group 14 resistance is limited to the DelMarVa region and NJ.

³ For use on sorghum containing the igrowth herbicide tolerance trait only.

⁴ For use on sorghum containing the Inzen herbicide tolerance trait only.

Table 5.35 - Comments on Postemergence Herbicides for Sorghum

The following herbicides can be added with postemergence herbicides to improve residual weed control. They will not provide control of emerged weeds, so they should be applied to weed-free soil surface or with products that will provide postemergence control of weeds present at time of application. Consult labels when tank-mixing with any herbicide. Some pesticides or adjuvants used in combination with the following herbicides could increase the chance of soybean injury.

Trade Name ¹	Common Name	Site of Action Number	Sorghum Type	Application Timing	Product/A	lb ai/A
Dual Magnum 7.62EC	S-metolachlor	15	grain, forage	POST	1–1.67pt	0.95–1.59
<ul style="list-style-type: none"> • Application timing is not specified on label. • Do not make more than one application per year. • Make applications at least 75 days before harvest. • <i>Water quality advisory.</i> 						
Prowl 3.3EC/ Prowl H2O 3.8CS	pendimethalin	3	grain only	4-inch growth stage up to layby	2.4–3.6pt 1.5–3pt	1–1.5
<ul style="list-style-type: none"> • Do not apply preplant incorporated or preemergence. • Do not make more than one application per year. • Do not apply on sorghum planted in double-row beds. • Do not replant sorghum if crop loss occurs. • Do not apply in liquid fertilizer. • Use only where adequate tillage is practiced to provide good seed coverage and plant seeds at least 1 inch deep, or crop injury may occur. • Prior to application, crop must be cultivated in such a manner as to throw at least 1 inch of soil over the base of the crop plants to prevent direct contact of Prowl with the zone of brace root formation. 						
Warrant 3CS	acetochlor	15	grain, forage	before 11 inches	1.5–3qt	1.125–2.25
<ul style="list-style-type: none"> • Acetochlor is similar in activity to Dual, but is more active on certain broadleaf weeds. • Do not apply POST using sprayable fluid fertilizer, or injury will occur. • <i>Water quality advisory.</i> 						
<p>The following treatments are applied after sorghum emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.</p>						
2,4-D amine 4S	2,4-D amine	4	grain only	6 to 15 inches Over 8" drops recommended	1 pt	0.5 ae
<ul style="list-style-type: none"> • Sorghum is not as tolerant to 2,4-D as corn. • Apply between 6- and 15-inch tall sorghum; if sorghum is over 8-inches tall consider drop nozzles to keep spray off the foliage; do not treat during the boot, flowering, or dough stages. • Do not apply during periods of rapid growth (high soil moisture, warm temperatures, recent nitrogen application) due to increased risk of crop injury. • Make only one application per season to emerged sorghum. • 2,4-D is volatile, be cautious of off-target movement. • Surfactants can increase risk of injury, be cautious of surfactant use when tank mixing with other herbicides. • 2,4-D does not provide any residual weed control. 						

Table 5.35 - Comments on Postemergence Herbicides for Sorghum (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Sorghum Type	Application Timing	Product/A	lb ai/A
Aim 2EC	carfentrazone	14	grain only	4 inches to boot stage	0.5 fl oz	0.008
<ul style="list-style-type: none"> • At rate labeled for Aim 2EC, control is limited to weeds less than 3-inches tall, or morningglory with no more than 3 leaves, and velvetleaf up to 4 inches. • Application timing is 4 inches tall to just prior to boot stage; but application should be based on small weeds. • Tank-mix with other herbicides to increase weed control spectrum. • Aim does not provide residual weed control. • Use a non-ionic surfactant (NIS); do not use crop oil concentrate (COC) on emerged sorghum with either formulation. 						
Atrazine 4L	atrazine	5	grain, forage	Before 12 inches	0.75–2.0 qts	0.75–2.0
Atrazine 90DF	atrazine	5		Before 12 inches	0.83–2.2 lbs	0.75–2.0
<ul style="list-style-type: none"> • Apply before sorghum exceeds 12 inches; apply before weeds are 1.5 inches tall. • Sorghum is not as tolerant as corn to atrazine. • If no atrazine was applied prior to sorghum emergence, maximum application rate is 2 qts/A. If POST application is following an earlier atrazine application, total atrazine amount cannot exceed 2.5 lbs active ingredient. • Length of residual control depends on rate applied. • Add 1 qt crop oil concentrate (COC)/A to spray solution. Do not include oil if sorghum is under stress from prolonged cold, wet weather or other factors. 						
ATRAZINE USE RESTRICTIONS						
Safety Precautions for Using Atrazine						
<ul style="list-style-type: none"> • Do not mix, load, or apply within 50 feet of drinking water wells, livestock wells, agricultural drainage wells, irrigation wells, abandoned wells, or sinkholes. • Do not mix or load within 50 feet of intermittent streams, perennial streams, rivers, lakes, or reservoirs. • Do not apply within 200 feet of lakes or reservoirs. • Do not apply within 66 feet of the points where surface water runoff enters intermittent streams, perennial streams, or rivers. The 66-foot buffers should be planted to a crop or seeded with grass on highly erodible land. • <i>Restricted-use pesticide and water quality advisory.</i> 						
Basagran 4S	bentazon	6	grain, forage	Before heading	1.5–2.0 pts	0.75–1.0
<ul style="list-style-type: none"> • Apply to sorghum before heading or blooming; however, Basagran needs to be applied when weeds are small and actively growing. • Basagran is weak on pigweed species, including Palmer amaranth. • Tank-mix with atrazine to broaden spectrum of control • Label recommends use of crop oil concentrate. • Split treatments may be required for yellow nutsedge and Canada thistle. • Basagran does not provide residual weed control. • <i>Water quality advisory.</i> 						

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Table 5.35 - Comments on Postemergence Herbicides for Sorghum (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Sorghum Type	Application Timing	Product/A	lb ai/A
Bicep II Magnum 5.5SC	S-metolachlor	15	grain, forage	3-leaf growth stage up to 12 inches	1.3–2.1 qt	0.78–1.26
	atrazine	5				0.99–1.6

- Use sorghum seed treated with an approved seed safener for chloroacetamide herbicides (Group 15).
- Do not apply more than a total of 2.58 qt of Bicep II Magnum/A/season (i.e. 1.55 lb ai/A s-metolachlor and 1.97 lb ai/A atrazine).
- If other products containing s-metolachlor have been applied, the combined total amount of s-metolachlor resulting from all applications must not exceed 1.7 lb ai/A/calendar year.
- See individual component sections in this table and atrazine use restrictions for additional information.
- Tank-mix with other herbicides to increase weed control spectrum.
- Make applications at least 75 days before harvest.
- Add 1 qt crop oil concentrate (COC)/A to spray solution. The addition of UAN or AMS is recommended to improve control.
- *Restricted-use pesticides and water quality advisory.*

Facet 1.5L	quinclorac	4	grain only	Before 12 inches tall	22–32 fl oz	0.25–0.375
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- Sorghum stage is from emergence up to 12-inches tall.
- For best activity apply with atrazine at 0.5 to 1 lb ai to weeds less than 2 inches tall.
- Add 1 qt crop oil concentrate or methylated seed soil for better weed control. Ammonium sulfate (AMS) or urea ammonium nitrate (UAN) can also be added for improved efficacy. Non-ionic surfactant (NIS) plus a nitrogen source (AMS) may be used when Facet is tank mixed with products that restrict use of crop oil concentrates.
- Facet can provide residual control of susceptible weed species.

FirstAct 0.83EC	quizalofop	1	grain only		6-10 fl oz	0.039–0.065
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- Labeled on Double Team grain sorghum only; conventional sorghum hybrids will be killed if treated with FirstAct.
- Do not replant Double Team grain sorghum in consecutive years.
- Do not use crop oils manufactured from vegetable oils; when tank-mixing with a broadleaf herbicide, always read both labels to make sure the right surfactant and concentration are used.
- Do not apply initial application of FirstAct until sorghum is 11-12 inches tall (V8 stage) otherwise crop injury may occur.
- Two applications of FirstAct can be applied POST, but there must be an interval greater than 7 days between FirstAct applications.
- Apply when grasses are within the recommended growth stage specified on the label; perennial grasses may require a second application for complete control.
- To avoid antagonism (reduced grass control) from broadleaf herbicides, spray 2 to 3 days before the broadleaf herbicide or wait 7 days after the broadleaf herbicide application.
- FirstAct must be applied at least 45 days before harvest.

Table 5.35 - Comments on Postemergence Herbicides for Sorghum (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Sorghum Type	Application Timing	Product/A	lb ai/A
Huskie 2.06EC	pyrasulfotole + bromoxynil	27 6	grain, forage	3 leaves to 30 inches tall (prior to flag leaf emergence)	12.8–16 fl oz	0.031–0.038 0.18–0.22
<ul style="list-style-type: none"> • Application timing for sorghum stage is 3-leaf up to 30 inches and/or prior to flag leaf emergence. • Huskie label does not require a surfactant. Nonionic surfactant (NIS) and ammonium sulfate (AMS) can be included under challenging growing conditions, or if tank-mix partner requires an additive. • Huskie can be tank-mixed with atrazine at 0.25 to 1.0 lb ai to improve and broaden spectrum of control; see atrazine entry in this table for precautions. • Addition of atrazine with Huskie is recommended for most situations. • Two applications of Huskie can be applied POST, but there must be an interval of 11 days between Huskie applications. • Crop injury can occur if Huskie is applied to fields treated with mesotrione (Lumax or Lexar). • <i>Water quality advisory.</i> 						
Maestro 2E	bromoxynil	6	grain, forage	4 leaves to preboot stage	1–1.5 pt	0.25–0.375
<ul style="list-style-type: none"> • Apply to sorghum between 4-leaf stage and up to preboot stage; however, Maestro needs to be applied when weeds are small and actively growing. • When applied alone, Maestro does not need any additional surfactant; when tank-mixing, it can be applied in combination with surfactants or crop oil concentrate. • Maestro is weak on pigweed species, including Palmer amaranth. • Maestro does not provide residual weed control. 						
Peak 57WG	prosulfuron	2	grain, forage	5 to 30 inches tall; over 20 inches drops are recommended	0.5–1.0 oz	0.018–0.036
<ul style="list-style-type: none"> • Application timing is between 5 and 30 inches tall, and prior to head emergence; use drop nozzles after sorghum is 20 inches tall. Application should focus on weed size rather than crop stage. • Tank mix with other labeled POST herbicides to broaden spectrum of control. • Peak applications should include a non-ionic surfactant (NIS). Crop oil concentrate can be included if tank mix partner recommends COC. • Refer to label for additional information on use and restrictions. • Peak will provide residual control of susceptible species. • Peak is an ALS (group 2) herbicide and there is wide-spread resistant to group 2 herbicides in the region. To prevent herbicide resistance, avoid repeated annual applications of ALS (group 2) herbicides. • <i>Water quality advisory.</i> 						

Table 5.35 - Comments on Postemergence Herbicides for Sorghum (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Sorghum Type	Application Timing	Product/A	lb ai/A
Permit 75WG/ Sandeia 75WG	halosulfuron	2	grain only	2 leaves to before head emergence	0.67–1.0 oz	0.031–0.047
<ul style="list-style-type: none"> • Apply from 2-leaf stage but before grain head emergence. • The 0.67 oz rate is the standard rate for annual weed control. • Permit/Sandeia is excellent on yellow nutsedge, but is weak on common lambsquarters. • Tank mix with other labeled POST herbicides to broaden spectrum of control. Yukon is a prepackaged product containing Permit + dicamba. • Permit/Sandeia should be applied with non-ionic surfactant (NIS); use of crop oil concentrate (COC) increases risk of crop injury. • Permit/Sandeia will provide residual control of susceptible species. • ALS-resistant biotypes of marestalk/horseweed are found in the region and thus Group 2 herbicides will not be effective against these populations. To prevent herbicide resistance, avoid repeated annual applications of ALS (Group 2) herbicides. 						
Starane Ultra 2.8L	fluroxypyr	4	grain, forage	3- to 7-leaf stage; use drops for 8-leaf to boot stage	0.4 pt	0.14
<ul style="list-style-type: none"> • Timing for broadcast application 3-leaf of sorghum through 7-leaf stage, and drop nozzles from 8-leaf to boot stage. • Can be tank-mixed with other labeled herbicides can be included to broaden spectrum of control. • Surfactants not needed; Starane Ultra is applied alone, but may be used when required by tank-mixed partner. • Two applications of Starane Ultra can be made. • Starane Ultra will not provide residual weed control. 						
Yukon 67.5WDG	halosulfuron + dicamba	2 4	grain only	2 to 15 inches tall; use drops after 8-leaf stage	4–6 oz	0.03–0.045 0.125–0.188
<ul style="list-style-type: none"> • Yukon is a premix of halosulfuron (Permit) plus the sodium salt of dicamba. • Yukon can be applied from 2-leaf through 15 inch tall sorghum; use drop nozzles after sorghum is 8 inches tall. • Include non-ionic surfactant (NIS); crop oil concentrate (COC) can be used, but increases the risk of injury. • See entry for each component of Yukon for more information. • ALS-resistant biotypes of marestalk/horseweed are found in the region and thus Group 2 herbicides will not be effective against these populations. To prevent herbicide resistance, avoid repeated annual applications of ALS (Group 2) herbicides. • Yukon will provide residual control of susceptible species. 						

Table 5.35 - Comments on Postemergence Herbicides for Sorghum (cont.)

The following treatments are applied after corn emergence to control established weeds. See specific product label to determine correct rate for soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Site of Action Number	Sorghum Type	Application Timing	Product/A	lb ai/A
Zest 75WDG	nicosulfuron	2	grain only	5- to flag-leaf stage	0.67–1.33 oz	0.031–0.062

- Labeled on Inzen grain sorghum only; conventional sorghum hybrids will be killed if treated with Zest.
- Zest is labeled for use in DE and VA only.
- Do not plant Inzen grain sorghum in fields known to have ALS-resistant johnsongrass or shattercane.
- Do not tank-mix with Huskie, or injury will occur.
- Two applications of Zest can be applied POST, but there must be an interval of 7 days between Zest applications.
- Zest should be applied with non-ionic surfactant (NIS), or crop oil concentrate (COC) except when mixed with 2,4-D or dicamba.
- Risk of crop injury is higher with early POST application or when cool weather conditions prevail. Zest may cause temporal yellowing to Inzen sorghum but will recover quickly.
- Zest does not provide residual weed control.
- ALS-resistant biotypes of marestalk/horseweed are found in the region and thus Group 2 herbicides will not be effective against these populations. To prevent herbicide resistance, avoid repeated annual applications of ALS (Group 2) herbicides.
- *Water quality advisory.*

POST-DIRECTED

Linex 4L or	linuron	6	label does not specify	1–2 pts	0.5–1.0
Lorox 50DF				1–2 lbs	

- Post-directed application only. Do not apply over the top of emerged sorghum.
- Use only when there is sufficient differential between height of sorghum and weeds so that weeds are thoroughly covered and upper leaves of sorghum and whorl are not exposed to spray or drift.
- Include a non-ionic surfactant (NIS).
- Weeds should be treated prior to 2-inch-tall grass weeds and 6-inch broadleaf weeds.
- Linex/Lorox will provide residual control of susceptible species.

¹ See Table 5.3 (generics table) for additional herbicides that contain these active ingredients.

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Table 5.36 - Weed Sizes for Postemergence Sorghum Herbicides

This table lists postemergence sorghum herbicides, their rates, and height ranges of weed species that are controlled or suppressed. This table is only a “quick reference”; refer to the herbicide label for additional information on application and timing.

Grasses	Barnyardgrass	Bermudagrass	Broadleaf signal grass	Crabgrass spp.	Fall Panicum	Foxtail spp.	Goosegrass	Johnsongrass (Seedling)	Johnsongrass (Rhizome)	Quackgrass	Shattercane	Texas panicum	Wirestem Muhly	Yellow Nutsedge
-----height range (inches) at application -----														
Atrazine (2 pt)	L-s*	—	—	L-s	—	L-s	—	—	—	—	—	—	—	—
Basagran (2 pt)	—	—	—	—	—	—	—	—	—	—	—	—	—	8
Facet (>26 fl oz)	2	—	2	2	—	2	—	—	—	—	—	—	—	—
FirstAct (> 6 fl oz) ¹	6	3	6	6	6	4	6	—	—	10	—	4	8	—
ImiFlex (6 fl oz) ²	3	—	3	3	3	3	3**	—	—	3**	—	3**	—	3**
Linex/Lorox (directed)	2	—	2	2	2	2	2	—	—	—	—	2	—	—
Permit/Sandea (0.67 oz)	—	—	—	—	—	—	—	—	—	—	—	—	—	6
Yukon (4 oz)	—	—	—	—	—	—	—	—	—	—	—	—	—	6
Zest (0.67 oz) ³	4	—	2	2	4	4	—	—	—	—	—	3	—	—

— = weed size is not on the herbicide label.

*L-s species are on the atrazine label as suppression.

**Suppression only; additional control measures may be necessary.

¹ For use on sorghum containing the Double Team herbicide tolerance trait only.

² For use on sorghum containing the igrowth herbicide tolerance trait only. ImiFlex is not labeled for use in NJ.

³ For use on sorghum containing the Inzen herbicide tolerance trait only. Zest is labeled for use in DE and VA only.

Table 5.36 - Weed Sizes for Postemergence Sorghum Herbicides (cont.)

Trade Name (rates/A)	Broadleaves													
	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters	Morningglory, Annual	Nightshade, Eastern Black	Palmer amaranth/ Waterhemp	Pigweed spp.	Ragweed, Common	Ragweed, Giant	Prickly sida	Smartweed	Spurred anoda	Velvetleaf
	----- maximum height at application (inches) -----													
2,4-D ¹	–	6	3	4	6	2	4	4	6	6	–	–	–	2
Aim (0.5 oz)	–	–	–	3	3 lvs	4	2	4	–	–	–	–	–	4
Atrazine ¹ (2 pt)	4	4	4	6	4	4	4	–	4	4	4	4	–	2
Basagran (2 pt)	–	10	10	2*	–	–	–	–	3	6	4	10	4	5
Dicamba ¹	4	4	4	4	4	4	4	4	4	4	4	6	–	2
Facet (>26 fl oz)	–	–	–	–	2	–	–	–	2-s	2-s	–	–	–	2-s
ImiFlex (6 fl oz) ²	–	8	6	5	4	5	4	8	5	5	4*	5	–	8
Huskie (12.8 fl oz)	4	4	–	4	4	4	4	4	4	4	–	–	–	4
Linex / Lorox (directed)	–	6	–	6	6	–	6	6	6	–	6	6	–	–
Maestro / Buctril (1.5–2 pt)	4	10	6	8	4	6	–	2	6	6	–	6	–	5
Peak (0.75 oz)	4-s*	10	6	4	4-s*	–	4	5	10	3	3-s*	4	–	6
Permit/Sandea (0.67 oz)	3*	9	–	2*	–	–	–	3	9	3	3	2	–	9
Starane Ultra ³	–	8	8	–	8	8-s*	–	–	8	8	–	–	–	8
Yukon (4–8 oz)	2-5	9-14	2-4	2-4	2-6	2-4	4-6	3-6	9-12	3-6	2-4	2-4	–	9-12

*Suppression only, additional control measures may be necessary.

¹ No sizes given on label, sizes listed above are best estimates.

² For use on sorghum containing the igrowth herbicide tolerance trait only. ImiFlex is not labeled for use in NJ.

³ Starane Ultra label states that susceptible broadleaf species will be controlled if treated before they reach height of 8 inches.

Table 5.37 - Herbicide Effectiveness on Perennial Broadleaf Weeds

Performance ratings are based on seasonal control from a postemergence application in sorghum.

Weed control rating: 10 = 95–100% 9 = 85–95% 8 = 75–85% 7 = 65–75% 6 = 55–65% N = less than 55%
or no control – = no local data available

Broadleaves													
Trade Name (rate/A)	Site of Action Number	Canada Thistle	Dandelion	Dewberry spp.	Dock spp.	Hedge Bindweed	Hemp Dogbane	Horsenettle	Jerusalem Artichoke	Milkweed	Mugwort	Poison Ivy	Pokeweed
2,4-D (1 pt)	4	7+	8	6	7+	8	6	6	7	6	6	7	7
Atrazine (1.5 lb ai)	5	6	6	6	7	7+	6	6	N	N	N	6	6
Basagran + atrazine (1 qt + 1 qt)	5/6	8	7	N	7+	7+	6	7	6+	N	N	7	6
Clarity (8 fl oz)	4	8	7+	6	8	8+	7	7	8	6	7+	7+	6
Huskie + atrazine (12.8 fl oz + 0.75 lb ai)	27/6/5	L-s	L-s	–	L-s	–	–	–	L-s*	–	–	–	–
ImiFlex (6 fl oz) ¹	2	6	7	6	7	7+	7	7	7	6	–	–	6
Marksman (1 qt)	4/5	8+	8	6	8	8+	7	8	8	6	7+	7+	7
Peak + Clarity (0.75 oz + 8 fl oz)	2/4	L-s	–	–	–	–	L-s	–	–	–	–	–	–
Starane Ultra (0.4 pt)	4	N	N	N	N	8	8+	N	N	N	N	N	N
Yukon (6 oz)	2/4	8+	8	6	7	8	7	7+	7	8	7+	–	8
Zest (0.67 oz) ²	2	6	N	8	N	7	6	6	6	6	N	–	7

* Herbicide label lists this species for partial control.

¹ For use on sorghum containing the igrowth herbicide tolerance trait only. ImiFlex is not labeled for use in NJ² For use on sorghum containing the Inzen herbicide tolerance trait only. Zest is labeled for use in DE and VA only.

Table 5.38 - Spray Additives and Rainfastness for Burndown and Postemergence Sorghum Herbicides

Trade Name	Adjuvant(s) ¹	Rate	Rainfastness (hours)
2,4-D amine	none, except in certain tank-mixes	–	6–8
Aim/Cadet	non-ionic surfactant or	2 pt/100 gal	1
	crop oil concentrate	1 gal/100 gal	
	plus ammonium sulfate or	2–4 lb/A	
	nitrogen solution (optional)	2–4 gal/100 gal	
Atrazine	crop oil concentrate	1 gal/100 gal	1–2
Basagran ²	crop oil concentrate	2 pt/A	8
	plus nitrogen solution or	1 gal/A	
	ammonium sulfate	2.5 lb/A	
Clarity ³	non-ionic surfactant or	1 qt/100 gal	4
	crop oil concentrate plus	1 gal/100 gal	
	nitrogen solution	2–4 qt/A	
Engenia	see label for details		4
Facet	crop oil concentrate or	1 gal/100 gal	6
	methylated seed oil	1–2 pt/A	
	plus nitrogen solution or	2.5 gal/100 gal	
	ammonium sulfate	8.5 lb/100 gal	
FirstAct	crop oil concentrate or	1 gal/100 gal	1
	non-ionic surfactant	1 qt/100 gal	
	plus ammonium sulfate (optional)	2 lb/A	
Glyphosate (if not fully loaded with formulation adjuvants)	non-ionic surfactant	2 qt/100 gal	6
	plus ammonium sulfate (optional)	8.5–17 lb/100 gal	
Gramoxone SL	non-ionic surfactant or	1 pt/100 gal	0.5
	crop oil concentrate	1 gal/100 gal	
Huskie	non-ionic surfactant	1–2 qt/100 gal	1–6
	plus nitrogen solution or	1–2 qt/A	
	ammonium sulfate (optional)	0.5–1 lb/A	
ImiFlex	non-ionic surfactant or	1 qt/100 gal	1
	crop oil concentrate or	1–2 gal/100 gal	
	methylated seed oil	1–2 gal/100 gal	
	plus ammonium sulfate (optional)	12–15 lb/100 gal	
Maestro ⁴	crop oil concentrate or	1 gal/100 gal	1
	nitrogen solution	1–4 gal/100 gal	
Peak	crop oil concentrate	1 gal/100 gal	4
Permit/Sandea	non-ionic surfactant or	1–2 qt/100 gal	4
	crop oil concentrate	1 gal/100 gal	
	plus nitrogen solution (optional)		

Table 5.38 - Spray Additives and Rainfastness for Burndown and Postemergence Sorghum Herbicides (con't)

Trade Name	Adjuvant(s) ¹	Rate	Rainfastness (hours)
+ 2,4-D, Clarity, or Maestro	non-ionic surfactant		
+ atrazine	crop oil concentrate	1 gal/100 gal	
Roundup/Glyphosate	non-ionic surfactant	2 qt/100 gal	6
	plus ammonium sulfate (optional)	8.5–17 lb/100 gal	
Roundup PowerMAX/Roundup WeatherMAX	no NIS/COC required	–	<1
	ammonium sulfate (optional)	8.5–17 lb/100 gal	
Sharpen	methylated seed oil	1 gal/100 gal	4
	plus nitrogen solution or	2–4 qt/A	
	ammonium sulfate	8.5–17 lb/100 gal	
Yukon	non-ionic surfactant or	1–2 qt/100 gal	4
	crop oil concentrate	1 gal/100 gal	
	plus nitrogen solution or	2–4 qt/A	
	ammonium sulfate (optional)	2–4 lb/A	
Zest	non-ionic surfactant or	1 qt/100 gal	4
	crop oil concentrate	1 gal/100 gal	
	plus ammonium sulfate (optional)	2 lb/A	

¹ In general, non-ionic surfactants should contain at least 80% surface active agent; crop or vegetable oil concentrates should be nonphytotoxic, containing at least 15% approved emulsifier; nitrogen solution is an ammonium-based fertilizer such as 28%, 30%, or 32% N; and ammonium sulfate should be spray-grade dry ammonium sulfate (21-0-0). 10-34-0 also may be used with some products.

² Use crop oil concentrate if lambsquarters, common ragweed, Canada thistle, yellow nutsedge, or field bindweed are present. Include nitrogen solution if velvetleaf is the primary target.

³ Do not use COC after sorghum exceeds 5 inches tall. Adjuvant addition depends on tank-mix partner.

⁴ When Maestro is applied alone, spray additives generally are not needed and may cause excessive leaf burn.

Table 5.39 - Grain Harvest and Forage Restrictions for Sorghum Herbicides

Trade Name	Forage	Grain
	(Days After Treatment)	
2,4-D amine 4S	30	30
2,4-D LVE 4E	30	30
Aatrex, Atrazine 4L/90DF	60 PRE / 45 POST	60 PRE / 45 POST
Aim 2EC	not specified	not specified
Basagran 4S	12	not specified
Bicep II Magnum 5.5EC	60 PRE/ not specified POST	75
Callisto 4SC	not labeled for forage	not specified
Cinch ATZ	60	not specified
Clarity 4S	do not graze or feed prior to mature grain stage	30
Degree Xtra 4.04ME	not labeled for forage	60
Dual II Magnum 7.64EC/Cinch	75	75
Facet L 1.5L	not specified	not specified
FirstAct 0.83EC	not labeled for forage	45
FulTime NXT 4.04EC	60	not specified
Huskie 2.06EC	7	60
ImiFlex 1SL	not specified	not specified
Lexar EZ 3.7SC	not specified	not specified
Lorox 50DF/Linex 4L	90	75
Lumax EZ 3.67SC	45	not specified
Maestro 2EC	45	not specified
Outlook 6EC	60	80
Peak 57WG	30 graze / 40 silage	60
Permit/Sandea 75WG	30	30
Prowl 3.3EC	not labeled for forage	not specified
Prowl H2O 3.8CS	not labeled for forage	not specified
Sandea 75WG	30	30
Sharpen 2.85SC	70	not specified
Starane Ultra 2.8L	40	70
Verdict 5.57EC	70	not specified
Warrant 3CS	60	not specified
Yukon 67.5WDG	30	30
Zest 75WDG	not labeled for forage	30

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Table 5.40 - Comments on Harvest-Aid Herbicides for Sorghum

Treatments are based on broadcast application, not wiper-bar or rope-wick applications.

Trade Name	Common Name	Site of Action Number	Product/A	lb ai/A
Aim 2EC	carfentrazone	14	1 fl oz	0.016

- Use as a harvest aid to desiccate a limited number of broadleaf weed species.
- Application shall be made when the crop is mature and the grain has begun to dry down.
- Use with a crop oil concentrate @ 1% v/v (1 gal/100 gal).
- Can be tank-mixed with glyphosate to improve the spectrum of control.
- Apply in 10 gal/A water.
- Include necessary adjuvants and make sure spray coverage is sufficient, otherwise poor control will result.
- Allow at least three days between application and harvest.

Defol 5	sodium chlorate		4.8 qt	6.0
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- Labeled to dry weeds and to facilitate harvest.
- Apply to sorghum 7 to 10 days before anticipated harvest, when sorghum is mature and ready to harvest.
- Use lower rates when grain moisture is low and weather is clear and dry; use higher rates when conditions for desiccation is poor.
- Apply in at least 5-10 gallons of water by air, and 10 to 20 gallons of water with ground application.

Glyphosate	glyphosate	9	varies with formulation	0.75–1.5 ae
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- Apply glyphosate to sorghum at 30% grain moisture.
- Apply glyphosate in 10–20 gallons of water/A to control weeds that may interfere with harvest or to control perennials such as quackgrass or Canada thistle.
- Allow a minimum of 7 days between application and harvest.
- Do not use on sorghum grown for seed.
- Will not control glyphosate-resistant weeds.
- See Table 5.1 for more information on various glyphosate formulations.

Soybean Weed Management

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Integrated Weed Management

The foundation of soybean weed management is a residual soil-applied herbicide program followed by a timely postemergence herbicide. Make residual soil-applied herbicide applications as close to planting as possible and postemergence applications three to four weeks after planting, when weeds are 4 inches in height or less. This approach relies on effective and timely postemergence weed control. Also, it is not necessary to control all weeds in a field to achieve maximum yield; weeds that germinate with the crop but are controlled in a timely fashion (three to four weeks after planting) will not impact final yields. Weed populations of 20 to 30 weeds per 100 square feet are sufficient to cause yield loss. However, weed populations of 10 plants per 100 square feet will have no impact on final yield. The impact of weed populations between 10 and 20 per 100 square feet is difficult to predict. The decision to treat the field depends on the weed species present, crop vigor, weather conditions, and herbicide cost.

Planting soybean in narrow rows (15 inches or less) will improve overall weed control since the crop canopy will close the rows sooner than wide rows and help to outcompete smaller weeds

Chemical Weed Control

Herbicides are useful tools in most weed management programs. They should be used to supplement, not replace, other methods or tools available. The following are definitions of terms you will find in this and similar publications on herbicides:

Early preplant (EPP) - These herbicides are applied at least 14 days before planting. EPP applications are generally used in no-till systems to control existing vegetation and provide residual control of early emerging weed species.

Preplant - These herbicides are applied from zero to 14 days before planting. Preplant applications are generally used in no-till systems to control existing vegetation and should include residual herbicides.

Preplant Incorporated (PPI) - These herbicides are applied to the soil after primary tillage but before planting, and mechanically mixed with the top 1 to 3 inches of soil with one of a variety of secondary tillage implements.

Preemergence (PRE) - These herbicides are applied to the soil after the crop is planted but before emergence. Rainfall or irrigation is needed to move the herbicide into the zone of weed seed germination before weed emergence for maximum effectiveness. If adequate rainfall for herbicide activation does not occur, a shallow cultivation or rotary hoeing should be done or postemergence herbicide applied to control weeds that have germinated.

Early postemergence (EPOST) - These herbicides are applied "over-the-top" of the crop to control weeds after they have emerged. The herbicide is applied at early stage, usually within 3 weeks of planting.

Postemergence (POST) - These herbicides are applied to "over-the-top" of the crop and weeds after they have emerged.

Residual activity/soil-applied herbicides - These herbicides can be taken up by emerging plant's roots and shoots and injure or kill the plant. All soil-applied herbicides, as well as many postemergence herbicides, have residual activity. Length of residual activity ranges from a few weeks to the entire growing season but is typically 3 to 5 weeks.

Translocated herbicides - These herbicides move throughout the plant and can cause injury to the parts of the plants that do not come in direct contact with the herbicide spray.

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Contact herbicides - These herbicides do not move throughout the plant. They cause injury only to plant parts that come in contact with the spray. These herbicides are usually called as burners as they burn the point of contact. Spray coverage is more critical to maximize effectiveness for contact than translocated herbicides. Therefore, a spray volume of 15 gallons per acre or more is recommended.

Selective herbicides - These herbicides control some species but not others such that weeds can be controlled without injuring the crop.

Non-selective herbicides - These herbicides control a broad spectrum of plant species, including most crops and weeds. These herbicides are generally used with no-tillage production and sprayed prior to planting when control of all plants is required.

Herbicide-resistant Soybean Varieties

Some soybean varieties have been genetically enhanced to withstand herbicide applications that otherwise would injure or kill soybean. Some of these enhanced varieties were developed by genetic engineering, while others were developed through traditional breeding methods. Genetically enhanced varieties allow herbicides to be used that provide a broader spectrum of control than would otherwise be available while reducing the risk of crop injury. Herbicide-resistant soybean varieties include Enlist E3, LibertyLink, LibertyLink GT27, Roundup Ready, STS and Bolt, Xtend, and Xtendflex soybean.

Enlist E3 are genetically engineered (GMO) to allow preemergence and over-the-top application of 2,4-D choline, glyphosate, and glufosinate. Enlist One and Enlist Duo with Colex-D® technology are the only herbicides containing 2,4-D that are labeled for preemergence and postemergence use with Enlist soybean. Refer to <https://www.enlist.com/> for stewardship requirements. In the Mid-Atlantic region, this technology is best suited for burndown application in no-till for control of winter annual weeds, including horseweed/marestail. Over-the-top application and use in double-crop soybean is not encouraged due to greater concern for off-target movement.

LibertyLink soybeans are GMO soybeans developed for over-the-top application of glufosinate (Liberty, Interline, Scout, others), which is a broad-spectrum postemergence herbicide that does not provide residual weed control.

LibertyLink® GT27™ soybeans are GMO soybeans developed to be resistant to glufosinate, glyphosate, and an HPPD (Group 27) herbicide (Alite 27). Both glufosinate and glyphosate provide nonselective, broad-spectrum postemergence weed control. Alite 27 is not labeled for use in LL GT27 soybean in the mid-Atlantic region.

Roundup Ready soybeans were developed to allow over-the-top application of glyphosate for broad-spectrum control of annual broadleaf, grasses, and perennials weeds. Exclusive use of glyphosate has led to the selection of glyphosate-resistant weed biotypes.

Roundup Ready 2 Xtend and XtendFlex soybeans are genetically engineered (GMOs) to allow preemergence and over-the-top application of dicamba. Roundup Ready 2 Xtend soybeans are also Roundup Ready (glyphosate resistant), and XtendFlex soybeans are resistant to glyphosate and glufosinate (Liberty). At the time of printing this publication, no dicamba products are labeled for use as over-the-top applications in Xtend brand soybean varieties.

STS and Bolt soybeans are non-GMO soybeans developed to be resistant to sulfonylurea herbicides (Group 2). STS were developed for their tolerance to Harmony (thifensulfuron) and Classic (chlorimuron). Bolt soybeans were developed for tolerance to Resolve (rimsulfuron). These varieties have the Roundup Ready trait as well. Weed biotypes resistant to Group 2 herbicides are widespread in the region.

Herbicide-resistant Weeds in Soybean

Herbicide-resistant weeds are common in the Mid-Atlantic region. Populations of herbicide-resistant weeds are selected for by repeated use of the same herbicide site of action over a period of time. Resistance is most likely to occur when one specific mode of action is used repeatedly, exclusively, and frequently. Weed species with a very high amount of seed production and genetic variation are more likely to develop resistant populations—for example, common lambsquarters and pigweed species. Resistance management requires use of herbicides with multiple modes of action and integrating mechanical (tillage and cultivation) and cultural weed control (cover crops, narrow row spacing, proper crop fertility, etc.) with chemical weed control.

ALS resistance - Weeds resistant to the Group 2 herbicides in the Mid-Atlantic region include several pigweed species, common and giant ragweed, common chickweed, horseweed, Italian ryegrass, giant foxtail, Johnsongrass, and shattercane.

Glyphosate resistance - Weeds resistant to the glyphosate herbicide (Group 9) in the Mid-Atlantic region include Palmer amaranth and waterhemp, common and giant ragweed, and horseweed. In soybean, these species can be managed with alternative herbicides, including those in Group 14 (PPO herbicides), Group 5 (triazine), Group 10 (requires LibertyLink soybean), or Group 4 (requires Enlist E3 soybean).

PPO resistance - Weeds resistant to Group 14 herbicides include common ragweed. This is not widespread in the region, but there are a few fields with biotypes resistant to Groups 2, 9, and 14. The only options in these fields are preemergence applications of metribuzin; timely postemergence applications of glufosinate in LibertyLink soybean; or 2,4-D (Enlist One or Enlist Duo) applications in Enlist E3 soybean.

Triazine resistance - Weeds resistant to the Group 5 herbicides in the Mid-Atlantic region include common lambsquarters, red-root and smooth pigweed, horseweed, scattered populations of barnyardgrass, giant foxtail, goosegrass, and suspected populations of common ragweed and velvetleaf. Metribuzin is the primary triazine herbicide in many premixes. For triazine-resistant (TR) pigweed control, include a Group 14 (flumioxazin or sulfentrazone) or Group 15 herbicide (acetochlor, dimethenamid, metolachlor, or pyroxasulfone) at planting.

For TR lambsquarters, some of the Group 15 herbicides will help suppress emergence (acetochlor and pyroxasulfone), but they are not as active on lambsquarters as they are on pigweed. Group 14 herbicides provide better control.

No-till Weed Management

Successful production of no-till soybean requires control of existing vegetation at planting (cover crops and weeds) and summer annual weeds that emerge after planting. Existing vegetation is traditionally controlled by the nonselective herbicides, which are often tank-mixed with residual herbicides. However, in many fields the presence of winter annual weeds, such as horseweed, requires an application while these plants are small and more susceptible to nonselective herbicides; this may require an application three to five weeks prior to planting. Some residual herbicides, such as Canopy or Envive, can enhance burndown weed control. However, when the products are applied 14 to 28 days before soybean planting, they provide residual weed control for only a week or two after planting soybean. In fields with weeds that are difficult to control, an application of a nonselective herbicide and 2,4-D should be used early to control winter annuals weeds, and a second application of the residual herbicides should be made at the time of soybean planting. This second application will improve overall weed control.

In no-till situations, burndown herbicides may be required to control weeds or cover crops present at the time of application. See appropriate tables for relative effectiveness of burndown herbicides.

Fall applications are one strategy to manage difficult-to-control winter annuals. Winter annuals are more susceptible in the fall because they are smaller and have not been stressed by cold weather, and air and soil temperatures are higher than in early spring so plants are “actively” growing. However, many species may have a prolonged germination period and seedlings could emerge after a fall application. There has been interest in including a residual herbicide with the nonselective to reduce the likelihood of weed emergence. Products labeled for this use are Authority First, Authority XL, Autumn Super, Canopy EX, Envive, Fierce XLT, Gangster, and Valor XLT.

Local research has not found a residual herbicide that will consistently provide residual control over the winter and early spring, as most fields will still require an additional burndown application before planting. Furthermore, this approach leaves the soil surface bare over the winter and early spring months and therefore exposed to wind and water erosion.

Residual Herbicides That Can Enhance Preplant Burndown Control

Products containing cloransulam (FirstRate), chlorimuron (Classic), and thifensulfuron (Harmony) have some activity on emerged broadleaf weeds and can improve preplant burndown control. However, these products will not control ALS-resistant (Group 2) weeds. When using an herbicide with one of these active ingredients as part of a burndown program, use full labeled rates, follow label recommendations for adjuvants, and apply to small, actively growing weeds. If relying on these herbicides to provide residual weed control, applications should be made within seven to ten days of planting. Prepackage mixtures containing these specific active ingredients include the following:

- Cloransulam (FirstRate): Authority First, Gangster, Sonic, and Surveil
- Chlorimuron (Classic): Authority XL, Canopy DF/ Blend, Canopy EX, Envive, Fierce XLT, Synchrony XP, and Trivence

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- Thifensulfuron (Harmony): Afforia, Canopy EX, Envive, Synchrony
- Flumioxazin (Valor): Afforia, Envive, Fierce/Fierce EZ, Fierce XLT, Gangster, Surveil, and Trivence

Weed Management for Double-Crop Soybean Planted After Wheat or Barley

Weed control for soybean grown after a small grain crop has additional considerations. As with full-season no-till, the fields should be treated to kill all weeds present at the time of planting. This includes winter annual weeds as well as summer annual weeds. The situation may involve controlling weeds that have been cut off and damaged during the small grain harvest operation, leaving little leaf surface to be treated. Local research indicates that paraquat alone or in combination with 2,4-D (in Enlist E3) can be effective at controlling horseweed “stumps” or those “topped” at harvest. Plants maybe present that are resistant to both glyphosate and Group 2 herbicides (e.g., Palmer amaranth and horseweed). Summer annual grass species may be present that require an application of glyphosate or a Group 1 herbicide (Select, etc.). Herbicides that delay soybean planting, such as Sharpen on coarse-textured soils, are seldom used. Local research shows that a combination of glyphosate plus glufosinate (Liberty, Interline, Scout, others) before planting provides good control of many troublesome species without impacting grass control.

Postemergence weed control needs timely application. The late emerging weeds are often not as competitive as weeds emerging in the early summer, plants emerging four weeks after planting soybean often do not impact yields. Since double-cropped soybeans are treated in the late summer, be sure to observe plant back time periods for crop after specific herbicides. A nine-month crop rotation may be too short of an interval to treat soybeans postemergence and allow for an early spring-planted crop.

Management of Herbicide-resistant Horseweed

Many of the horseweed populations in the region are resistant to glyphosate, but many populations in the region are also resistant to the ALS-inhibitors (Classic, FirstRate, etc.). The most economical treatments for control include 2,4-D ester at 2 pints per acre applied to small plants (less than 3-inch rosettes) to ensure effective control. Enlist One or Enlist Duo are effective options when applied to small plants and do not have a planting restriction for Enlist E3 soybean. Elevore is also an effective option, but it has a 14-day planting restriction. Herbicides containing saflufenacil, such as Sharpen, will also provide excellent horseweed control if applied to small plants, but observe plant-back restrictions on coarse soils or at higher rates. A primary goal for horseweed management in soybean should be effective control of emerged plants prior to planting since there are very few options to control it once soybeans have emerged.

Management of Herbicide-resistant Palmer Amaranth and Common Waterhemp

Palmer amaranth control is difficult because (1) it emerges throughout the summer, (2) it grows rapidly, so once the plants emerge there are only a few weeks before it becomes too tall to control, and (3) many of the populations are resistant to glyphosate as well as Group 2 herbicides.

Effective management of Palmer amaranth requires a residual soil-applied herbicide applied within seven to ten days of planting and at the full labeled rates. Applying residual herbicides two weeks or more ahead of planting means there is a limited period of control once soybeans are planted. Postemergence applications must be made timely to small susceptible Palmer amaranth plants—according to various trials, within four weeks after the soil-applied herbicides were applied. The most consistent options have been fomesafen (Reflex or Flexstar GT), Liberty/Interline/Scout/others (with LibertyLink soybean), dicamba (XtendiMax, Engenia, and others) in Xtend soybean, and 2,4-D (Enlist One or Enlist Duo) in Enlist E3 soybean. The postemergence herbicide applications should include a product that provides residual control of Palmer amaranth, such as fomesafen (Reflex), Dual, Outlook, Warrant, or Zidua. In double-cropped soybeans, rotation intervals may limit the use of Reflex.

Table 5.41 - Soybean Herbicides and Their Restrictions

Restricted Use pesticides can be purchased and used only by licensed applicators. To become licensed, contact your state's Department of Agriculture.

Herbicides with Water Quality Advisory have properties that may result in ground or surface water contamination. Do not apply them in areas where soils are permeable or coarse and groundwater is near the surface. Practices should be followed to minimize the potential for runoff in ground water and/or runoff erosion. See the herbicide label for specific restrictions.

Worker Reentry is the minimum time between application and reentry into a treated area. If soil-applied products are injected or incorporated at application time, under certain circumstances the Worker Protection Standard allows workers to enter the treated area if they will have no contact with anything that has been treated. Personal protective equipment is required for early entry to treated areas if contact with treated soil, plants, or water is involved.

Trade Name ¹	Common Name	Site of Action Number	Manufacturer	Restricted-Use Pesticide	Water Quality Advisory	Worker Reentry (hours)
2,4-D amine 4S	2,4-D amine	4	several	–	–	48
2,4-D LVE 4E	2,4-D LVE	4	several	–	–	12
Afforia 50.8WG	flumioxazin + thifensulfuron + tribenuron	14, 2, 2	Corteva	–	–	12
Aim 2EC	carfentrazone ethyl	14	FMC	–	–	12
Antares Complete	sulfentrazone + metribuzin + S-metolachlor	14,5,15	Helena	–	yes	24
Anthem Maxx 4.3SC	pyroxasulfone + fluthiacet	15, 14	MC	–	yes	12
Assure II 0.88E/Targa	quizalofop	1	AMVAC/Gowan	–	–	12
Authority Assist 4L	sulfentrazone + imazethapyr	14, 2	FMC	–	yes	12
Authority Edge 4.25SC	sulfentrazone + pyroxasulfone	14, 15	FMC	–	yes	12
Authority Elite/BroadAxe XC 7E	sulfentrazone + S-metolachlor	14, 15	FMC/Syngenta	–	yes	24
Authority First 70DF/Sonic	sulfentrazone + cloransulam	14, 2	FMC	–	yes	12
Authority MTZ 45DF	sulfentrazone + metribuzin	14, 5	FMC	yes	yes	12
Authority Supreme 4.16SC	sulfentrazone + pyroxasulfone	14, 15	FMC	–	yes	12
Authority XL 70WG/ Authority Maxx 66WG	sulfentrazone + chlorimuron	14, 2	FMC	–	yes	12
Basagran 4S	bentazon	6	Arysta LifeScience	–	yes	12
Boundary 6.5EC	S-metolachlor + metribuzin	15, 5	Syngenta	–	yes	12
BroadAxe XC 7E/Authority Elite	sulfentrazone + S-metolachlor	14, 15	Syngenta/FMC	–	yes	24
Butyrac 200 2E	2,4-DB	4	Bayer CropScience	–	yes	48
Cadet 0.91EC	fluthiacet	14	FMC	–	yes	12

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Table 5.41 - Soybean Herbicides and Their Restrictions (cont.)

Trade Name ¹	Common Name	Site of Action Number	Manufacturer	Restricted-Use Pesticide	Water Quality Advisory	Worker Reentry (hours)
Canopy 75DF	chlorimuron + metribuzin	2, 5	Corteva	–	yes	12
Canopy Blend 58.3DG	chlorimuron + metribuzin	2, 5	Corteva	–	yes	12
Canopy EX 29.5WDG/ Cloak 29.5 EX	chlorimuron + tribenuron	2, 2	Corteva/Nufarm	–	–	12
Clarity 4S	dicamba (DGA Salt)	4	BASF	–	yes	24
Classic 25DF	chlorimuron	2	AMVAC	–	–	12
Cloak 75WG	chlorimuron + metribuzin	2, 5	Nufarm	–	yes	12
Cobra 2E	lactofen	14	Valent	–	–	12
Command 3ME	clomazone	13	FMC	–	–	12
Dual II Magnum 7.62EC	S-metolachlor	15	Syngenta	–	yes	24
Durango DMA/Duramax 4S ²	glyphosate	9	Corteva	–	–	4
Elevore 0.572SC	halauxifen	4	Corteva	–	yes	12
Enlist One 3.8SL ⁵	2,4-D choline	4	Corteva	–	–	48
Enlist Duo 3.3SL ⁵	2,4-D choline + glyphosate	4, 9	Corteva	–	–	48
Enlite 48WDG	chlorimuron + flumioxazin + thifensulfuron	2, 14, 2	Corteva	–	–	12
Enversa 3CS	acetochlor	15	Corteva	–	yes	12
Envive 41.3WDG	chlorimuron + flumioxazin + thifensulfuron	2, 14, 2	Corteva	–	–	12
EverpreX 7.62EC	S-metolachlor	15	Corteva	–	–	4
Extreme 2.17L ²	imazethapyr + glyphosate	2, 9	BASF	–	yes	48
Fierce 76WDG/Fierce EZ 3.04SC	pyroxasulfone + flumioxazin	15, 14	Valent	–	yes	12
Fierce MTZ 2.64SC	flumioxazin + metribuzin + pyroxasulfone	14, 5, 15	Valent	–	yes	12
Fierce XLT 62.41WDG	pyroxasulfone + flumioxazin + chlorimuron	15, 14, 2	Valent	–	yes	12
FirstRate 84WDG	cloransulam	2	AMVAC	–	yes	12
Flexstar GT 3.5 2.82L ²	fomesafen + glyphosate	14, 9	Syngenta	–	yes	24
Fusilade DX 2E	fluazifop	1	Syngenta	–	–	12
Fusion 2.56E	fluazifop + fenoxaprop	1, 1	Syngenta	–	–	24
Gramoxone 2SL/3SL	paraquat	22	Syngenta	yes	–	12

Table 5.41 - Soybean Herbicides and Their Restrictions (cont.)

Trade Name ¹	Common Name	Site of Action Number	Manufacturer	Restricted-Use Pesticide	Water Quality Advisory	Worker Reentry (hours)
Harmony SG 50WDG	thifensulfuron	2	Corteva	–	–	4
Harmony Extra SG/Audit 1:1	thifensulfuron + tribenuron	2,2	FMC/UPL	–	yes	12
Intermoc 3.57L	glufosinate + S-metolachlor	10, 5	UPL	–	yes	24
LeadOff 33.4WDG	rimsulfuron + thifensulfuron	2, 2	Corteva	–	–	4
Liberty 2.34SL ³ /Interline 2.34SL/others	glufosinate	10	various	–	–	12
Lorox 50DF/Linex 4L	linuron	7	Nova Source	–	–	24
Marvel 3L	fluthiacet + fomesafen	14, 14	FMC	–	yes	24
Metribuzin 75DF/4L	metribuzin	5	various	–	yes	12
Moccasin MTZ 4.5SC	S-metolachlor + metribuzin	15, 5	UPL	–	yes	24
OpTill 68WG	saflufenacil + imazethapyr	14, 2	BASF	–	yes	12
Optill PRO (co-pack)	saflufenacil + imazethapyr + dimethenamid	14, 2, 15	BASF	–	yes	12
Outlook 6EC	dimethenamid	15	BASF	–	yes	12
Panther MTZ	flumioxazin + metribuzin	14, 5	Nufarm	–	yes	12
Panther Pro	flumioxazin + metribuzin + imazethapyr	14, 5, 2	Nufarm	–	yes	12
Panoflex 50WDG	thifensulfuron + tribenuron	2, 2	Corteva	–	–	12
Permit Plus 74WDG ⁴	halosulfuron + thifensulfuron	2, 2	Gowan	–	–	12
Perpetuo 2.3SC	flumiclorac + pyroxasulfone	14, 15	Valent	–	yes	12
Preview 2:1SC	metribuzin + sulfentrazone	5, 14	UPL	–	yes	12
Poast 1.5E	sethoxydim	1	BASF	–	–	12
Poast Plus 1E	sethoxydim	1	BASF	–	–	12
Prefix 5.3EC	S-metolachlor + fomesafen	15, 14	Syngenta	–	yes	24
Prowl 3.3E / Prowl H ₂ O 3.8CS	pendimethalin	3	BASF	–	–	12
Pursuit 2S	imazethapyr	2	BASF	–	yes	12
Python 80WDG	flumetsulam	2	AMVAC	–	yes	12
Raptor/Beyond Xtra 1S	imazamox	2	BASF	–	–	4
Reflex 2E / Flexstar 1.88E	fomesafen	14	Syngenta	–	yes	24

Table 5.41 - Soybean Herbicides and Their Restrictions (cont.)

Trade Name ¹	Common Name	Site of Action Number	Manufacturer	Restricted-Use Pesticide	Water Quality Advisory	Worker Reentry (hours)
Resource 0.86EC	flumiclorac	14	Valent	–	–	12
Reviton SC	tiafenacil	14	Helm Agro US	–	yes	12
Roundup WeatherMax/ PowerMax 4.5S ²	glyphosate	9	Bayer	–	–	4
Scepter 70DG	imazaquin	2	AMVAC	–	–	12
Select 2E/Max 0.97E	clethodim	1	Valent	–	–	12
Sequence 5.25EW ²	S-metolachlor + glyphosate	15, 9	Syngenta	–	yes	24
Sharpen 2.85SC	saflufenacil	14	BASF	–	yes	12
Sonic 70WG/Authority First 70DF	sulfentrazone + cloransulam	14, 2	Corteva	–	yes	12
Spartan 4F	sulfentrazone	14	FMC	–	yes	12
Spartan Charge	sulfentrazone + carfentrazone	14, 14	FMC	–	yes	12
Storm 4S	acifluorfen + bentazon	14, 6	UPL	–	yes	48
Surveil 48WG	flumioxazin + cloransulam	14, 2	Corteva	–	yes	12
Synchrony XP 28.4WDG ⁴	chlorimuron + thifensulfuron	2, 2	Corteva	–	–	12
Tendovo 4.12 ZC	S-metolachlor + metribuzin + cloransulam-methyl	15, 5, 2	Syngenta	–	yes	12
Treflan 4E, Tri-4, Trific, Trilin	trifluralin	3	Corteva	–	–	12
Tripzin ZC 4ZC	pendimethalin + metribuzin	3, 5	United Phosphorus, Inc.	–	yes	24
Trivence 61.3WDG	chlorimuron + flumioxazin + metribuzin	2, 14, 5	Corteva	–	yes	12
Ultra Blazer 2S	acifluorfen	14	UPL	–	yes	48
Up-Stage 3CS	clomazone	3	UPL	–	yes	12
Valor SX 51WDG/Valor EZ 4SC	flumioxazin	14	Valent	–	–	12
Valor XLT 40.3WDG	chlorimuron + flumioxazin	2, 14	Valent	–	–	12
Verdict 5.57EC	saflufenacil + dimethenamid	14, 15	BASF	–	yes	12
Warrant 3CS	acetochlor	15	Bayer	–	yes	12
Warrant Ultra 3.45CS	acetochlor + fomesafen	14, 15	Bayer	–	yes	24
Zalo 2.52S	quizalofop + glufosinate	1, 10	AMVAC	–	–	12

Table 5.41 - Soybean Herbicides and Their Restrictions (cont.)

Trade Name ¹	Common Name	Site of Action Number	Manufacturer	Restricted-Use Pesticide	Water Quality Advisory	Worker Reentry (hours)
Zidua 85WDG/ Zidua SC 4.17SC	pyroxasulfone	15	BASF	–	yes	12
Zidua PRO 4.09SC	imazethapyr + pyroxasulfone + saflufenacil	2, 15, 14	BASF	–	yes	12
Zone Defense	sulfentrazone + flumioxazin	14, 14	Helm Agro US	–	yes	12

¹ Generic alternatives to some of these products are available. See Table 5.3 (generics table) for additional herbicides that contain these active ingredients.

² May be applied over the top on glyphosate-resistant soybean varieties only.

³ For use on glufosinate-resistant soybean varieties only.

⁴ For use on STS or Bolt soybean varieties only.

⁵ For use on 2,4-D resistant soybean varieties only.

Table 5.42 - Soybean Herbicide Prepackaged Mixes, or Co-Packs, and Equivalents

Trade Name	Components (ai or ae/gal or lb)	If you apply (per acre)	You have applied (ai or ae lb / A)	Site of Action Number	An equivalent tank-mix of
Afforia 50.8 WG	0.408 lb flumioxazin		0.064 lb flumioxazin	14	2 oz Valor SX 51WDG
	0.05 lb thifensulfuron	2.5 oz	0.008 lb thifensulfuron	2	0.25 oz Harmony 50DF
	0.05 lb tribenuron		0.008 lb tribenuron	2	0.25 oz Express 50DF
Antares Complete	0.4 lb sulfentrazone		0.15 lb sulfentrazone	14	4.8 fl oz Spartan 4F
	1.0 lb metribuzin	3 pt	0.38 lb metribuzin	5	8.11 oz mertribuzin 75 DF
Anthem 2.15SE	4.7 lb S-metolachlor		1.76 lb S-metolachlor	15	1.85 pt Dual Magnum 7.62EC
	2.087 lb pyroxasulfone	6 fl oz	0.098 lb pyroxasulfone	15	3.02 fl oz Zidua 4.17SC
Anthem Maxx 4.3SC	0.063 lb fluthiacet		0.003 lb fluthiacet	14	0.42 fl oz Cadet 0.91E
	4.174 lb pyroxasulfone	3 fl oz	0.098 lb pyroxasulfone	15	3.02 fl oz Zidua 4.17SC
Authority Edge 4.25SC	0.126 lb fluthiacet		0.003 lb fluthiacet	14	0.42 fl oz Cadet 0.91E
	1.52 lb pyroxasulfone	6.6 fl oz	0.078 lb pyroxasulfone	15	2.39 fl oz Zidua 4.17SC
Authority Elite 7SE or BroadAxe XC	2.73 lb sulfentrazone		0.141 lb sulfentrazone	14	4.5 fl oz Spartan 4F
	0.7 lb sulfentrazone	28 fl oz	0.153 lb sulfentrazone	14	4.9 fl oz Spartan 4F
Authority First70DF	6.3 lb S-metolachlor		1.38 lb S-metolachlor	15	1.45 pt Dual Magnum 7.62EC
	0.621 lb sulfentrazone	6.45 oz	0.25 lb sulfentrazone	14	8 fl oz Spartan 4F
Authority MTZ 45DF	0.079 lb cloransulam		0.032 lb cloransulam	2	0.6 oz FirstRate 84WDG
	0.18 lb sulfentrazone	16 oz	0.18 lb sulfentrazone	14	5.76 fl oz Spartan 4F
Authority Supreme 4.16SC	0.27 lb metribuzin		0.27 lb metribuzin	5	5.8 oz metribuzin 75DF
	2.08 lb sulfentrazone	7 fl oz	0.114 lb sulfentrazone	14	3.65 fl oz Spartan 4F
	2.08 lb pyroxasulfone		0.114 lb pyroxasulfone	15	3.5 fl oz Zidua 4.17SC

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Table 5.42 - Soybean Herbicide Prepackaged Mixes or Co-Packs, and Equivalents (cont.)

Trade Name	Components (ai or ae/gal or lb)	If you apply (per acre)	You have applied (ai or ae lb / A)	Site of Action Number	An equivalent tank-mix of
Authority XL 70WG	0.62 lb sulfentrazone	7.0 oz	0.27 lb sulfentrazone	14	5.8 fl oz Spartan 4F
	0.08 lb chlorimuron		0.035 lb chlorimuron	2	2.1 oz Classic 25DF
Boundary 6.5L	5.25 lb S-metolachlor	2 pt	1.24 lb S-metolachlor	15	1.3 pt Dual Magnum 7.26EC
	1.25 lb metribuzin		0.314 lb metribuzin	5	6.7 oz metribuzin 75DF
Canopy 75DF/Cloak 75WG	0.107 lb chlorimuron	5 oz	0.033 lb chlorimuron	2	2.14 oz Classic 25DF
	0.643 lb metribuzin		0.2 lb metribuzin	5	4.27 oz metribuzin 75DF
Canopy Blend 58.3DG/Cloak 58.3WDG	0.083 lb chlorimuron	6.5 oz	0.033 lb chlorimuron	2	2.14 oz Classic 25DF
	0.5 lb metribuzin		0.2 lb metribuzin	5	4.27 oz metribuzin 75DF
Canopy EX 29.5WDG	0.227 lb chlorimuron	2.2 oz	0.031 lb chlorimuron	2	2 oz Classic 25DF
	0.068 lb tribenuron		0.009 lb tribenuron	2	0.2 oz Express 75DF
Enlist Duo	1.6 lb 2,4-D choline	4.75 pt	0.95 lb ae 2,4-D choline	4	2 pt Enlist One
	1.7 lb ae glyphosate		1.00 lb ae glyphosate	9	28.4 oz Roundup PowerMax
Envive 41.3WDG	0.292 lb flumioxazin	3.5 oz	0.064 lb flumioxazin	14	2.0 oz Valor SX 51WDG
	0.029 lb thifensulfuron		0.006 lb thifensulfuron	2	0.14 oz Harmony 75DF
	0.092 lb chlorimuron		0.020 lb chlorimuron	2	1.3 oz Classic 25DF
Fierce 76WDG	0.335 lb flumioxazin	3 oz	0.063 lb flumioxazin	14	2.0 oz Valor SX 51WDG
	0.425 lb pyroxasulfone		0.08 lb pyroxasulfone	15	2.46 fl oz Zidua 4.17SC
Fierce EZ 3.04SC	1.34 lb flumioxazin	6.0 fl oz	0.063 lb flumioxazin	14	2 oz Valor SX 51WDG
	1.70 lb pyroxasulfone		0.08 lb pyroxasulfone	15	2.46 fl oz Zidua 4.17SC
Fierce MTZ	0.5 lb flumioxazin	1.25 pt	0.078 lb flumioxazin	14	2.45 oz Valor SX 51WDG
	1.5 lb metribuzin		0.234 lb metribuzin	5	4.99 fl oz metribuzin 75DF
	0.64 lb pyroxasulfone		0.10 lb pyroxasulfone	15	3.07 fl oz Zidua 4.17SC
Fierce XLT 62.41WDG	0.3117 lb pyroxasulfone	4 oz	0.78 lb pyroxasulfone	15	2.39 fl oz Zidua 4.17SC
	0.2457 lb flumioxazin		0.061 lb flumioxazin	14	1.93 oz Valor SX 51WDG
	0.0667 lb chlorimuron		0.017 lb chlorimuron	2	1.07 oz Classic 25DF
Flexstar GT3.5L	0.56 lb fomesafen	4.5 pt	0.315 lb fomesafen	14	1.3 pt Reflex 2E
	2.26 lb ae glyphosate		1.28 lb ae glyphosate	9	36.4 fl oz Roundup PowerMax
Fusion 2.67E	2 lb fluazifop	8 fl oz	0.125 lb fluazifop	1	8.0 fl oz Fusilade DX 2E
	0.67 lb fenoxaprop		0.042 lb fenoxaprop	1	0.042 lb fenoxaprop
InterMoc 3.57L	1.07 lb glufosinate	64 fl oz	0.54 lb glufosinate	10	30 fl oz Interline 2.34SL
	2.5 lb S-metolachlor		1.25 lb S-metolachlor	15	1.3 pt Dual Magnum 7.62EC
Marvel 3L	0.117 lb fluthiacet	7.25 fl oz	0.007 lb fluthiacet	14	0.9 fl oz Cadet 0.91E
	2.883 lb fomesafen		0.163 lb fomesafen	14	10.4 fl oz Reflex 2E
Moccasin MTZ	3.35 lb S-metolachlor	42 fl oz	1.10 lb S-metolachlor	15	1.15 pt Dual Magnum 7.62EC
	1.11 lb metribuzin		0.36 lb metribuzin	5	7.68 oz metribuzin 75DF

Table 5.42 - Soybean Herbicide Prepackaged Mixes or Co-Packs, and Equivalentents (cont.)

Trade Name	Components (ai or ae/gal or lb)	If you apply (per acre)	You have applied (ai or ae lb / A)	Site of Action Number	An equivalent tank-mix of
OpTill 68WG	0.502 lb imazethapyr	2.0 oz	0.063 lb imazethapyr	2	4.0 fl oz Pursuit 2L
	0.178 lb saflufenacil		0.022 lb saflufenacil	14	1.0 fl oz Sharpen 2.85SC
Optill PRO (co-pack)	0.502 lb imazethapyr	2 oz	0.063 lb imazethapyr	2	4 fl oz Pursuit 2L
	0.178 lb saflufenacil		0.022 lb saflufenacil	14	1 fl oz Sharpen 2.85SC
Panther MTZ	6.0 lb dimethenamid	10 fl oz	0.47 lb dimethenamid	15	10 fl oz Outlook 6.0EC
	3.0 lb metribuzin	12 fl oz	0.28 lb metribuzin	5	5.97 oz metribuzin 75DF
Panther Pro 4.23SC	0.67 lb flumioxazin	12 fl oz	0.063 lb flumioxazin	14	1.98 oz Valor SX 51WDG
	3.0 lb metribuzin		0.28 lb metribuzin	5	5.97 oz metribuzin 75DF
Perpetuo 2.3SC	0.59 lb flumiclorac	8 fl oz	0.037 lb flumiclorac	14	5.5 fl oz Resource 0.86EC
	1.71 lb pyroxasulfone		0.107 lb pyroxasulfone	15	3.28 fl oz Zidua 4.17SC
Permit Plus	0.662 lb halosulfuron	1.25 oz	0.052 lb halosulfuron	2	1.1 oz Permit 75WDG
	0.078 lb thifensulfuron		0.006 lb thifensulfuron	2	0.128 oz Harmony 75DF
Prefix 5.3EC	4.34 lb S-metolachlor	2 pt	1.05 lb S-metolachlor	15	1.1 pt Dual Magnum 7.62EC
	0.95 lb fomesafen		0.24 lb fomesafen	14	0.95 pt Reflex 2E
Preview 2:1 SC	2.23 lb metribuzin	16 fl oz	0.279 lb metribuzin	5	5.95 oz metribuzin 75DF
	1.12 lb sulfentrazone		0.14 lb sulfentrazone	14	3.0 fl oz Spartan 4F
Sequence 5.25EW	2.25 lb ae glyphosate	3.5 pt	0.98 lb ae glyphosate	9	28 fl oz Roundup PowerMax
	3 lb S-metolachlor		1.31 lb S-metolachlor	15	1.38 pt Dual Magnum 7.62EC
Sonic 70DF	0.621 lb sulfentrazone	6.45 oz	0.25 lb sulfentrazone	14	8 fl oz Spartan 4F
	0.079 lb cloransulam		0.032 lb cloransulam	2	0.6 oz FirstRate 84WDG
Spartan Charge	3.15 lb sulfentrazone	8.5 fl oz	0.21 lb sulfentrazone	14	6.69 fl oz Spartan 4F
	0.35 lb carfentrazone		0.023 lb carfentrazone	14	1.49 fl oz Aim 2EC
Storm 4S	2.67 lb bentazon	1.5 pt	0.50 lb bentazon	6	1.0 pt Basagran 4S
	1.33 lb acifluorfen		0.25 lb acifluorfen	14	1.0 pt Blazer 2S
Surveil 48WDG	0.36 lb flumioxazin	3.5 oz	0.080 lb flumioxazin	14	2.5 oz Valor SX 51WDG
	0.12 lb cloransulam		0.026 lb cloransulam	2	0.5 oz FirstRate 84WDG
Synchrony XP 28.4WDG	0.215 lb chlorimuron	0.375 oz	0.005 lb chlorimuron	2	0.32 oz Classic 25DF
	0.069 lb thifensulfuron		0.0014 lb thifensulfuron	2	0.03 oz Harmony 75DF
Tendovo 4.12 ZC	3.47 lb S-metolachlor	48 fl oz	1.30 lb S-metolachlor	15	1.37 pt Dual Magnum 7.62EC
	0.642 lb metribuzin		0.241 lb metribuzin	5	5.14 oz metribuzin 75DF
Tripzin	0.065 lb chloransulam	44 fl oz	0.024 lb chloransulam	2	0.46 FirstRate 84WDG
	2.9 lb pendimethalin		1.00 lb pendimethalin	3	2.1 pt Prowl H20 3.8CS
	1.1 lb metribuzin		0.38 lb metribuzin	5	8.0 oz metribuzin 75DF

Table 5.42 - Soybean Herbicide Prepackaged Mixes or Co-Packs, and Equivalents (cont.)

Trade Name	Components (ai or ae/gal or lb)	If you apply (per acre)	You have applied (ai or ae lb / A)	Site of Action Number	An equivalent tank-mix of
Trivence 61.3WDG	0.039 lb chlorimuron		0.020 lb chlorimuron	2	1.25 oz Classic 25DF
	0.128 lb flumioxazin	8 oz	0.064 lb flumioxazin	14	2.0 oz Valor 51WDG
	0.446 lb metribuzin		0.22 lb metribuzin	5	4.7 oz metribuzin 75DF
Valor XLT 40.3WDG or Rowel FX	0.3 lb flumioxazin	3.5 oz	0.065 lb flumioxazin	14	2.1 oz Valor SX 51WDG
	0.103 lb chlorimuron		0.022 lb chlorimuron	2	1.44 oz Classic 25DF
Verdict 5.57EC	5.0 lb dimethenamid	5.0 fl oz	0.19 lb dimethenamid	15	4.0 fl oz Outlook 6EC
	0.57 lb saflufenacil		0.022 lb saflufenacil	14	1.0 fl oz Sharpen 2.85SC
Warrant Ultra 3.45CS	2.82 lb acetochlor	3 pt	1.06 lb acetochlor	15	2.8 pt Warrant 3CS
	0.631 lb fomesafen		0.24 lb fomesafen	14	15 fl oz Reflex 2E
Zidua PRO 4.09SC	2.28 lb pyroxasulfone		0.107 lb pyroxasulfone	15	3.28 fl oz Zidua 4.17SC
	1.33 lb imazethapyr	6 fl oz	0.063 lb imazethapyr	2	4 fl oz Pursuit 2L
	0.48 lb saflufenacil		0.022 lb saflufenacil	14	1 fl oz Sharpen 2.85SC
Zone Defense	0.62 lb sulfentrazone	5.0 oz	0.194 lb sulfentrazone	14	6.21 fl oz Spartan 4F
	0.15 lb flumioxazin		0.047 lb flumioxazin	14	1.47 oz Valor SX 51WDG

Table 5.43 - Relative Effectiveness of “Burndown” Herbicides for Control of Weeds in No-Till Full-Season Soybean

Relative effectiveness of herbicides on individual weeds which are commonly present prior to planting soybeans are listed in this table. Ratings are based on labeled application rates and weed size or growth stage; which often means an application is made weeks prior to planting. Delaying applications will result in reduced control. Treatments are rated only for control of vegetation existing at the time of application.

Weed control rating:

10 = 95–100% 9 = 85–95% 8 = 75–85% 7 = 65–75% 6 = 55–65% N = less than 55% or no control

— = not applicable or no local data available + = upper end of rating scale

Herbicide ¹	Site of Action Number	Brome, Downy	Burdock, Common	Chickweed ²	Dandelion	Dock, Curly	Evening Primrose, Cutleaf	Field Violet/Pansy	Fleabanes, Annual	Foxtail, spp.	Garlic, Wild	Geranium, Carolina	Groundsel, common	Hemp, Dogbane, Dewberry, Milkweed, etc.	Henbit/Deadnettle	Horseweed/Marestail ^{2,3}	Lambsquarters	Mustards spp.	Quackgrass Sod	Ragweed, Common ^{2,3}	Smartweed	Thistle, Canada
2,4 (spring-applied) (1 lb ae/a)	4	N	7	6	8	7	9	6	7	N	7	—	6	N	N	8+	9	9	N	9	7	8
Dicamba (spring-applied) (0.5 lb ae/a) ⁴	4	N	7	6	7	8	8	6	7	N	7	—	6	N	N	9	9+	6	N	9	8	8
Elevore	4	N	—	N	—	N	N	N	6	N	6	—	—	—	8+	9	9	6	N	9	—	6
Glyphosate (fall-applied) ³	9	9	8+	9	9	7	7	7	8	—	9	8	9	8+	8	8+ ³	—	9	9	—	—	9
Glyphosate (spring-applied) ³	9	9	7	9	6	6	6	6	7+	9+	8	7	9	7	6	8 ³	9	8	8	9	7	8
Glyphosate + 2,4-D or dicamba (fall-applied) ³	9/4	9	9+	9	9	7	9+	7	9 ⁶	—	9	8	9	9	8+ ⁵	9+ ³	—	9 ⁴	9	—	—	9+
Glyphosate + 2,4-D or dicamba (spring-applied) ³	9/4	9	7+	9	8	7	9	7+	8	9+	8	7	9	7+	8+	9 ³	9	9	9	9	8+	8+
Glyphosate + Metribuzin	9/5	9	7	9	6	6	6	8	8	9	8	7	9	7	8+	8+ ³	9	9	9	9	9	8
Gramoxone	22	7	N	8+	N	N	7	8	6	9	6	8	8+	6	7	7	8	8	6	8	7	6
Gramoxone + 2,4-D or dicamba ³	22/4	7	7	9	7	7	9	8+	7	9	7	8	8+	6	8	8+	9	9	6	9	8+	8
Gramoxone + Metribuzin	22/5	7	6	9	N	N	8	8	6	9	6	9	8+	6	8	8	8	8+	6	9	9+	6

Table 5.43 - Relative Effectiveness of “Burndown” Herbicides for Control of Weeds in No-Till Full-Season Soybeans (cont.)

Herbicide ¹	Site of Action Number	Brome, Downy	Burdock, Common	Chickweed ²	Dandelion	Dock, Curly	Evening Primrose, Cutleaf	Field Violet/Pansy	Fleabanes, Annual	Foxtail, spp.	Garlic, Wild	Geranium, Carolina	Groundsel, Common ³	Hemp, Dogbane, Dewberry, Milkweed, etc.	Henbit/Deadnettle	Horseweed/Marestail ^{2,3}	Lambsquarters	Mustards spp.	Quackgrass Sod	Ragweed, Common ²	Smartweed	Thistle, Canada
Harmony Extra/FirstShot/Audit	2/2	N	6	9 ²	6	8	7	N	N	N	8+	-	9	6	8	8+ ²	9	9	N	6 ²	9+	8
Harmony Extra/FirstShot/Audit + 2,4-D	2/4	N	7	9	9	9	9	7	6	N	8+	-	9	6+	9	8+	9	9	N	9	9	8+
Liberty / Interline/ Scout/others	10	6	6	8	6	-	9	N	8	8	-	-	7	N	7	8	8	8	6	8	8	6
Reviton (2 oz)	14	7	-	8	7	-	8	8	7+	7	-	-	-	-	7	7	8	8	-	8	-	-
Sharpen (1 fl oz)	14	N	N	6	7	-	N	N	7+	N	-	-	8	N	6	8	8	8	N	8	8	6
Sharpen + glyphosate	14/9	9	7	9	8	-	6	6	8	9+	-	-	9	7	8	9 ³	9	9	8	9 ³	9	8
Valor	14	-	N	9	7 ⁵	N	6	8+	N	N	-	-	7	N	7	6	9	8	N	7	7	N

¹ See Table 5.3 (generics table) for additional herbicides that contain these active ingredients.

² Harmony Extra will not control ALS (group 2) resistant chickweed, horseweed/marestail, or common ragweed.

³ Roundup and other glyphosate products are not effective on glyphosate-resistant (Group 9) horseweed/marestail or common ragweed.

⁴ Ratings based on dicamba rate (0.5 lb ae/a) for dicamba resistant soybean.

⁵ Effectiveness is reduced if applied in certain tank-mixes such as Roundup and other glyphosate products with photosynthesis inhibitors such as triazine herbicides, or 2,4-D/dicamba with Gramoxone. May still be tank-mixed for convenience, but burndown is improved if applied separately.

⁶ Based on control in early spring. Emergence of seedlings in the spring will reduce full-season control.

⁷ Valor provides control of germinating dandelion seedling; however, it is weak on dandelion when applied POST.

Table 5.44 - Relative Effectiveness of Herbicides for Control of Common Cash or Cover Crops in the Spring before Planting Soybeans

Cover crop control rating: 10 = 95–100% 9 = 85–95% 8 = 75–85% 7 = 65–75% 6 = 55–65%

L = listed as controlled on herbicide label, but local data are limited

N = less than 55% or no control + = upper end of rating scale — = not applicable or no local data available

Herbicide	Rate (lb ai/acre) ¹	Site of Action Number	Broadleaf species							Grass species					
			Alfalfa ²	Austrian Winter Pea	Clover, Crimson	Clover, Red ²	Clover, White	Vetch, Hairy	Mustards/Radish/Rapeseed	Bluegrass/Timothy ²	Bromegrass/Orchardgrass ²	Ryegrass, Annual	Rye, Cereal	Triticale	Wheat, Winter
2,4-D ester	0.5	4	7+	N	7	8	6	9	8	N	N	N	N	N	N
	1	4	8	N	8	9	7	9+	9	N	N	N	N	N	N
dicamba	0.5	4	9	7	8	9	9	9	6	N	N	N	N	N	N
Elevore	0.004	4	—	7	N	—	—	8	N	N	N	N	N	N	N
glyphosate	0.75	9	6	8	8+	7	6	7	7+	9	8	8	9	9	9
	1.5	9	7	8+	9	7+	7	8	8+	9+	8+	9	9	9	9
paraquat	0.5	22	N	7	8	7	7	7	8	7	6	6	7	7	8
	0.75	22	N	8	9	8	7	8	8+	7+	7	6	8	7+	8+
Liberty, others ⁴	0.59	10	N	8+	9	L	—	9	6	—	N	6	6	7	7
Reviton (2 fl oz)	0.04	14	N	6+	8	—	—	N	—	N	N	N	N	N	N
Sharpen (1 fl oz)	0.02	14	N	6	N	—	—	N	N	N	N	N	N	N	N
Mixtures															
2,4-D ester + dicamba	0.5 + 0.5	4 + 4	9+	7	8+	9	9	9+	8	N	N	N	N	N	N
2,4-D ester + Liberty, others ⁴	0.5 + 0.59	4 + 10	N	9	9	—	—	9+	8	—	N	6	6	6	7
glyphosate + 2,4-D ester	0.75 + 0.5	9 + 4	8+	9	9	8	8	9+	9	9	8	8	9	9	9
glyphosate + dicamba	0.75 + 0.5	9 + 4	9	9	9	9	9	9+	8	9	8	8	9	9	9
glyphosate + Liberty, others ⁴	0.75 + 0.59	9 + 10	—	9	—	—	—	9	6	—	—	8	9	9	9
glyphosate + Reviton	0.75 + 0.02	9 + 14	—	9	8	—	—	8	7	—	8	8+	9	9	9
glyphosate + Sharpen	0.75 + 0.04	9 + 14	6	8	9+	—	—	7	9	9	8	8	9	9	9
paraquat + metribuzin	0.5 + 0.25	22 + 5	7	8+	9+	8+	7	9	8+	9	8	7	8+	7+	8+
paraquat + 2,4-D or dicamba	0.75 + 0.5	22 + 4	7+	8	9	8+	8	9+	9	7	6	6	8	7	8+

Table 5.44 - Relative Effectiveness of Herbicides for Control of Common Cash or Cover Crops in the Spring before Planting Soybeans (cont.)

Herbicide	Rate (lb ai/acre) ¹	Alfalfa ²	Austrian Winter Pea	Clover, Crimson	Clover, Red ²	Clover, White	Vetch, Hairy	Mustards/Radish/Rapeseed	Bluegrass/Timothy ²	Bromegrass/Orchardgrass ²	Ryegrass, Annual	Rye, Cereal	Triticale	Wheat, Winter
¹ 0.75 lb Glyphosate = 32 fl. oz of a 41% glyphosate; 0.5 lb paraquat = 2 pt Gramoxone SL 2.0 or 1.33 pt Gramoxone SL 3.0; see Table 5.2 (glyphosate table) for more information on glyphosate formulations. ² Application in the fall can improve control with some herbicides. ³ Tank mixing clethodim (Select, etc.) or rimsulfuron (Resolve, Basis Blend) with glyphosate has shown improved burndown activity on annual ryegrass cover crop control in university field trials. Consult herbicide label for use guidelines. ⁴ Warm temperatures, high humidity, and bright sunlight improve the performance of Liberty. Weed control may be reduced when applications are made to weeds under stress from drought or cool temperatures.														

Table 5.45 - Comments on “Burndown” Herbicides for No-till Soybeans

In no-till situations, “burndown” herbicides may be required to control weeds or cover crops present at the time of application. See appropriate tables for relative effectiveness of “burndown” herbicides.

Fall applications are one strategy to manage difficult-to-control winter annuals. Winter annuals are more susceptible in the fall because they are (1) smaller; (2) have not been stressed by cold weather; and (3) air and soil temperatures are higher than in early spring so plants are “actively” growing. However, many species may have a prolonged germination period and seedlings could emerge after a fall application. There has been interest in including a residual herbicide with the non-selective to reduce the likelihood of weed emergence. Products labeled for this use are:

Authority First	Authority XL	Autumn Super	Canopy EX
Envive	Fierce XLT	Gangster	Valor XLT

Refer to product label for rates and precautions for fall applications. Note, many of these products have rotational restrictions that require only soybeans can be planted in the spring after fall applications.

University of Delaware and University of Maryland research has not found a residual herbicide that will consistently provide residual control over the winter and early spring, as most fields will still require an additional “burndown” application before planting. Furthermore, this approach leaves the soil surface bare over the winter and early spring months and therefore exposed to wind and water erosion.

Residual Herbicides That Can Enhance Pre-Plant Burndown Control

Products containing cloransulam (FirstRate), chlorimuron (Classic), and thifensulfuron (Harmony) have some activity on emerged broadleaf weeds and can improve pre-plant burndown control. However, these products will not control ALS-resistant (group 2) weeds. When using a herbicide with one of these active ingredients as part of a burndown program, use full-labeled rates, follow label recommendations for adjuvants, and apply to small, actively growing weeds. If relying on these herbicides to provide residual weed control, applications should be made within 7 to 10 days of planting.

Prepackage mixtures containing these specific active ingredients include:

cloransulam (FirstRate)	chlorimuron (Classic)	thifensulfuron (Harmony)	flumioxazin (Valor)
Authority First	Authority XL	Afforia	Afforia
Gangster	Canopy DF/Blend	Canopy EX	Envive
Sonic	Canopy EX	Envive	Fierce/Fierce EZ
Surveil	Envive	Synchrony	Fierce XLT
	Fierce XLT		Gangster
	Synchrony XP		Surveil
	Trivence		Trivence

Table 5.45 - Comments for “Burndown” Herbicides for No-Till Soybean (cont.)

Trade Name	Common Name	Site of Action Number	Product/A	lb ai/A
2,4-D 4L formulations ** (many trade names)	2,4-D	4	0.5–2.0 pt	0.25–1.0 lb ae
Enlist One 3.8SL	2,4-D choline	4	1.5–2 pt	0.71–0.95 lb ae

- For spring applications, the 2 pt rate of 2,4-D has been more effective and more consistent than lower rates. Applications made 30 days preplant have been more effective on horseweed than applications made 14 days preplant.
- Apply 2,4-D ester (LVE) at 2 pt at least 30 days before planting, 1 pt or less at least 7 days ahead of planting or up to 2 pt at least 30 days before planting; some LVE formulations allow a 15-day interval between application and planting soybean (i.e. Salvo, Shredder E-99, Weedone 650).
- Enlist One may be applied through planting of Enlist E3 soybean varieties only.
- 2,4-D amine at 2 pt should be applied 30 days before planting and at 1 pt or less at least 15 days ahead of planting.
- Add 2,4-D to paraquat or glyphosate for added burndown of hard to control broadleaf weeds.
- Use 2,4-D for added control or suppression of mustard spp., plantains, horseweed, and 2,4-D susceptible annual broadleaf weeds.
- Do not apply 2,4-D prior to planting soybeans if you are not prepared to accept the results of soybean injury, including possible loss of stand and yield.
- The risk of injuring sensitive plants via off-target movement is much less when these products are used early burndown prior to planting full-season soybean in the spring compared to burndown applications prior to planting double-crop soybean during the summer months.
- Spray droplet size plays an important role in minimizing off-target movement. Nozzles that produce extremely coarse or ultra coarse droplets while limiting the amount of driftable fine droplets are necessary to limit spray drift. Consult labels for approved nozzles.
- 2,4-D can be difficult to completely remove from spray equipment and residue is capable of injuring sensitive plants. Follow label instructions concerning sprayer cleanout.
- Cotton, grapes, pepper, sweetpotato, tobacco, tomato, watermelon, and many other crops are very sensitive to 2,4-D. Follow application instructions on label to avoid injuring neighboring plants.
- See labels for details on drift management, including recommended nozzles and pressures, wind speed, boom height, temperature inversions, buffers, susceptible plants, and spray equipment cleanout.

Table 5.45 - Comments for “Burndown” Herbicides for No-Till Soybean (cont.)

Trade Name	Common Name	Site of Action Number	Product/A	lb ai/A
Clarity 4S	dicamba DGA Salt	4	0.5–1pt	0.25–0.5 lb ae
<ul style="list-style-type: none"> • Applications made 30 days preplant have been more effective on horseweed than applications made 14 days preplant. • Following application of Clarity and a minimum accumulation of 1 inch of rainfall or overhead irrigation, wait at least 14 days before planting for 0.25 lb ae per acre or less and 28 days for 0.5 lb ae per acre. Do not apply dicamba prior to planting soybeans if you are not prepared to accept the results of soybean injury, including the possible loss of stand and yield. • Add dicamba to paraquat or glyphosate for added burndown of hard-to-control broadleaf weeds. • Use dicamba for added control of horseweed and dicamba-susceptible annual broadleaf weeds. • Dicamba has little to no activity on mustard species including rapeseed and is not recommended for control of these weeds, even when tank-mixed with glyphosate. • The risk of injuring sensitive plants via off-target movement is much less when these products are used early burndown or prior to planting full-season soybean in the spring compared to burndown applications prior to planting double-crop soybean during the summer months. • Spray droplet size plays an important role in minimizing off-target movement. Nozzles that produce extremely coarse or ultra-coarse droplets while limiting the amount of driftable fine droplets are necessary to limit spray drift. Consult labels for approved nozzles. • Dicamba can be difficult to completely remove from spray equipment and residue is capable of injuring sensitive plants. Follow label instructions concerning sprayer cleanout. • <i>Water quality advisory.</i> 				
Canopy 75DF Canopy Blend 58.3DG	chlorimuron + metribuzin	2/5	4–8 oz 5–9 oz	0.026–0.053 0.16–0.32
<ul style="list-style-type: none"> • Metribuzin will enhance the activity of paraquat or glufosinate when used as a tankmixture for burndown weed control. • See comments in preemergence section. 				
Canopy EX 29.5DG	chlorimuron + tribenuron	2	1.1–3.3 oz	0.016–0.047 0.0047–0.013
<ul style="list-style-type: none"> • Apply with glyphosate or Gramoxone to no-till fields, any time after harvest in the fall at 2.2 to 3.3 oz/A up to 14 days before soybean planting, or 1.1 to 2.2 oz/A up to 7 days before soybean planting; consult label for details. • For best results apply to annual weeds less than 3 inches in height or diameter and perennial weeds less than 6 inches in height or diameter. • The addition of 1 pint/A of 2,4-D ester is recommended and is required for some species. • Applications must include either a crop oil concentrate or a nonionic surfactant. Crop oil concentrate is the required adjuvant unless tank-mixing with a product that precludes its use. • On soils with pH 7.0 or less, Canopy EX can be applied at rates of 1.5 - 3.3 oz/A., and will provide residual control or suppression of several winter and summer annual weeds through normal planting dates, but will not provide season-long control. 				

Table 5.45 - Comments for “Burndown” Herbicides for No-Till Soybean (cont.)

Trade Name	Common name	Site of Action Number	product/A	lb ai/A
Elevore 0.572SC	halauxifen-methyl	4	1 oz	0.004 lb ae
<ul style="list-style-type: none"> • Must be applied at least 14 days prior to planting. • Tank-mix with glyphosate or Gramoxone to improve spectrum of control. • Use Elevore for marestalk/horseweed control. 				
Glyphosate¹	glyphosate	9	varies by formulation and acid equivalent	0.36–3 lb ae
<ul style="list-style-type: none"> • Fall applications of glyphosate are better than spring applications for control of orchardgrass sods and quackgrass. Spring applications of may be used to control annual weeds. For control of most annual weeds, apply 0.75–1.13 lb ae/acre. • Glyphosate may be applied in clear liquid nitrogen fertilizers and clear liquid complete-analysis fertilizers. Do not use glyphosate with suspension-type liquid fertilizers. • Use rates vary by product, formulation, and weed size. Higher rates are usually recommended for annual weeds taller than 6 inches. • To aid in the control of marestalk/horseweed, mustard species, common lambsquarters, common ragweed, and other emerged, susceptible broadleaf weeds, 2,4-D or dicamba should be added. • Glyphosate is available in some pre-packaged mixtures, but glyphosate rate may not be adequate for “burndown” control. <p>¹Consult specific product label for active ingredient concentration and application rate; various formulations of this herbicide are available (e.g., 1 qt/A glyphosate = 22 fl oz/A WeatherMax).</p>				
Gramoxone SL 2.0	paraquat	22	2.0–4.0 pt	0.48–1.0
Gramoxone SL 3.0			1.3–2.7 pt	0.49–1.0
<ul style="list-style-type: none"> • Use appropriate precautions when handling paraquat to minimize exposure to the herbicide. • Apply in 20 to 60 gallons of water per acre; increase gallonage as density of stubble, crop residue or weeds increases. • Rate is dependent on weed size (see label). Paraquat may not control weeds taller than 6 inches. • 2,4-D at 0.5-0.75 pint per acre may be added to this program for additional control of marestalk (horseweed), common lambsquarters, common ragweed, and other emerged, susceptible broadleaf weeds. • Phosphate-containing liquid fertilizers diminish paraquat activity. • The addition of metribuzin will improve overall control with paraquat (this includes Glory, TriCor, Boundary, Canopy, Trivence, and Authority MTZ). <p>Paraquat Use Restrictions</p> <ul style="list-style-type: none"> • <i>Restricted Use Pesticide.</i> • Only certified applicators, who successfully complete the paraquat-specific training, can mix, load or apply paraquat. • Application of paraquat "under the direct supervision" of a certified applicator is no longer allowed; registered technicians cannot apply. • Required training link (http://usparaquattraining.com); certified applicators must repeat training every three years. 				

5-150 Weed Control in Field Crops: Soybeans

Table 5.45 - Comments for “Burndown” Herbicides for No-Till Soybean (cont.)

Trade Name	Common Name	Site of Action Number	product/A	lb ai/A
Liberty 2.34 SL	glufosinate	10	32–43 oz	0.59–0.79
<ul style="list-style-type: none"> • Liberty may be applied as a burndown treatment prior to the planting or emergence of any soybean variety. • Apply a minimum of 32 fl oz/A to young, actively growing weeds; burndown and in-crop applications may not exceed 87 fl oz/A per season. • Warm temperatures, high humidity, and bright sunlight improve the performance of Liberty. Weed control may be reduced when applications are made to weeds under stress from drought or cool temperatures. • Applications should be made between 2 hours after sunrise and 1 hour before sunset to avoid the possibility of reduced weed control. • Liberty performs better as a POST herbicide or burndown for double-cropped soybeans compared to burndown applications in April. • Liberty must be applied with ammonium sulfate at the rate of 3 lb/A. • Uniform, thorough spray coverage is necessary to achieve consistent weed control; do not use nozzles that produce large droplets; use at least 15 gal/A, 20 gal/A if dense vegetation is present. 				
Reviton	tiafenacil	14	1–3 oz	0.022-0.066
<ul style="list-style-type: none"> • Reviton may be applied as a burndown treatment prior to soybean planting. • Apply as a broadcast spray using conventional low-pressure ground spray equipment. • The maximum single application rate is 3 oz/A. DO NOT exceed 6 oz/A/year. • DO NOT reapply within 14 days. • No plant-back restriction at 1 oz. 7 day plant-back restriction at 2 to 3 oz. • Use higher rate for dense and/or mature weed infestations. • <i>Water quality advisory.</i> 				
Sharpen 2.85SC	saflufenacil	4	1.0–2.0 oz	0.022–0.044
<ul style="list-style-type: none"> • Sharpen may be applied as a burndown treatment from 44 days early preplant through preemergence timings as directed on the label. • Apply Sharpen in a typical glyphosate or glufosinate burndown herbicide program to increase weed spectrum, including glyphosate-resistant horseweed; 1.5 oz provides more consistent horseweed control than lower rates. • The label requires use of methylated seed oil (MSO) plus a nitrogen source such as ammonium sulfate (AMS). • On coarse-textured soils with less than 2% organic matter: a minimum of 30 days between application of 1 to 1.5 oz of Sharpen and soybean planting is required; minimum of 44 days between application of 2.0 oz of Sharpen and soybean planting. • All other soils: no waiting period of 1 oz of Sharpen is applied; minimum of 14 days between applications of 1.5 oz of Sharpen and planting on all other soil types; and 30 days if 2 oz of Sharpen is used. • Do not apply during soybean cracking stage or after emergence as severe crop damage will occur. Control of emerged grasses will require adding an additional herbicide. • Do not apply Sharpen with other Group 14 herbicides such as sulfentrazone or flumioxazin as a tank-mix or sequential application within 30 days or crop injury may result with coarse-textured soils with less than 2% o.m.; and a minimum of 14 days on all other soil types (see label). • Local research indicates limited residual control with Sharpen at rates and use pattern for soybeans. • Sharpen is a Group 14 herbicide and due to concerns for long-term viability of this herbicide mode of action, extension specialists in the Mid-Atlantic region recommend not using it every year. This mode of action has greater utility in soybeans than corn and especially for control of glyphosate-resistant horseweed (marestail). As such, we suggest that Sharpen and other saflufenacil-containing products (e.g., Verdict, OpTill) be used in soybean and only in alternate years. The use of Sharpen in continuous corn should also be limited to every other year (alternating years with HPPD-containing herbicide [Group 27]). 				

Table 5.45 - Comments for “Burndown” Herbicides for No-Till Soybean (cont.)

Trade Name	Common Name	Site of Action Number	product/A	lb ai/A
Valor SX 51WDG	flumioxazin	14	1–2.5 oz	0.032–0.08 lb

- Valor may be included in a typical burndown herbicide program to enhance the speed of burndown and increase weed spectrum.
- Valor has fair to good postemergence activity on field pansy/violet.
- Premixes containing Valor: Valor XLT contains chlorimuron (Classic) and can also be used as a PRE/burndown treatment; Fierce XLT is similar to Valor XLT but also contains pyroxasulfone (Zidua); Envive contains chlorimuron (Classic) and thifensulfuron (Harmony); Gangster or Surveil contain (cloransulam (FirstRate).

¹ See Table 5.1 (glyphosate formulations) for information on various formulations of this herbicide.

Table 5.46 - Water Solubility and Longevity of Soil-Applied Herbicides

Solubility (parts per million; ppm): How many microliters of the herbicide will dissolve in 1 liter of water. The less soluble the herbicide, the more moisture (rain or irrigation) is needed to activate the herbicide and move it into the root zone. Solubility is used as a guideline for rainfall or irrigation required within a short time after application. Moisture needed also depends on the soil moisture at time of application.

Relative moisture levels to move herbicide into the soil to achieve optimum level of control.

Relative Moisture to Activate	ppm	Estimate Water to Activate*
Low	>500 ppm (very soluble)	0.33 inch
Medium	250-500 ppm	0.33-0.5 inch
High	100-250 ppm	0.5-0.75 inch
Very High	<100 ppm	>0.75 inch

*More water (additional irrigation) maybe necessary if soil is dry at time of application, soils with higher clay content, or high plant residues are present.

Relative duration of residual control is for comparison only. Based on herbicide half-life (length of time it takes for half the herbicide to break down). Herbicide breakdown results from chemical and/or microbial activity. Since the speed of breakdown is affected by a number of factors including soil pH, soil temperature, and soil moisture, duration can vary for herbicides based on the specific conditions. Residual activity is not the same as herbicide carryover. Duration of residual control assumes 1) good activation; 2) no excessive rain or irrigation; and 3) weed species are sensitive to the herbicide(s) applied.

Table 5.46 - Water Solubility and Longevity of Soil-Applied Herbicides (cont.)

Trade Name	Solubility (ppm)	Relative Moisture Amount Required to Activate	Duration of Residual Control
Classic	pH 5: 11	Very High	4-5 weeks
	pH 6.5: 450	Medium	
	pH 7: 1,200	Low	
Command	1,100	Low	2-4 weeks
Dual Magnum	530	Medium	4-5 weeks
Express	pH 5: 48	Very High	1-2 weeks
	>pH 7: >2040	Low	
FirstRate	pH 5: 3	Very High	2-4 weeks
	pH 7: 184	High	
Harmony SG	pH 5: 223	High	1-2 weeks
	>pH 7: >2,240	Low	
Lorox / Linex	75	Very High	4-5 weeks
Metribuzin	1,200	Low	4-5 weeks
Outlook	1,174	Low	2-4 weeks
Prowl / other pendimethalin formulations	1	Very High	4-5 weeks
Pursuit	1,400	Low	4-6 weeks
Python	5,600	Low	4-6 weeks
Reflex / Flexstar	600,000	Low	2-4 weeks
Sharpen	pH5 : 30	Very High	1-3 weeks
	pH7 : 2100	Low	
Spartan	780	Low	4-6 weeks
Treflan/other formulations	1	Very High	4-5 weeks
Valor SX	2	Very High	4-5 weeks
Warrant/Enversa	223	Medium	4-5 weeks
Zidua	3.49	Very High	4-5 weeks

Table 5.46 - Water Solubility and Longevity of Soil-Applied Herbicides (cont.)

Premix	Constituents
Afforia	Valor SX, Harmony SG, Express
Antares Complete	Spartan, metribuzin, Dual Magnum
Anthem / Anthem Maxx	Cadet, Zidua
Authority Edge	Spartan, Zidua
Authority Elite / BroadAxe XC	Spartan, Dual Magnum
Authority First / Sonic	Spartan, FirstRate
Authority MTZ	Spartan, metribuzin
Authority Supreme	Spartan, Zidua
Authority XL	Spartan, Classic
Boundary	Dual Magnum, metribuzin
Canopy DF / Blend	Classic, metribuzin
Canopy EX	Classic, Express
Envive	Classic, Valor SX, Harmony SG
Fierce / Fierce EZ	Valor SX, Zidua
Fierce MTZ	Valor, Zidua metribuzin
Fierce XLT	Zidua, Valor, Classic
Gangster / Surveil	Valor SX, FirstRate
Moccasin MTZ	Dual Magnum, metribuzin
OpTill	Sharpen, Pursuit
OpTill PRO	Sharpen, Pursuit, Outlook
Panther MTZ	Metribuzin, Valor
Panther Pro	Metribuzin, Valor, Pursuit
Permit Plus	Harmony SG, Sandea
Prefix	Dual Magnum, Reflex
Preview 2:1	Metribuzin, Spartan
Sequence	Dual Magnum, glyphosate
Synchrony XP	Classic, Harmony SG
Tendovo	Dual Magnum, metribuzin, FirstRate
Tripzin	Prowl, metribuzin
Trivence	Classic, Valor SX, metribuzin
Valor XLT	Valor SX, Classic
Verdict	Sharpen, Outlook
Warrant Ultra	Warrant, Reflex
Zidua Pro	Zidua, Pursuit, Sharpen
Zone Defense	Spartan, Valor

5-154 Weed Control in Field Crops: Soybeans

Table 5.47 - Relative Effectiveness of Soil-Applied Herbicides

Ratings are based on labeled application rates for the soil type and timely rainfall or irrigation to incorporate the herbicides. Ratings are also based on weed control 3 to 4 weeks after application. Length of effective control (residual control) beyond 4 weeks after application often declines. Results may differ with variations in soil type, temperature, rainfall, soil moisture, soil organic matter, and soil pH. For ratings on herbicide combinations not listed, see the component parts.

Weed control rating:

10 = 95–100%
 9 = 85–95%
 8 = 75–85%
 7 = 65–75%
 6 = 55–65%
 N = less than 55% or no control
 + = upper end of rating scale

Crop tolerance:

E = excellent; almost never any crop injury observed
 VG = very good; on rare occasion is crop injury observed
 G = good; seldom is crop injury observed as long as proper management practices are followed (e.g., seedling depth, seed slit closure, herbicide rate and application timing, adjuvants)
 FG = fair to good; occasionally crop injury is observed even with proper management practices; injury is often due to herbicide interactions with environmental conditions
 F = fair; some crop injury is commonly observed

Trade Name	Site of Action Number	Grasses														
		Barrydgrass	Bermudagrass	Broadleaf signalgrass	Crabgrass	Fall Panicum	Foxtails	Goosegrass	Johnsongrass (Seedling)	Johnsongrass (Rhizome)	Quackgrass	Shattercane	Texas panicum	Volunteer Corn	Wirestem Muhly	Yellow Nutsedge
Command ¹	13	8+	6	9+	8+	9	9	9+	8	N	7	7	8	7	N	N
Dual products	15	9	N	8	9	8+	9	9+	6	N	N	6	6	N	N	8
Lorox / Linex	7	6	N	N	6	N	N	7	6	N	N	6	N	N	6	6
Metribuzin	5	6	N	N	6	N	N	6	6	N	N	6	N	N	N	6
Outlook	15	9	N	7	8+	8+	9	9	6	N	N	6	6	N	N	7+
Prowl	3	8+	N	9	8+	9	8+	9	7	N	N	7	8	N	N	6
Pursuit	2	8	N	N	7	7	8	–	6	N	N	6	–	6	N	7
Treflan ¹	3	9	N	9	9	9	9	9	8	7	7	8	8+	6	N	N
Warrant/Enversa	15	8+	N	7	8	8	8+	8+	6	N	N	N	N	N	N	6
Zidua	15	9	N	8+	9	8+	9	9+	6	N	N	6	7	N	N	6
Mixtures																
Anthem Maxx	14/15	9	N	8+	9	8+	9	9+	6	N	N	6	7	N	N	6
Authority Edge	14/15	8+	N	8	8+	8	8+	9	6	N	N	6	6	N	N	7
Authority Elite / BroadAxe XC	14/15	9	N	8	9	8+	9	9+	6	N	N	6	6	N	N	7
Authority Supreme	14/15	9	N	8+	9	8+	9	9+	6	N	N	6	7	N	N	7
Boundary	5/15	8	N	6	8	7	8	8+	N	N	N	N	N	N	N	7
Canopy DF / Canopy Blend	2/5	6	N	6	6	N	N	–	N	N	N	8	N	7	N	7
Fierce / Fierce EZ / Fierce XLT	14/15/ 14/15/(2)	9	N	8	9	8+	9	9+	6	N	N	6	7	N	N	6
OpTill	2/15	7	N	N	7	6	7	–	6	N	N	6	6	6	N	6
Prefix	14/15	8	N	6	8	7	9	8+	N	N	N	N	N	N	N	7
Tendovo	15/5/2	9	N	8	9	8+	9	9+	6	N	N	6	6	6	N	8
Warrant Ultra	14/15	8+	N	7	8	8	8+	8+	6	N	N	N	N	N	N	6
Zidua PRO	15/2/14	9	N	8+	9	8+	9	9+	6	N	N	6	7	N	N	7

¹ Command 4E, Treflan and trifluralin require incorporation; Command 3ME may be applied preemergence and not incorporated.

Table 5.47 - Relative Effectiveness of Soil-Applied Herbicides on Individual Weed Species (cont.)

Broadleaves																		
Trade Names	Herbicide Group (Mode of Action)	Burcucumber	Cocklebur	Horseweed / Marestalk ¹	Jimsonweed	Lambsquarters ²	Morningglory, Annual	Nightshade, Eastern Black	Palmer Amaranth / Waterhemp ¹	Pigweed ²	Ragweed, Common ³	Ragweed, Giant	Sida, Prickly	Smartweed	Spurred Anoda	Velvetleaf	Soybean Tolerance / Med. Soils	Soybean Tolerance / Coarse Soils
Command ⁴	13	N	7+	N	9	9+	N	6	6	6	8	N	8+	8+	9+	9+	E	E
Dual products/ Cinch	15	N	N	N	N	6	N	7+	8+	8	6	N	N	N	N	N	E	E
FirstRate	2	N	8+	9 ²	8	9	8	N	N	9 ²	9 ³	8	7	8	9	8+	E	E
Lorox / Linex	7	N	7+	7	7	8+	N	7	7	8	8	N	7+	9	N	7	G	FG
Metribuzin	5	6	8	8+	8	9	N	N	8+	8+	7	N	8+	9	7	8	G	FG
Outlook	15	N	N	N	N	6	N	7+	8	8	6	N	N	6	N	N	VG	VG
Prowl	3	N	N	N	6	9	N	N	8	8	N	N	N	8	N	8+	VG	G
Pursuit	2	6	8	-	8	8	7	8	N	9 ²	7+ ³	6	8	9	-	8	VG	VG
Reflex	14	N	8	N	8	8	7	8	9	9	9	6	7	7	N	6	E	VG
Spartan	1	N	N	8+	6	8+	9	8	9	9	7+	6	6	7	-	8	VG	VG
Treflan ⁴	3	N	N	N	N	9	N	N	9	9	N	N	N	6	N	7+	E	E
Valor	14	N	6	8+	8	9	7+	9	9	9	7+	6	8	7	8	7	VG	G
Warrant/Envers	15	N	N	N	N	6	N	7	8	8	6	N	N	N	N	N	VG	G
Zidua	15	N	N	N	7	8	N	8	9	9	7	6	6	7	N	6	VG	VG
Mixtures																		
Afforia	2/2/14	N	6	8+	8	9	7+	9	9	9	8	7	8	7	8	7	G	FG
Anthem / Anthem Maxx	14/15	N	N	N	7	8	N	8	9	9	7	6	6	7	N	6	VG	VG
Authority Edge	14/15	N	6	8+	7	9	8	8+	9	9	7	6	6	7	N	7	VG	VG
Authority Elite / BroadAxe XC	14/15	N	6	8+	6	9	7	7+	8	8	6	6	6	7	N	7	VG	VG
Authority First / Sonic	2/14	N	8	8+	8	8+	8	8	9	9	8+	7	7+	7+	9	8	VG	VG
Authority Supreme	14/15	N	6	8+	7	8+	7	8	9	9	7	6	6	7	N	7	VG	VG
Authority MTZ	5/15	6	8	8+	8+	9	8	8	9	9	8	N	8+	9	7	8	G	FG
Authority XL	2/14	7	8+	8+	8	8+	9	8	9	9	8	6	8	8+	8	8	G	FG
Boundary	5/15	N	7+	8+	7+	8+	N	6	8+	8+	7	N	8+	8+	7	7	G	G
Canopy DF / Canopy Blend	2/5	7	9	8+	9	9	7+	6	9	9+	7+	8	9	9	8	9	FG	F
Envive	2/2/14	7	8+	8+	9	9	7+	9	9	9	8	7	8+	8+	8	8+	G	F
Fierce / Fierce EZ	14/15	N	6	8+	8	9	7+	9	9	9	7	6	8	7	8	7	G	F
Fierce XLT	2/14/15	7	8+	8+	9	9	8	9	9	9	8	8	8+	8+	8	8+	G	F

Table 5.47 - Relative Effectiveness of Soil-Applied Herbicides on Individual Weed Species (cont.)

Broadleaves																		
Trade Names	Herbicide Group (Mode of Action)	Burcucumber	Cocklebur	Horseweed / Marestalk ¹	Jimsonweed	Lambsquarters ²	Morningglory, Annual	Nightshade, Eastern Black	Palmer Amaranth / Waterhemp ¹	Pigweed ²	Ragweed, Common ³	Ragweed, Giant	Sida, Prickly	Smartweed	Spurred Anoda	Velvetleaf	Soybean Tolerance / Med. Soils	Soybean Tolerance / Coarse Soils
Gangster (co-pack)/Surveil	2/14	N	8+	8+	8	9	8	9	9	9	9	8	8	8	8	8+	G	F
OpTill	2/14	6	8	6	8	8	7	8	6	9	7+	6	8	9	N	8	G	G-F
Prefix	14/15	N	N	N	6	6	6	7+	8+	8+	7	N	6	6	N	6	E	E
Tendovo	15/5/2	6	8+	8+	8	9	9	7+	9	8+	9 ³	8	8+	9	9	8+	G	FG
Trivence	2/5/14	7	9	8+	9	9	8	9	9	9	8	7	9	9	8	9	G	F
Valor XLT	2/14	7	8+	8+	9	9	7+	9	9	9	8	7	8+	8+	8	8+	G	F
Verdict	14/15	N	N	N	N	7	7+	7	7	7	6	N	N	6	N	N	G	- ⁵
Warrant Ultra	14/15	N	N	N	8	8	7	8	8+	8+	8	6	7	7	N	6	VG	G
Zidua PRO	15/2/14	N	N	8+	7	8+	7	8	9	9	7	6	6	7	N	8	VG	- ⁵

See Table 5.3 (generics table) for additional herbicides that contain these active ingredients

¹ Biotypes resistant to Group 2 herbicides are common in the region; do not rely on Group 2 herbicides to provide effective control.

² Triazine-resistant (Group 5) lambsquarters and pigweed are common in the region; metribuzin will not control these biotypes.

³ Common ragweed biotypes resistant to Group 2 herbicides have been confirmed in Delaware, Maryland, and Virginia.

⁴ Command 4E, Treflan, and trifluralin require incorporation; Command 3ME may be applied preemergence and not incorporated.

⁵ Not labeled for application on this soil type.

Table 5.48 - Comments on Preplant or Preemergence Herbicides for Conventional, Minimum, or No-Till Soybeans

See specific product label to determine correct rate for soil type, tillage practices, and weed species found in each field.

Mechanical incorporation reduces the need for timely rainfall after application and may improve control of certain weeds. Mechanical incorporation will improve weed control when no rainfall or irrigation occurs within 7 to 10 days after planting.

In no-till situations, “burndown” herbicides may be required to control weeds or cover crops present at time of application.

EPP= early preplant means application at least 7 days prior to plant; PPI= applied to conventionally tilled soil than mechanically incorporated; PRE= preemergence (applied before the crop has emerged).

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Anthem Maxx 4.3SC	pyroxasulfone + fluthiacet	15 14	EPP, PPI, or PRE	2–5.5 oz	0.04–0.088

- Fluthiacet (Cadet) does not provide any residual weed control.
- See Zidua entry for more comments.

Authority products	sulfentrazone	14	EPP, PPI, or PRE	varies	0.132–0.309
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- Spartan contains the single active ingredient sulfentrazone, but products that include sulfentrazone are branded as “Authority”; several premixed products contain sulfentrazone (Authority/Spartan).
- Each of these products contains different active ingredients and/or ratios. See various tables in this guide and product labels for additional details about these products.
- Rates are based on region, soil type, and soil organic matter. Applications made after soil-cracking occurs or crop emergence will result in severe crop injury; soybean stunting may occur if excessive rainfall occurs after application but before soybeans emerge.
- Sulfentrazone provides good control of yellow nutsedge.
- Observe labeled rotational crop restrictions for all products containing sulfentrazone.
- Sulfentrazone becomes more available when soil pH exceeds 7.0, increasing the risk of soybean injury.
- Refer to label regarding applications with/or in sequence with Sharpen and other group 14 herbicides.
- Products that contain sulfentrazone include Antares Complete (Authority + metribuzin + Dual), Authority Assist (Authority + Pursuit), Authority Edge (Authority + Zidua), Authority Elite/BroadAxe XC (Authority + Dual), Authority First/Sonic (Authority + FirstRate), Authority MTZ (Authority + metribuzin), Authority Supreme (Authority + Zidua), Authority XL/Maxx (Authority + Classic), and Spartan Charge (Authority + Aim).
- *Water quality advisory.*

Authority Edge 4.25SC	sulfentrazone + pyroxasulfone	14 15	EPP, PPI, or PRE	5.9–15.7 fl oz	0.126–0.335 0.070–0.186
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- See entries for Authority and Zidua entries for more comments.
- *Water quality advisory.*

Authority Elite 7E or BroadAxe XC	sulfentrazone + S-metolachlor	14 15	EPP, PPI, or PRE	19.0–38.7 fl oz	0.104–0.153 0.94–1.87
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- Authority Elite and BroadAxe XC are the same products.
- See Dual and Authority entries for more comments.
- *Water quality advisory.*

5-158 *Weed Control in Field Crops: Soybeans*

Table 5.48 - Comments on Preplant or Preemergence Herbicides for Conventional, Minimum, or No-Till Soybeans (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Authority First 70DF / Sonic	sulfentrazone + cloransulam	14 2	EPP, PPI, or PRE	6.45–8 oz	0.25–0.31 0.032–0.04
<ul style="list-style-type: none"> • Authority First and Sonic are identical products. • See entries for FirstRate and Authority for more comments. 					
Authority MTZ 45WDG	sulfentrazone + metribuzin	14 5	EPP, PPI, or PRE	12–18 oz	0.135–0.202 0.202–0.304
<ul style="list-style-type: none"> • See Authority and metribuzin entries for comments. • <i>Water quality advisory.</i> 					
Authority Supreme 4.16SC	sulfentrazone pyroxasulfone	14 15	EPP, PPI, or PRE	6–11.5 fl oz	0.098–0.187 0.098–0.187
<ul style="list-style-type: none"> • See entries for Authority and Zidua entries for more comments. • <i>Water quality advisory.</i> 					
Authority XL 70WG	sulfentrazone + chlorimuron	14 2	EPP, PPI, or PRE	3.0–9.0 oz	0.116–0.347 0.015–0.045
<ul style="list-style-type: none"> • Authority XL is a premix of Authority (sulfentrazone) + Classic (chlorimuron) and can be used as a burndown and/or preemergence application. • For burndown, Authority XL may be tankmixed with glyphosate, Gramoxone, or 2,4D plus COC or MSO to increase activity. • See Authority entry for more comments. 					
Boundary 6.5EC	S-metolachlor + metribuzin	15 5	EPP, PPI, or PRE	1.2–3 pt	0.74–1.9 0.188–0.469
<ul style="list-style-type: none"> • See metribuzin and Dual entry for comments. • The amount of Dual in this premix is low compared to amount recommended when applied by itself. • <i>Water quality advisory.</i> 					
Canopy 75DF Canopy Blend 58.3 WDG	chlorimuron + metribuzin	2/5	EPP, PPI, or PRE	4.0–7.0 oz 5.1–9.0 oz	0.027–0.047 0.16–0.28
<ul style="list-style-type: none"> • Apply prior to soybean emergence. Do not use on sand or any soil with less than 0.5% organic matter • Do not apply more than 2.25 oz/A if soil pH is 7.0 or higher. • Observe rotational crop restrictions. Do not use on soils with a pH greater than 6.8, or carryover injury may result the following year. • Observe labeled rotational crop restrictions for all products containing chlorimuron (Classic). • Adding chlorimuron to metribuzin improves control of common ragweed, cocklebur, velvetleaf, jimsonweed, and annual morningglory. • <i>Water quality advisory.</i> 					

Table 5.48 - Comments on Preplant or Preemergence Herbicides for Conventional, Minimum, or No-Till Soybeans (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Command 3ME	clomazone	13	EPP or PRE	1.33–2.67 pt	0.5–1.0
<ul style="list-style-type: none"> • Command 3ME must be used as a preemergence soil-applied treatment without incorporation. • Do not apply within 1,200 feet of towns; residential areas; commercial fruit, nut, or vegetable production; or commercial greenhouses or nurseries. • Do not apply during temperature inversions or when wind speed is greater than 10 mph. Apply in a minimum spray volume of 10 gal/A. Use coarse sprays to reduce drift. • Observe labeled rotational crop restrictions. 					
Dual II Magnum 7.62EC	S-metolachlor	15	EPP, PPI, or PRE	1.0–2.0 pt	0.95–1.9
<ul style="list-style-type: none"> • Dual is similar in activity to Outlook, Zidua, and Warrant. Dual II Magnum contains a crop safening agent for corn. • For early preplant applications or fields with heavy surface plant residue, Dual rate may need to be increased by up to 20%. • Incorporation improves control of yellow nutsedge. • Dual can be applied after soybean emergence, but Dual will not control emerged weeds. • For extended residual or control of heavy weed infestations up to 2.6 pt/A is allowed. • DO NOT exceed 3.71 lb ai/A/year of any S-metolachlor containing product • <i>Water quality advisory.</i> 					
Enversa 3CS	acetochlor	15	EPP or PRE	1.25–2qt	0.94–1.5
<ul style="list-style-type: none"> • Encapsulated acetochlor for enhanced crop safety and residual control of weeds before they germinate. • Can be applied preplant through R2. POST application should be made after soybeans are completely emerged but before soybeans reach growth stage R2. • The optimum timing and rate of application is when soybeans are V2-V3 at 1.5 qts/acre. • Weeds emerged at the time of application are not controlled by this product. • <i>Water quality advisory.</i> 					
Envive 41.3DG	flumioxazin +	14	EPP or PRE	2.5–5.3 oz /A	0.044–0.094
	chlorimuron +	2			0.015–0.031
	thifensulfuron	2			0.004–0.009
<ul style="list-style-type: none"> • Do not mechanically incorporate into the soil after application. • Can be tank-mixed with products such as Command or pendimethalin for improved grass control. • If Envive is tank-mixed with group 15 herbicides and applied within 14 days of planting, plant under no-till or minimum tillage conditions on wheat stubble or field corn stubble. • Products containing flumioxazin have specific tank-cleaning instructions on the label or in technical bulletins to help avoid contaminant injury from spray tank residues. • Envive can to provide some burndown and residual weed control when applied 2 weeks before planting up to 3 days after planting (before soybean emergence), but often needs to be tank-mixed with glyphosate and/or 2,4-D to achieve complete burndown. • Refer to label regarding applications with/or in sequence with Sharpen and other group 14 herbicides. • See Valor entry for more information. 					

5-160 *Weed Control in Field Crops: Soybeans*

Table 5.48 - Comments on Preplant or Preemergence Herbicides for Conventional, Minimum, or No-Till Soybeans (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Fierce 76WDG	pyroxasulfone + flumioxazin	15	EPP or PRE	3–3.75 oz	0.08–0.10
		14			0.063–0.78
Fierce EZ 3.04SC	pyroxasulfone + flumioxazin	15	EPP or PRE	6–7.5 fl oz	0.08–0.100
		14			0.064–0.079
Fierce XLT 62.41WDG	pyroxasulfone + flumioxazin+ chlorimuron	15	EPP or PRE	3.75–5.25 oz	0.073–0.102
		14			0.057–0.08
		2			0.016–0.022

- See Zidua and Valor entry for comments.
- Fierce XLT improves morningglory control compared to Fierce or Fierce EZ due to addition of chlorimuron.
- Products containing flumioxazin have specific tank-cleaning instructions on the label or in technical bulletins to help avoid contaminant injury from spray tank residues.
- *Water quality advisory.*

FirstRate 84WDG	cloransulam	2	EPP, PPI, or PRE	0.6–0.75 oz	0.031–0.039
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- Cloransulam provides good control of several annual broadleaves including common lambsquarters, pigweed, common ragweed, velvetleaf, and cocklebur. Common ragweed is commonly resistant to FirstRate and other group 2 herbicides in the region.
- FirstRate water-dispersible packets are not soluble in liquid fertilizer solutions; premixing in water is required.
- Gangster and Surveil are copacks that contain flumioxazin (Valor) and cloransulam (FirstRate).
- Gangster/Surveil can be applied as a fall (after October 15) or spring preplant treatment or preemergence.
- *Water quality advisory.*

Gangster / Surveil (co-pack) / Surveil 48WDG	flumioxazin + cloransulam	14	EPP or PRE	2.5–3.0 oz	0.08–0.096
		2		0.5–0.6 oz /3.5–4.2 oz	0.026–0.031

- Gangster and Surveil are co-packs that contain flumioxazin (Valor) and cloransulam (FirstRate); Surveil 48WDG is a single product containing both active ingredients.
- Do not mechanically incorporate.
- Products containing flumioxazin have specific tank-cleaning instructions on the label or in technical bulletins to help avoid contaminant injury from spray tank residues.
- See FirstRate and Valor entries for more comments.
- *Water quality advisory*

Intermoc	S-metolachlor + glufosinate	15	EPP or PRE	64-80 fl oz	1.79-2.23
		10			

- Intermoc may be applied as burndown treatment prior to planting any soybean variety.
- Apply a minimum of 64 fl oz/A to young, actively growing weeds.
- Include AMS 2-4 lb/A.
- Do not use nitrogen solutions as spray carriers.
- Do not apply within 2 weeks of planting on course-textured soils.
- Do not apply more than 2 applications per year, and do not apply more than 5 days apart.
- Do not apply more than 122 fl oz/A per year.

Table 5.48 - Comments on Preplant or Preemergence Herbicides for Conventional, Minimum, or No-Till Soybeans (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Lorox 50DF / Linex 4L	linuron	7	EPP or PRE	0.75–2.0 lb 1 to 2 pt	0.38–1.0
<ul style="list-style-type: none"> • Do not mechanically incorporate. • Do not use on sands or loamy sands, or on soils with less than 0.5% organic matter. • Do not apply after soybean emergence. • Provide good agitation in tank before and during application. • Follow labeled directions regarding soybean planting depth. • Do not plant any crop not on label within 4 months of application. 					
Metribuzin 75DF	metribuzin	5	EPP, PPI, or PRE	4–8 oz	0.2–0.4
<ul style="list-style-type: none"> • Do not use on sands or loamy sands or on soils with less than 0.5% organic matter, or crop injury may result. If used on coarse textured soils with less than 2% organic matter or if heavy rainfall follows soon after application, severe stand losses can occur. • Rates on coarse-textured soils in lower portion of the Eastern Shore and Delaware should be no more than 4 oz. • Soybean varieties have different levels of tolerance to metribuzin; refer to product label for list of susceptible varieties. • Do not apply after soybean emergence. • Metribuzin is a triazine (Group 5) herbicide and does not control triazine-resistant weeds. • Potential for crop injury may increase if atrazine was used the previous year due to the additive effect of residual atrazine and metribuzin. • Plant at least 1.5 inches deep. • <i>Water quality advisory.</i> 					
OpTill 68WG	saflufenacil + imazethapyr	14 2	EPP or PRE	2.0 oz	0.022 0.063
<ul style="list-style-type: none"> • On coarse-textured soils with less than 2% organic matter, a minimum of 30 days between application of Optill and soybean planting is required. • Optill may be applied as a preplant burndown application from early spring through preemergence; do not apply if soil cracking has begun or soybeans have emerged. • In a burndown program it is best to include glyphosate or glufosinate in addition to the necessary adjuvants (COC or MSO plus AMS or nitrogen solution) to improve control of emerged weeds, including horseweed. • Do not apply Optill with any other Group 14 herbicide (flumioxazin, sulfentrazone, fomesafen) as a tank mixture or sequential application within 14 days of planting, or crop injury may result. • Postemergence herbicides containing a Group 14 herbicide (Reflex or Flexstar GT) can be applied 14 days after soybean emergence. • Adequate soil moisture is necessary for optimum activity. • Do not plant corn until 8.5 months after application. Consult label for other rotation restrictions. Do not apply products containing chlorimuron during the same season, or injury to rotational crops may result. • OpTill PRO is a co-pack of OpTill and Outlook. • <i>Water quality advisory.</i> 					

Table 5.48 - Comments on Preplant or Preemergence Herbicides for Conventional, Minimum, or No-Till Soybeans (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Outlook 6.0EC	dimethenamid	15	EPP, PPI, or PRE	10–21 fl oz	0.47–0.98
<ul style="list-style-type: none"> • Outlook is similar in activity to Dual, Zidua, and Warrant. • For early preplant applications or fields with heavy surface plant residue, use 21 fl oz/A. • Incorporation improves control of yellow nutsedge. • Do not exceed a rate of 12 oz/A of Outlook on coarse soils with less than 1.5% organic matter. PPI applications are not recommended on these soils. Outlook will have very short residual when used on coarse-textured soils. • Outlook can be applied after soybean emergence (up to 5PthP trifoliolate), but Outlook will not control emerged weeds. • OpTill PRO is a co-pack of OpTill and Outlook. • <i>Water quality advisory.</i> 					
Prefix 5.3EC	S-metolachlor + fomesafen	15 4	EPP, PPI, or PRE	2–3 pt	0.73–1.1 0.16–0.24
<ul style="list-style-type: none"> • See Dual entry for more comments. • Prefix contains S-metolachlor (Dual Magnum) and fomesafen (Reflex) for annual grass, nutsedge, and broadleaf control. The ratio of fomesafen in this product is relatively low, below what is typically recommended for soil-applications. • In most situations, Prefix provides foundational weed control but will likely need to be followed by additional weed control measures. • Be cautious of restrictions associated with fomesafen use in consecutive years and use rates that vary across the region. Refer to label for additional use restrictions. • Prefix followed by sequential applications of Reflex are prohibited; use of fomesafen as a postemergence treatment is preferable to use as a soil-application. • Refer to label regarding applications with/or in sequence with Sharpen and other group 14 herbicides. 					
Prowl 3.3E	pendimethalin	3	EPP, PPI, or PRE	1.2–3.6 pt	0.5–1.5
Prowl H₂O 3.8CS	pendimethalin	3	EPP, PPI, or PRE	2–3 pt	0.95–1.4
<ul style="list-style-type: none"> • Prowl 3.3E: do not exceed 2.4 pt/A rate when using surface application. • Under certain environmental conditions, preemergence applications may cause callus tissue development at soil line, resulting in brittle soybean stems and increase incidence of lodging. • Prowl (all formulations) should be applied pre-plant incorporated (PPI) north of I-80 due to stem callus and possible lodging concerns. • Do not apply to emerged soybeans. • Generic EC formulations are available; consult individual labels for rates and restrictions. 					
Pursuit 2S	imazethapyr	2	EPP, PPI, or PRE	4 fl oz	0.063
<ul style="list-style-type: none"> • Adequate soil moisture is necessary for optimum activity. • Do not plant corn until 8.5 months after application. Consult label for other rotational restrictions. Do not apply products containing chlorimuron during the same season, or injury to rotational crops may result. • <i>Water quality advisory.</i> 					

Table 5.48 - Comments on Preplant or Preemergence Herbicides for Conventional, Minimum, or No-Till Soybeans (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Python 80WDG	flumetsulam	2	EPP or PRE	0.8–1.33 oz	0.04–0.066
<ul style="list-style-type: none"> • Python may be tank mixed with other herbicides to broaden the spectrum of control. Check individual herbicide labels for potential tankmix partners. • Do not apply where soil pH is greater than 7.8. • Do not apply to emerged soybeans. • <i>Water quality advisory.</i> 					
Reflex 2E	fomesafen	14	EPP or PRE	1–1.5 pt	0.25–0.375
Flexstar 1.88E				1.06–1.6 pt	
<ul style="list-style-type: none"> • Apply Reflex/Flexstar for broadleaf weed control; tank mix with residuals that will improve annual grass activity. • Be cautious of restrictions associated with fomesafen use in consecutive years and the use rates that vary across the region. Refer to label for additional use restrictions. • Use of fomesafen as a postemergence treatment is preferable to use as a soil application. • Refer to label regarding tank-mixtures. • <i>Water quality advisory.</i> 					
	S-metolachlor	15			1.041–4.077
	metribuzin	5	EPP, PPI, or PRE	1.2–2.35 qt	0.193–0.377
Tendovo	chloransulam	2			0.020–0.038
<ul style="list-style-type: none"> • See comments for Dual Magnum, metribuzin, and FirstRate • Incorporation improves control of yellow nutsedge. • Do not exceed 3.71 lb ai/A per year of any S-metolachlor containing product • Soybean injury may occur on soils with less than 0.5% organic matter. • Soybean injury may occur if used on coarse-textured soils with less than 1% organic matter or if heavy rainfall follows soon after application. • Soybean varieties have different levels of tolerance to metribuzin; refer to product label for list of susceptible varieties. • Plant at least 1.5 inches deep. • <i>Water quality advisory.</i> 					
Treflan 4E	trifluralin	3	PPI	1.0–2.0 pt	0.5–1.0
<ul style="list-style-type: none"> • Incorporate thoroughly to a depth of 2–3 inches within 24 hours of application. Label recommends twopass incorporation. • Plant soybeans after early season adverse weather has passed. • Do not plant deeper than 2 inches. 					

Table 5.48 - Comments on Preplant or Preemergence Herbicides for Conventional, Minimum, or No-Till Soybeans (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Trivence 61.3WDG	chlorimuron +	2	EPP or PRE	6.0–10.0 oz	0.014–0.023
	flumioxazin +	14			0.048–008
	metribuzin	5			0.169–0.282

- Do not mechanically incorporate Trivence into the soil after application.
- Do not apply Trivence if beans have begun to emerge.
- Trivence has some burndown activity, but it should be tankmixed with glyphosate or paraquat in most cases.
- Trivence can be tankmixed with products such as Command or pendimethalin for improved grass control.
- If Trivence is tank-mixed with group 15 herbicides and applied within 14 days of planting, plant under no-till or minimum tillage conditions on wheat stubble or field corn stubble.
- Splashing soil from irrigation or heavy rainfall may cause injury to newly emerged soybeans. Do not irrigate when soybeans are cracking.
- Products containing flumioxazin have specific tankcleaning instructions on the label or in technical bulletins to help avoid contaminant injury from spray tank residues.
- Refer to label regarding applications with/or in sequence with Sharpen and other Group 14 herbicides.
- See Valor SX entry for additional information and mode of action statement.

Valor SX 51WDG	flumioxazin	14	EPP or PRE	2.0–2.5 oz	0.063–0.08 oz
Valor EZ 4SC				2.0–2.5 fl oz	

- Valor products may be tankmixed with certain herbicides to broaden weed control spectrum.
- Do not use more than 3 oz/A of Valor SX or Valor EZ per season.
- Rate is dependent upon weed species targeted, soil type, and soil organic matter; refer to label.
- Do not mechanically incorporate Valor products into the soil after application.
- Do not apply products containing flumioxazin if beans have begun to emerge. Splashing soil from irrigation or heavy rainfall may cause injury to newly emerged soybeans.
- If Valor SX or Valor EZ is tank-mixed with Group 15 herbicides and applied within 14 days of planting, plant under no-till or minimum tillage conditions on wheat stubble or field corn stubble.
- Valor SX or EZ at 1–2.5 oz/A, can enhance the speed of burndown and increase weed spectrum of typical burndown herbicide programs.
- Refer to label regarding applications with, or in sequence, with Sharpen and other group 14 herbicides.
- Gangster and Surveil are co-packs that contain flumioxazin (Valor) and cloransulam (FirstRate). Other premix products that contain flumioxazin include Afforia, Envive, Fierce, Trivence, Valor XLT, and others.
- Products containing flumioxazin have specific tank cleaning instructions on the label or in technical bulletins to help avoid contaminant injury from spray tank residues.

Table 5.48 - Comments on Preplant or Preemergence Herbicides for Conventional, Minimum, or No-Till Soybeans (cont.)

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Valor XLT 40WDG	flumioxazin + chlorimuron	14 + 2	EPP or PRE	3.0–5.0 oz/A	0.056–0.094
<ul style="list-style-type: none"> • Do not mechanically incorporate into the soil after application. • Can be tank-mixed with products such as Command or pendimethalin for improved grass control. • If Valor XLT is tank-mixed with group 15 herbicides and applied within 14 days of planting, plant under no-till or minimum tillage conditions on wheat stubble or field corn stubble. • Products containing flumioxazin have specific tank-cleaning instructions on the label or in technical bulletins to help avoid contaminant injury from spray tank residues. • Refer to label regarding applications with, or in sequence, with Sharpen and other Group 14 herbicides. • See Valor entry for more information. 					
Warrant 3CS	acetochlor	15	EPP or PRE	1.25–2.0 qt	0.94–1.5
<ul style="list-style-type: none"> • Warrant can be soil applied for residual control of certain annual grasses and broadleaves. • Warrant can be applied after soybean emergence (up to R2 stage) but will not control emerged weed seedlings. • Do not mechanically incorporate Warrant prior to planting (PPI). • Warrant Ultra is a prepackaged mixture of Warrant and Reflex; however, the ratio of fomesafen in this product is relatively low, below what is typically recommended for soil-applications. • <i>Water quality advisory.</i> 					
Zidua 85WDG	pyroxasulfone	15	EPP, PPI, or PRE	1.5–3.5 oz	0.08–0.186
Zidua 4.17SC				2.5–5.75 fl oz	0.081–0.187
<ul style="list-style-type: none"> • Zidua has annual grass activity similar to Dual, Outlook, Warrant, etc., but it also provides control of several annual broadleaves. • Zidua can be applied as an early pre-plant application up through planting and then as an early POST application from emergence to sixth trifoliolate stage. Zidua will not control emerged weed seedlings. • Must be activated by at least 0.5 inch of rainfall prior to weed germination or effectiveness may be reduced. • Zidua can be tankmixed with other herbicides to increase the spectrum of control. • Refer to the labels for rotations restrictions (most vegetables have an 18-month rotational restriction); see Table 5.5 (crop rotation table). • Fierce is a prepackaged mixture of Zidua and Valor; Fierce XLT is Zidua, Valor, and Classic. 					
	pyroxasulfone + imazethapyr + saflufenacil	15 2 14	EPP or PRE	4.5–6.0 fl oz	0.08–0.107 0.047–0.062 0.017–0.023
Zidua PRO 4.09SC					
<ul style="list-style-type: none"> • On coarse-textured soils with less than 2% organic matter, a minimum of 30 days between application of Zidua PRO and soybean planting is required. • Zidua PRO may be applied as a preplant burndown application from early spring through preemergence; do not apply if soil cracking has begun or soybeans have emerged. • In a burndown program it is best to include glyphosate or glufosinate in addition to the necessary adjuvants (COC or MSO plus AMS or nitrogen solution) to improve control of emerged weeds, including horseweed. • Do not apply Zidua PRO with any other Group 14 herbicide (flumioxazin, sulfentrazone, fomesafen) as a tank-mixture or sequential application within 14 days of planting, or crop injury may result. • Postemergence herbicides containing a Group 14 herbicide (Reflex or Flexstar GT) can be applied 14 days after soybean emergence. • Outlook at 10 fl oz is lower than recommended rates for medium- and fine-textured soils. 					

¹ See Table 5.3 (generics table) for additional herbicides that contain these active ingredients.

Table 5.49 - Soybean Herbicide Preplant or Preemergence Rates Based on Soil Texture and Organic Matter

The herbicide rates presented are for conventionally tilled soils for the given soil texture and organic matter levels. This table shows application rates for products applied alone. Rates may vary if tank-mixed with other products and/or if weed infestations are heavy, or if used in conservation tillage situations. See specific product label for additional information on application rates and uses. Rates are based on regional university experience and potential crop injury.

Trade Name	Site of Action	Unit/A	<3% Organic Matter			≥3% Organic Matter			Inc. for No-Till ¹
			Coarse	Medium	Fine	Coarse	Medium	Fine	
Afforia 50.8WG	2, 2, 14	oz	2.5	2.5	2.5	2.5	2.5	2.5	no
Antares Complete	14, 15, 5	pt	do not use ³	2.5	3.0	do not use ³	3.0	3.0	no
Anthem Max 4.3SC	14,15	fl oz	3	4	4.5	3.25	4.5	5.25	no
Authority Edge 4.25SC	14,15	fl oz	8.8	11.0	12.0	9.4	12.0	15.7	no
Authority Elite 7E / BroadAxe XC	14, 15	fl oz	25	28	28	25	28	34	no
Authority First 70WDG or Sonic	2, 14	oz	6.45	6.45	6.45	8.0	8.0	8.0	no
Authority MTZ 45WG	5, 14	oz	12	16	18	14	18	20	no
Authority Supreme 4.16SC	14, 15	fl oz	6.9	7.8	10	6.9	7.8	10	no
Authority XL 70WG	2, 14	oz	5.3	7	8	5.3	7.5	8.5	no
Boundary 6.5EC	5, 15	pt	1.25	2	2.5	1.5	2.5	2.75	yes
Canopy 75DF	2, 5	oz	4	5	6	4	5	7	no
Canopy Blend 58.3WDG	2, 5	oz	5.1	6.4	7.75	5.1	6.4	9.0	no
Command 3ME	13	pt	1.25	2	2.67	1.25	2.67	2.67	no
Dual II Magnum 7.62EC	15	pt	1.25	1.33	1.33	1.25	1.33	1.67	yes
Envive 41.3WDG	2, 2, 14	oz	3.5	3.5	4	3.5	4	5	no
Fierce 76WDG	14, 15	oz	3	3	3	3	3	3	no
Fierce EZ 3.04SC	14, 15	fl oz	6.0	6.0	6.0	6.0	6.0	6.0	no
Fierce MTZ 2.64SC/Kyber	5, 14, 15	pt	1	1.5	1.5	1	1.5	1.5	no
Fierce XLT 62.41WDG	2, 14, 15	oz	4	4	4.75	4	4.5	5	no
FirstRate 84WDG	2	oz	0.6	0.6	0.6	0.75	0.75	0.75	no
Gangster / Surveil (co-pack)	2, 14	oz	3	3.6	3.6	3	3.6	3.6	no
Linex 4L	7	pt	1.25	1.3	1.75	1.5	1.75	2.0	no
Lorox 50DF	7	lb	1.25	1.3	1.75	1.5	1.75	2.0	no
Metribuzin 75DF	5	oz	4	8	10	4	11	12	no
OpTill 68WG	2, 14	oz	2.0	2.0	2.0	2.0	2.0	2.0	no

Table 5.49 - Soybean Herbicide Preplant or Preemergence Rates Based on Soil Texture and Organic Matter (cont.)

The herbicide rates presented are for conventionally tilled soils for the given soil texture and organic matter levels. This table shows application rates for products applied alone. Rates may vary if tank-mixed with other products and/or if weed infestations are heavy, or if used in conservation tillage situations. See specific product label for additional information on application rates and uses. Rates are based on regional university experience and potential crop injury.

Herbicide	Herbicide group #	Unit	<3% Organic Matter			≥3% Organic Matter			Inc. for No-Till ¹
			Coarse	Medium	Fine	Coarse	Medium	Fine	
Outlook 6.0E	15	fl oz	14	16	18	14	16	18	no
Panther MTZ	5, 14	fl oz	do not use ³	15	18	12	15–18	18	no
Panther Pro	5, 14, 2	fl oz	do not use ³	12	15	do not use ³	12	15	no
Perpetuo 2.3SC	14, 15	fl oz	8.0	10.0	10.0	8.0	10.0	10.0	no
Prefix 5.3E	14, 15	pt	2.0	2.25	2.5	2.25	2.5	2.5	yes
Preview 2:1SC	5, 14	fl oz	11	16	22	14	22	26	no
Prowl 3.3E	3	pt	1.8	2.4	2.4	1.8	2.4	3	yes
Prowl H ₂ O 3.8CS	3	pt	1.5	2.0	2.0	1.5	2.0	2.5	yes
Pursuit 2S	2	fl oz	4.0	4.0	4.0	4.0	4.0	4.0	no
Reflex 2E	14	pt	1.25	1.25	1.25	1.25	1.25	1.25	no
Spartan 4F	14	fl oz	6	8	10	8	10	12	no
Surveil 48WG	2, 14	oz	3.5	4.2	4.2	3.5	4.2	4.2	no
Tendovo 4.12 ZC	15, 5, 2	qt	1.2	1.5	1.9	1.5	2.0	2.3	no
Treflan 4E	3	pt	1.0	1.5	2.0	1.5	1.5	2.0	no
Trivence 61.3WDG	2, 5, 14	oz	7	8	8	7	8	8	no
Valor SX 51WDG	14	oz	2.5	2.5	2.5	2.5	2.5	2.5	no
Valor EZ 4SC	14	fl oz	2.5	2.5	2.5	2.5	2.5	2.5	no
Valor XLT 40.3WDG	2, 14	oz	3	3.5	4	3	4	4.5	no
Warrant/Enversa 3CS	15	qt	1.5	1.5	1.5	1.5	1.5	1.5	no
Warrant Ultra 3.45CS	14, 15	fl oz	48	55	60 ²	60	60 ²	60 ²	no
Zidua 81WDG	15	oz	2	2.5	3	2	2.5	3	no
Zidua SC 4.17SC	15	fl oz	3.3	4.1	4.9	3.3	4.1	4.9	no
Zidua PRO 4.09SC	15, 2, 14	fl oz	6	6	6	6	6	6	no
Zone Defense	14, 14	oz	4.0	5.0	5.0	5.0	5.0	–	no

¹ In general, when increasing the product rate for no-till or reduced tillage, use the upper end of the rate range if applicable. See specific product label for additional information on application rates and uses.

² Maximum rate depends on the location; refer to label for rates based on area use map.

³ Not recommended on coarse-textured soils due to potential crop injury.

Table 5.50 - Herbicides Commonly Used after Soybean Emergence (POST)

Comparable residual activity is given for comparison purposes only. The data are based on herbicide half-life, which is the length of time it takes for half the herbicide to break down. Herbicide degradation (break-down) is the result of chemical and/or microbial activity, which can be dependent on soil pH, soil temperature and soil moisture levels. Since degradation is dependent on a number of factors, length of time can vary for herbicides based on the specific environmental conditions. Residual activity is not the same as herbicide carryover. Herbicide rates maybe less with POST applications than PRE so duration of residual control may not be as long.

Postemergence (POST) Activity

Translocated herbicide These herbicides move throughout the plant and can cause injury to parts of the plants that are did not come in direct contact with the herbicide spray.

Contact herbicide These herbicides do not move throughout the plant. They cause injury only to those parts of the plant that comes in contact with the spray. Spray coverage is more critical for contact than translocated herbicides.

Group 1 herbicides only control grass weed species (no activity on yellow nutsedge).

Group 15 herbicides do not control weeds that are emerged at time of application.

Residual Activity

none

short= 1 to 2 weeks of residual control

yes= over 2 weeks of residual control

Trade Name	Site of Action Number	POST Activity	Residual Activity ¹
Assure II / Targa	1	translocated	none
Basagran	6	contact	none
Cadet	14	contact	none
Classic	2	translocated	broadleaf only
Cobra	14	contact	none
Dual Magnum	15	none	yes
Enlist One	4	translocated	none
FirstRate	2	translocated	yes
Fusilade DX	1	translocated	none
glyphosate	9	translocated	none
Harmony SG	2	contact	none
Liberty/Interline/ Scout/others	10	contact	none
Permit/Sandea	10	translocated	broadleaf only
Poast	1	translocated	none
Pursuit	2	translocated	yes
Raptor/Beyond Xtra	2	translocated	yes
Reflex/Flexstar	14	contact	Broadleaf only
Resource	14	contact	none
Select Max	1	translocated	none
Ultra Blazer	14	contact	none
Warrant/Enversa	15	none	yes
Zidua	15	none	yes

¹ Residual activity: none; short = 1 to 2 weeks of residual control; yes = over 2 weeks of residual control. See Table 5-59 for more information.

Table 5.50 - Herbicides Commonly Used after Soybean Emergence (POST) (cont.)

Herbicide Pre-mixes	Site of Action Number	Constituent Products
Anthem Maxx	14, 15	fluthiacet, pyroxasulfone
Enlist Duo	4, 9	Enlist One, glyphosate
Extreme	9, 2	glyphosate, Pursuit
Flexstar GT	9, 14	glyphosate, Reflex
Intermoc	10, 15	Liberty/Interline/Scout/others, Dual Magnum
Permit Plus	2, 2	halosulfuron (Permit/Sandea), Harmony
Prefix	15, 14	Dual Magnum, Reflex
Sequence	9, 15	glyphosate, Dual Magnum
Storm	6, 14	Basagran, Ultra Blazer
Synchrony	2, 2	Harmony, Classic
Warrant Ultra	15, 14	Warrant, Reflex

Table 5.51 - Relative Effectiveness of Postemergence Herbicides on Individual Weed Species

Ratings are based on labeled application rates and weeds at 4 inches in height. Results may differ with variations in weed size, temperature, rainfall, soil moisture, and spray coverage. Ratings are based only on postemergence (POST) activity and do not reflect possible residual activity. For ratings on herbicide combinations not listed, see the component parts. Ratings assume good growing conditions and proper usage of adjuvants.

Weed control rating:	Crop tolerance:
10 = 95–100%	E = excellent; almost never any crop injury observed
9 = 85–95%	VG = very good; on rare occasion is crop injury observed
8 = 75–85%	G = good; seldom is crop injury observed as long as proper management practices are followed (e.g., herbicide rate and application timing, adjuvants)
7 = 65–75%	FG = fair to good; occasionally crop injury is observed even with proper management practices; injury is often due to herbicide interactions with environmental conditions
6 = 55–65%	F = fair; some crop injury is commonly observed
N = less than 55% or no control	
+ = upper end of rating scale	

Trade Name (rates/A)	Site of Action Number	Grasses														
		Barnyard-grass	Bermudagrass	Broadleaf signalgrass	Crabgrass	Fall Panicum	Foxtails, spp. ¹	Goosegrass	Johnsongrass (Seedling)	Johnsongrass (Rhizome)	Quackgrass	Shattercane	Texas panicum	Volunteer Corn	Wirestem Muhly	Yellow Nutsedge
Assure II (8 fl oz)	1	9	9	9	8+	9	9 ¹	9	9	9	9	9+	8+	9+	6	N
Basagran (1 qt)	6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	7+
Classic (0.67 oz)	2	N	N	N	N	N	N	N	N	N	N	6	N	6	N	8
Fusilade DX (12 fl oz)	1	9	9	9	8+	9	8+	9	9	9	9	9+	8+	9+	8+	N
Glyphosate (0.75 lb ae) ²	9	9+	9	9+	9+	9	9+	9+	9+	9	9	9	9+	9 ³	9	7
Liberty/Interline/Scout/ others (32 fl oz) ⁴	10	8	6	8+	8+	8+	8 ¹	6	9	6	6	9	8	7 ⁵	7	6
Poast (1 – 1.5 pt) ⁶	1	9+	8+	9+	9	9	9+	9	8+	8	8	8+	9+	8	7	N
Pursuit (4 fl oz)	2	8	N	8	7	8	8 ¹	N	9	7	6	9	6	6	N	7
Raptor/Beyond Xtra (5 fl oz)	2	8	N	8	7	8	8 ¹	N	8+	7	N	8+	6	8	N	6
Select (8 fl oz)	1	9	9	9+	9	9	9+	9	9	9	8+	9	9+	9	8+	N
Mixtures																
Flexstar GT (4.5 pt) ²	9/14	9+	9	9+	9+	9	9+	9+	9+	9	9	9	9+	9 ³	9	7
Fusion (8 fl oz)	1/1	9	9	9	8+	9	9 ¹	9	8	8	8	8	8+	8	6	N
Permit Plus (0.75 oz) ⁷	2/2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9+
Storm (1.5 pt)	6/14	N	N	N	N	N	N	N	N	N	N	N	N	N	N	7+
Synchrony (0.75 oz) ⁷	2/2	N	N	N	N	N	N	N	6	N	N	6	N	6	N	8

¹ Herbicide is less effective on yellow foxtail compared to giant foxtail. Ratings for yellow foxtail: Assure II/Targa = 7; Fusion = 8; Liberty = 6 Pursuit = 6; Raptor = 6

² For use on glyphosate-resistant soybean varieties only.

³ Glyphosate will not control glyphosate-resistant corn.

⁴ For use on glufosinate-resistant soybean varieties only.

⁵ Liberty will not control glufosinate-resistant corn, nor many hybrids with Bt traits.

⁶ Rates for Poast on annual grasses is 1 pt and 1.5 pt for perennial grasses.

⁷ For use on STS, Bolt, or non-STS soybean varieties; a lower rate must be used on non-STS varieties.

Table 5.51 - Relative Effectiveness of Postemergence Herbicides on Individual Weed Species (cont.)

Trade Name (rates/A)	Broadleaves																	
	Site of Action Number	Burcucumber	Cocklebur	Horseweed / Marestalk ^{1,2}	Jimsonweed	Lambsquarters	Morningglory, Annual	Nightshade, Eastern Black	Palmer Amaranth / Waterhemp ^{1,2}	Pigweed ¹	Ragweed, Common ^{2,3}	Ragweed, Giant	Sicklepod	Sida, Prickly	Smartweed	Spurred Anoda	Velvetleaf	Soybean Tolerance
Basagran (1 qt)	6	N	9	N	9	8	N	N	6	6	8	7	N	8	9	8+	8+	FG
Cadet (0.9 oz)	14	N	N	N	N	7	7	7	7	7	N	N	N	7	N	7	9+	F
Classic (0.67 oz)	2	8	9+	7 ¹	9	7	7	N	N ¹	9 ¹	8 ³	7+	8	N	8+	N	8	F
Cobra (12.5 fl oz)	14	8	8	N	9	7	8	8+	9	9	9 ³	8+	6	6	7	7	8+	F
Enlist One (2 pt) ⁴	4	7	9	8+	8+	9	8	8	8+	8+	8+	7+	8	8	7+	8	8	E
FirstRate (0.3 oz)	2	6	9	8 ¹	8	N	8+	N	N	N	9 ³	9	6	N	8	9	9	VG
Glyphosate (0.75 lb ae) ⁵	9	8+	9	6 ²	9	8+	8	8	N ²	9+	9 ²	8	9	8	8+	9	8	E
Harmony SG (0.125 oz) ⁶	2	7	7+	N	7	9	N	N	N	9 ¹	6 ³	N	N	N	9	N	8+	- ⁷
Liberty, Interline, Scout, others (32 fl oz) ⁶	10	8	9	8+	9	9	8	8	8+	8+	9	8+	8+	8	8+	7+	8	VG
Pursuit (4 fl oz) ¹	2	6	9	N	8	7	7+	8+	N ¹	9 ¹	8 ³	6	N	6	8+	7	9	FG
Raptor/Beyond Xtra (5 fl oz) ¹	2	6	9	N	8	8+	7	8+	N ¹	9 ¹	8 ³	8	N	6	8	7	9	G
Reflex/Flexstar (1.25 pt)	14	7	8	N	9	6	8	8+	9	9	9 ³	8	N	N	8	6	7+	FG
Resource (6 fl oz)	14	6	6	N	7	7	N	8	7+	7+	7+ ³	6	N	6	6	6	9+	FG
Ultra Blazer (1.5 pt)	14	7	8	N	9	7	8	8	9	9	9 ³	8	N	N	8+	6	7+	F
Mixtures																		
Flexstar GT (4.5 pt) ⁴	9/14	8+	9	6 ²	9	8+	8	8	9 ²	9	9 ^{2,3}	9	9	8	8+	9	8+	F
Permit Plus (0.75 oz) ⁷	2/2	7	9	N	7	9	6	6	N ¹	9 ¹	9 ³	8	N	7	9	-	9	- ⁸
Storm (1.5 pt)	6/14	6	8	N	9	7	7+	7	8+	8+	8+ ³	7	6	7	8+	8	8	FG
Synchrony (0.75 oz) ⁷	2/2	8+	9+	8 ¹	9	9	7	N	N ¹	9+ ¹	8 ³	7+	8+	N	9	N	9	- ⁸

¹ Group 2 resistance has been confirmed for this species and it is widespread in the region; Group 2 herbicides will not control these biotypes.

² Glyphosate resistance has been confirmed for this species and is widespread in the region.

³ Common ragweed biotypes resistant to Groups 2 and 14 herbicides have been confirmed in the region. Group 14 resistance is limited to the DelMarVa region and New Jersey.

⁴ For use on 2,4-D resistant (Enlist E3) soybean varieties only.

⁵ For use on glyphosate-resistant soybean varieties only.

⁶ For use on glufosinate-resistant soybean varieties only.

⁷ For use on STS, Bolt, or non-STS soybean varieties; a lower rate must be used on non-STS varieties.

⁸ Excellent crop tolerance for STS or Bolt varieties, but fair or worse ratings if used on non-STS varieties.

5-172 *Weed Control in Field Crops: Soybeans*

Table 5.52 - Effectiveness of Postemergence Herbicides on Perennial Broadleaf Weeds in Soybean (Based on Seasonal Control)

Weed control rating:

10 = 95–100% 9 = 85–95% 8 = 75–85% 7 = 65–75% 6 = 55–65% N = less than 55% or no control

– = no local data available + = upper end of rating scale L-S = labeled as suppressed

Trade Name	Site of Action Number	Canada Thistle	Dandelion	Dewberry	Dock spp.	Groundcherry	Hedge Bindweed	Hemp Dogbane	Horsenettle	Jerusalem Artichoke	Common Milkweed	Poison Ivy	Pokeweed
Basagran	6	7	N	N	7	N	7	N	6	6+	N	N	N
Classic	2	7	7	7	7	–	8	7	7	7+	6	6	7+
Cobra, Reflex, Ultra Blazer	14	6	N	N	6	6	7	6	7	6	6	N	7
Enlist One ¹	4	7	9+	6	8	7	9	6	6	–	6	7	7
FirstRate	2	L-S	–	–	–	–	–	–	6	–	–	–	6
Glyphosate (broadcast) ²	9	9	7	8	8	7+	8	8+	8	8	8	8	8+
Glyphosate (wiper application) ³	9	7	N	N	N	6	N	7+	N	7+	7+	6	8+
Liberty/ Interline/ Scout/others	10	6	7	–	6	6	N	6	7	–	6	–	6
Pursuit/ Raptor/ Beyond Xtra	2	6	7	6	7	–	7+	7	8	7	6	6	6
Synchrony	2/2	7+	7	7	6	–	7	7	N	7+	7+	6	7+

¹ For use on 2,4-D-resistant (Enlist E3) soybean varieties only.

² Broadcast applications of certain glyphosate products for use on glyphosate-resistant soybean varieties only. Refer to product label use restrictions. Information on various glyphosate formulations can be found in Table 5-2 (glyphosate table).

³ Mix 1/3 glyphosate product with 2/3 water. Two passes in opposite directions is most effective.

Table 5.53 - Weed Sizes for Postemergence Soybean Herbicides

This table lists postemergence soybean herbicides, their rates, and height ranges of weed species that are controlled or suppressed. This table is only a "quick reference"; refer to the herbicide label for additional information on application and timing. Postemergence grass herbicide rates may vary if tank-mixed with broadleaf herbicides due to antagonism. Split applications should be made if target growth stages for broadleaves and grasses do not correspond or if grasses to be managed are difficult-to-control species such as perennials. For split-applications, it is best to apply post-grass herbicides 24 hours before or about 7 days after broadleaf herbicide application.

Herbicides	Assure II/Targa ¹		Fusillade DX ^{1,2}		Fusion ^{1,2}		Liberty		Poast ¹		Pursuit 2L Xtra		Raptor/ Beyond		Glyphosate Select/Clethodim ^{4,5}											
	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH								
GRASSES Annuals	grass size (in.)	rate/A (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	gr. size ⁶ (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)								
Barnyard-grass	2-6	8 S ⁷	2-3	12	12	2-4	8	10	<4	—	18	—	1-3	4	2-5	5	4-8	0.75	1-4	4	—					
																						2-8	6	8-10		
Crabgrass	2-6	8 S ⁷	1-2	12	12	1-4	8	10	<6	4	24	24	1-3	4	2-4*	5	4-8	0.75	1-4	4-5	—					
Foxtail, giant	2-4	5	2-6	12	12	2-8	7	10	<8 ⁸	—	36	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	2-8	7				≤16 ⁸	8-14	—		6	24	24														
Foxtail, green	2-4	7	2-4	12	12	2-4	8	10	<16	36	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Foxtail, yellow	2-4	7 S ⁷	2-4	12	12	2-4	8	10	<16 ⁸	36	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Goose-grass	2-6	7	2-4	8	8	2-4	8	8-12	6	6	16	—	—	—	2-4	5	2-6	—	—	—	—	—	—	—	—	
Panicum, fall	2-6	7	2-6	12	12	26	8	10	<4	18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

Table 5.53 - Weed Sizes for Postemergence Soybean Herbicides (cont.)

This table lists postemergence soybean herbicides, their rates, and height ranges of weed species that are controlled or suppressed. This table is only a "quick reference"; refer to the herbicide label for additional information on application and timing. Postemergence grass herbicide rates may vary if tank-mixed with broadleaf herbicides due to antagonism. Split applications should be made if target growth stages for broadleaves and grasses do not correspond or if grasses to be managed are difficult-to-control species such as perennials. For split-applications, it is best to apply post-grass herbicides 24 hours before or about 7 days after broadleaf herbicide application.

Herbicides	Assure II/Targa ¹		Fusillade DX ^{1,2}		Fusion ^{1,2}		Liberty		Poast ¹		Pursuit 2L Xtra		Raptor/ Beyond		Glyphosate Select/Clethodim ^{4,5}							
	grass size (in.)	rate/A (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	grass size ⁶ (in.)	alone w/BH	alone w/BH	grass size (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A (lb ae/A)	grass size (in.)	rate/A ⁶ (fl oz)			
Panicum, Texas	2-4	8	2-8	12	2-8	8	8-12	4	22	8	8	16	-	-	-	-	-	2-6	6			
Shattercane	6-12	5	6-12	6	6-12	6	8	6	22	<18	-	24	-	1-8	4	2-8	5	4-8	0.75	4-10	4	
Signalgrass, broadleaf	2-6	10	2-4	12	2-4	8-10	10-12	3	22	8	8	16	-	1-8	4	2-5	5	2-6	6	6-18	6	8-10
Volunteer corn	6-18	5	12-24	6	12	12-24	6	8	10	22	<12	18	-	-	-	2-8	5	4-8	0.75	4-12	4	-
					12	29	<20	12	24	24	12-24	6	8-10									

Table 5.53 - Weed Sizes for Postemergence Soybean Herbicides (cont.)

Herbicides	Assure II/Targa ¹		Fusillade DX ^{1,2}		Fusion ^{1,2}		Liberty		Poast ¹		Pursuit DG		Raptor/Beyond Xtra		Glyphosate		Select/Clethodim ^{4,5}		
	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH	alone	w/BH	
GRASSES	grass size (in.)	rate/A (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A ⁶ (fl oz)	gr. size ⁶ (in.)	rate/A ⁶ (fl oz)	grass size (in.)	rate/A (oz)	grass size (in.)	rate/A (fl oz)	grass size (in.)	rate/A (lb ae/A)	grass size (in.)	rate/A ⁶ (fl oz)	
Bermudagrass																			
1st applic.	≤6	10	4-8	12	4-8	12	22	stolon	6	24	-	-	-	-	-	-	3	8	
2nd applic.	≤6	7	4-8	8	4-8	8	22	stolon	4	16	-	-	-	-	-	-	3	8	
Johnsongrass (rhizome)																			
1st applic.	10-24	10	8-18	12	8-18	12	-*	20-25	6-12*	24	6-12*	4	6-12*	5	12-24	0.75-1.5	12-24	8	16
2nd applic.	6-10	7	6-12	8	6-12	8	6-12	6-12	24	24	<24	-	-	-	-	-	6-18	6	-
Quackgrass																			
1st applic.	6-8	10	S ⁷	6-10	12	6-10	12	6-8	6-8	36	-	-	-	4-8*	5	0.75-1.5	4-8	8	16
2nd applic.	4-8	7	<10	8	-	10	8	6-8	6-8	36	-	-	-	4-8*	8	-	-	-	-
Wirestem muhly																			
1st applic.	4-8*	8	S ⁷	4-12	12	4-12	8	<6	<6	36	-	-	-	-	-	0.75-1.5	4-8+	8	16
2nd applic.	4-8*	7	-	4-12	12	4-12	8	<6	<6	36	-	-	-	-	-	-	4-8	8	-

* Suppression only; provides <75% control. ≤ means less than or equal to; > means greater than.

¹ May be tank-mixed with certain broadleaf herbicides only, refer to herbicide labels.

² Special reduced rates may be possible if applied early and under certain conditions; refer to label.

³ For use on glyphosate-resistant soybean varieties only. Split applications may be necessary if new weed flushes occur.

⁴ Select/Clethodim can be applied at a special high rate of 8 oz/A for annual grasses and 16 oz/A for perennials. These high rates should be used only for heavy grass pressure or when grasses are at maximum height.

⁵ Select/Clethodim application rates vary when tank-mixed with certain broadleaf herbicides. Average rate ranges are shown above. Refer to label for additional information.

⁶ Refers to rate per acre of herbicide if applied alone or if tank-mixed with broadleaf herbicides ("w/BH"). For Poast, target grass sizes are smaller if tank-mixed with broadleaf herbicides.

⁷ Split applications may be necessary. May not provide adequate control of this species if tank-mixed with a broadleaf herbicide.

⁸ Rescue application only, better control will result if applied alone. (Do not tank-mix Fusion with broadleaf herbicides for rescue treatments).

Table 5.53 - Weed sizes for postemergence soybean herbicides (cont.)

Broadleaves	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters	Morningglory, Annual	Nightshade, Eastern Black	Palmer Amaranth	Waterhemp	Pigweed	Ragweed, Common	Ragweed, Giant	Sida Prickly	Smartweed	Spurred Anoda	Velvetleaf
Herbicide (rate/A)	height range (inches) at application														
Basagran (2 pt)	-	≤10	≤10	≤2*	-	-	-	-	-	≤3	≤6	3	≤10	4	≤6
Caddet (0.9 fl oz)	≤3	-	≤2	≤3*	≤3	≤2	≤4	≤4	≤4	-	-	-	≤2	-	≤36
Classic (0.5 oz)	-	2-6	2-4	-	1-2	-	1-2	1-2	1-2	-	-	-	1-2	-	-
Classic (0.66 oz)	2-3*	2-8	2-5	-	1-3	-	1-3	1-3	1-3	2-3	2-4*	-	1-3	-	2-4
Classic (0.75 oz)	2-6*	2-12	2-6	-	1-4	-	1-4	1-4	1-4	2-4	2-6	-	1-4	-	2-6
Cobra (12.5 fl oz) ¹	4 lvs	6 lvs	4 lvs	-	<4 lvs	6 lvs	6 lvs	6 lvs	6 lvs	6 lvs	4 lvs	3	4 lvs*	2*	4 lvs
Enlist One (2 pt) ²	-	≤6	≤6	≤6	≤6	≤6	≤6	≤6	≤6	≤6	≤6	≤6	≤6	≤6	≤6
FirstRate (0.3 oz)	-	<10	<4	-	<6	-	-	-	-	<10	<10	-	<6	-	<6
Flexstar GT (3.5 pt)	-	≤4	≤4	≤4	≤3	≤4	≤4	≤4	≤4	≤4	≤4	2	≤4	4	≤4
Glyphosate (0.75 lb ae) ³	4-8	4-8	4-8	3-6	3-6	4-8	4-8	4-8	4-8	4-8	4-8	2	3-6	2	4-8
Harmony SG (0.125 oz)	-	2-6*	2-4*	2-4	-	-	2-8	2-8	2-8	-	-	-	2-6	-	2-6
Liberty (32 fl oz)	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Permit Plus (0.75 oz)	≤3	≤9	≤4	≤4	≤3	-	≤6	≤6	≤6	≤9	≤3	-	≤6	-	≤9
Pursuit 2L (4 fl oz)	-	1-8	1-3	1-2*	1-2*	1-3	1-8	1-8	1-8	1-3*	1-3*	-	1-3	1-2	1-3
Raptor/Beyond Xtra (5 fl oz)	-	2-8	2-6	2-5	2-4	2-5	2-8	2-8	2-8	2-5*	2-5	4*	2-5	-	2-8
Reflex (1.25 pt) ¹	-	2 lvs	6 lvs	2 lvs	2 lvs	4 lvs	2-6 lvs	2-6 lvs	2-6 lvs	4 lvs	4 lvs	-*	4 lvs	2 lvs	2 lvs
Resource (6 fl oz) ¹	-	-	-	2-3 lvs*	-	-	≤3 lvs ³	≤3 lvs ³	≤3 lvs ⁴	≤4 lvs	-	3	-	-	≤8 lvs
Storm (1.5 pt)	-	≤6	≤6	≤2*	≤2	≤2	2-3	2-3	2-3	≤3	≤6	2	≤6	2	≤2*
Synchrony ⁵	2-3*	2-8	2-5	2-4	1-3*	-	2-8	2-8	2-8	2-4	2-4*	-	2-8	3*	2-8
Ultra Blazer (1.5 pt)	-	≤2	≤6	≤2	≤2	≤2	≤4	≤4	≤4	≤3	≤3	-	≤6	-	-

Note: See Table 5.3 (generics table) for additional herbicides that contain these active ingredients and Table 5.2 (glyphosate table) for information on glyphosate formulations.

* Suppression only, additional control measures may be necessary.

¹ Labels refer to weed size by number of leaves (lvs).

² For use on 2,4-D-resistant (Enlist E3) soybean varieties only.

³ For use on glyphosate-resistant soybean varieties only.

⁴ Smooth pigweed control only.

⁵ For use on STS, Bolt, or non-STS varieties; use lower rate on non-STS soybeans.

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The following herbicides can be added with postemergence herbicides to improve residual weed control. They will not provide control of emerged weeds, so they should be applied to weed-free soil surface, or apply with products that will provide post-emergence control of weeds present at time of application. Consult labels when tankmixing with any herbicide. Some pesticides or adjuvants used in combination with the following herbicides could increase the chance of soybean injury.

Residual Herbicides Labeled for Postemergence Use

Table 5.54 - Comments on Postemergence Herbicides for Soybeans

Trade Name	Herbicide Common Name	Site of Action Number	Application (timing on soybean growth stage)	Product/A	lb ai/A
Anthem Maxx 4.3SC	pyroxasulfone + fluthiacet	15 14	preemergence up to third trifoliolate (R6)	2–5.7 fl oz	0.033–0.186 0.002–0.006
<ul style="list-style-type: none"> • Do not exceed a seasonal total of 3.4 fl oz on coarse soils or 5.7 fl oz on all other soils. • Contains fluthiacet (Cadet) and pyroxasulfone (Zidua); see Cadet and Zidua for more information. • Make applications at least 60 days before harvest. 					
Dual Magnum 7.62EC Dual II Magnum 7.64EC	S-metolachlor	15	postemergence	1–2 pt	0.95–1.9
<ul style="list-style-type: none"> • Application timing is not specified on label. • Do not exceed a seasonal total of 3.9 pt/A. • Make applications at least 75 days before harvest. • A prepackaged mixture with glyphosate is available as Sequence; application timing is cracking through 3PrdP leaf stage. • A prepackaged mixture with fomesafen (Reflex) is available as Prefix; label mentions early postemergence application timing. Ratio of fomesafen (Reflex) is too low for consistent postemergence control of emerged weeds. • DO NOT exceed 3.71 lb ai/A/year of any S-metolachlor containing product • <i>Water quality advisory.</i> 					
Inversa 3CS	acetochlor	15	EPP or PRE	1.25–2qt	0.94–1.5
<ul style="list-style-type: none"> • Encapsulated acetochlor for enhanced crop safety and residual control of weeds before they germinate. • Can be applied preplant through R2. POST application should be made after soybeans are completely emerged but before soybeans reach growth stage R2. • The optimum timing and rate of application is when soybeans are V2-V3 at 1.5 qts/acre. • Weeds emerged at the time of application are not controlled by this product. • <i>Water quality advisory.</i> 					
Outlook 6EC	dimethenamid	15	cracking stage to 5th trifoliolate (V5)	12–21 fl oz	0.56–0.98
<ul style="list-style-type: none"> • Rates vary with soil type, refer to label. • Limited residual control when applied to coarse-textured soils. • Do not exceed a seasonal total of 24 fl oz. 					
Perpetuo	pyroxasulfone flumiclorac	15 14	emergence to 6th trifoliolate (V6)	6.0–10.0 fl oz	0.108–0.180
<ul style="list-style-type: none"> • Do not apply more than 8 fl oz/ac on coarse soils. • Contains flumiclorac (Resource) and pyroxasulfone (Zidua); see Resource and Zidua for more information. 					

5-178 Weed Control in Field Crops: Soybeans

Table 5.54 - Comments on Postemergence Herbicides for Soybeans

Trade Name	Herbicide Common Name	Site of Action Number	Application (timing on soybean growth stage)	Product/A	lb ai/A
Warrant 3CS	acetochlor	15	emergence to R2	1.25–2 qts	0.94–2.0
<ul style="list-style-type: none"> • Rates vary with soil type and organic matter, refer to label. • Do not exceed 4 qts/A/yr. • Label recommends application at V2 to V3 stage. • A prepackaged mixture with fomesafen (Reflex) is available as Warrant Ultra; ratio of fomesafen (Reflex) is too low for consistent postemergence control of emerged weeds. 					
Zidua 85WDG	pyroxasulfone	15	emergence to 6th	1–3.5 oz wt	0.053–0.186
Zidua SC 4.17SC			trifoliolate	1.75–5.75 fl oz	0.057–0.187
<ul style="list-style-type: none"> • Rates vary with soil type, refer to label. • Can be applied from emergence to the sixth trifoliolate stage. • Do not exceed 2.1 oz wt and 3.5 fl oz per acre per season on coarse-textured soils, 3.0 oz wt and 5.0 fl oz on medium-textured soils, and 3.5 oz wt and 5.75 fl oz on fine-textured soils of Zidua 85WDG and Zidua SC 4.17SC, respectively. 					

The following herbicides are commonly applied postemergence to control emerged weeds. Most of these herbicides require an adjuvant to improve control; refer to proper tables to assist with adjuvant selection.

Postemergence Herbicides

Table 5.54 - Comments on Postemergence Herbicides for Soybean (cont.)

Trade Name	Herbicide Common Name	Site of Action Number	Application	Product/A	Active Ingredient (ai) lb/A
Assure II 0.88E/ Targa	quizalofop	1	postemergence	5–10 fl oz	0.03–0.06
<ul style="list-style-type: none"> • Do not use crop oils manufactured from vegetable oils. • When tank-mixing with a broadleaf herbicide, always read both labels to make sure the right surfactant and concentration are used. • Apply when grasses are within the recommended growth stage specified on the label • Perennial grasses may require a second application for complete control. • Apply to actively growing grasses in 10 to 40 gallons of water per acre using flat fan or hollow cone nozzles. • To avoid antagonism (reduced grass control) from broadleaf herbicides, spray 2-3 days before the broadleaf herbicide or wait 7 days after the broadleaf herbicide application. • Assure II/Targa must be applied at least 80 days before harvest. • A premix with glufosinate (Liberty) is available as Zalo. 					

Table 5.54 - Comments on Postemergence Herbicides for Soybean (cont.)

Trade Name	Herbicide Common Name	Site of Action Number	Application	Product/A	Active Ingredient (ai) lb/A
Basagran 4S	bentazon	6	postemergence	1.5–2.0 pt	0.75–1.0
<ul style="list-style-type: none"> • Application should be made while weeds are small and actively growing and before weeds reach maximum size listed on product label. Basagran will not control pigweed species. • Add crop oil concentrate or nitrogen solution to spray mixture as directed. • Apply in a minimum of 20 gal of water/A and at minimum pressure of 40 psi. • Tank-mixing with Ultra Blazer improves pigweed control. • Apply at least 30 days prior to harvest as forage. • <i>Water quality advisory.</i> 					
Butyrac 200 2L	2,4-DB	4	postemergence	0.7–0.9 pt	0.175–0.22
<ul style="list-style-type: none"> • 2,4-DB is not recommended for use by itself due to limited control and potential for crop injury. Rather 2 oz of 2,4-DB can improve morningglory, cocklebur, and jimsonweed control when tank-mixed with other postemergence herbicides. • Potential for crop injury is increased under hot, dry growing conditions. • If more than 2 oz/A rate is used, apply as directed spray into rows when soybeans are 8 to 12 inches high and cocklebur, morningglory, jimsonweed and pigweed have not exceeded a height of 3 inches. • Top of weed seedling must be sprayed. Use precision directed spray application equipment. Apply with sprayer nozzles mounted on skids or gauge wheels. Do not spray more than one-third of the base of soybean as severe injury may occur. • Apply at least 60 days prior to harvest (forage or grain). 					
Cadet 0.91EC	fluthiacet	14	emergence to full flowering (R2)	0.4–0.9 fl oz	0.0028–0.006
<ul style="list-style-type: none"> • Apply 0.4 to 0.6 fl oz/A with glyphosate (RR-soybean) or glufosinate (LL-soybean); or 0.6 to 0.9 fl oz when applied alone. • Include the necessary spray additives (NIS or COC plus AMS or nitrogen solution). Applications should be made when susceptible broadleaf weeds are small. Cadet is very effective on velvetleaf, but other broadleaf weeds must be small (less than 3 inches) to achieve control/suppression. Tank-mixing with other herbicides will usually be necessary to provide broad-spectrum weed control. • Cadet does not provide residual weed control. • Cadet can cause bronzing or browning of the soybean leaves. • Marvel is prepackaged mixture with Reflex and Cadet; but rate of Reflex is below what is typically recommended and needed for effective weed control. • Apply at least 60 days prior to grain harvest. 					

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Table 5.54 - Comments on Postemergence Herbicides for Soybean (cont.)

Trade Name	Herbicide Common Name	Site of Action Number	Application	Product/A	Active Ingredient (ai) lb/A
Classic 25DF	chlorimuron	2	after 1st trifoliolate (V1)	0.5–0.75 oz wt	0.008–0.012
<ul style="list-style-type: none"> • Application should be made while weeds are small and actively growing. • Always read the label to determine the proper adjuvants. • Observe labeled rotational crop restrictions for all products containing Classic (see Table 5-5). • If the soil pH is greater than 7.0, at Classic rates of 0.5 oz/A or greater, do not plant corn for at least 9 months after application. Use of STS and Bolt varieties will reduce the risk of injury. • Classic plus Harmony SG is available as a prepackaged mixture called Synchrony XP. Synchrony XP can be applied to non-STS soybean varieties at 0.375 oz/A use rate or to STS and Bolt varieties at rates up to 1.125 oz/A. • There is widespread resistance to Classic and other Group 2 herbicides in the region. • Apply at least 60 days prior to harvesting for grain. 					
Cobra 2E	lactofen	14	postemergence	6.0–12.5 fl oz	0.09–0.19
<ul style="list-style-type: none"> • Soybeans should have one to two trifoliolate leaves. • Applications should be made while weeds are small and actively growing. • Use surfactant or crop oil concentrate as directed. • Cobra often causes foliar injury to soybeans. • Use 6–8 fl oz/A for control of four- to six-leaf common ragweed or pigweed. • Apply at least 45 days prior to harvesting for grain or prior to R6 (full seed). 					
Enlist One 3.8SL	2,4-D choline	4		1.5–2 pt	0.71–0.95 ae
Enlist Duo 3.3SL	2,4-D choline + glyphosate	4 9	emergence up to R2	3.5–4.75 pt	0.71–0.95 ae 0.74–1.0 ae
<ul style="list-style-type: none"> • Apply over-the-top to 2,4-D tolerant (Enlist E3) soybean varieties only. • Apply in a broadcast spray volume from 10 to 15 gallons per acre for best results. • Applications should be made while weeds are small (4 inches) and actively growing. • Do not apply more than one preemergence application and no more than two postemergence applications per season. • Make one to two applications with a minimum of 12 days between applications. • Spray droplet size plays an important role in minimizing off-target movement. Nozzles that produce extremely coarse or ultra-coarse droplets while limiting the amount of driftable fine droplets are necessary to limit drift. Comply with guidelines for drift management (see labels for details). • Reduced grass control can occur when tank-mixed with group 1 herbicides as well as glyphosate. • Refer to product label and Enlist.com/TankMix for details on approved adjuvants, drift reduction agents, other tank mixes, drift management, recommended nozzles and pressures, wind speed, boom height, temperature inversions, buffers, susceptible plants, spray equipment cleanout, and other use guidelines that must be followed when using these products. • For all applications, consult label for run-off mitigation measures. • Available online training: https://www.enlist.com/en/enlist-360-training.html. 					

Table 5.54 - Comments on Postemergence Herbicides for Soybean (cont.)

Trade Name	Herbicide Common Name	Site of Action Number	Application	Product/A	Active Ingredient (ai) lb/A
Engenia	dicamba BAMPA Salt	4	N/A	12.8 fl oz for Engenia	0.5 (ae)
XtendiMax	dicamba DGA Salt with VaporGrip			22 fl oz for Xtendimax	0.5 (ae)
<ul style="list-style-type: none"> • These herbicides may not have registration in 2021 and beyond. Carefully read and follow product labels. • As of July 31, 2024 (and at the time of printing this publications), use of Engenia, XtendiMax, and Tavium is prohibited per the District Court of Arizona's order and the EPA's existing stocks order. • Refer to product label and Engeniatankmix.com and xtendimaxapplicationrequirements.com for details. 					
FirstRate 84WDG	cloransulam	2	1 st trifoliolate to R1	0.3–0.6 oz	0.016–0.031
<ul style="list-style-type: none"> • Tank-mix to broaden weed spectrum. • FirstRate may be applied up to 0.6 oz for heavy weed infestations or added residual control. • FirstRate water-dispersible packets are not soluble in liquid fertilizer solutions; premixing in water is required. UAN will improve velvetleaf control. • Two applications of 0.3 oz/A are allowed. Do not exceed 1.05 oz/A per season. • FirstRate is a Group 2 herbicide, and there is wide-spread resistance in the region to this family of herbicides. • Apply at least 65 days prior to harvesting for grain and 14 days prior to harvesting for forage. • <i>Water quality advisory.</i> 					
Flexstar GT 3.5	glyphosate + fomesafen	9 + 14	postemergence	3–4.5 pt	1.0–1.47 (ae) + 0.24–0.35
<ul style="list-style-type: none"> • Prepackaged mixture of glyphosate plus Reflex; refer to comments in those sections for more information. 					
Fusilade DX 2E	fluazifop	1	postemergence	6–12 fl oz	0.09–0.18
Fusion 2.56EC	fluazifop + fenoxaprop	1 + 1	postemergence	6–12 fl oz	0.094–0.188 0.031–0.062
<ul style="list-style-type: none"> • See label for rate and size of weed to be controlled. • Most annual grasses should be treated when 2–4 inches in height. Perennial grasses may require second application to achieve complete control. • To avoid antagonism (reduced grass control) from broadleaf herbicides, spray 2-3 days before the broadleaf herbicide or wait 7 days after the broadleaf herbicide application. • Apply before soybeans begin to bloom. 					

Table 5.54 - Comments on Postemergence Herbicides for Soybean (cont.)

Trade Name	Herbicide Common Name	Site of Action Number	Application	Product/A vary by formulation and acid equivalent ¹	Active Ingredient (ai) lb/A
Glyphosate	glyphosate	9	postemergence		0.75–1.5 (ae)

- Apply over-the-top to glyphosate-resistant (Roundup Ready) soybean varieties only.
- There are many formulations available, but sure to read the label for rates, adjuvants etc.
- Treat in-crop from soybean emergence through full flowering of soybeans.
- If additional weed emergence is anticipated, consider including a herbicide that provides residual control.
- Perennial weeds may require higher rates and repeat applications. Best control may be obtained when perennial weeds are treated in the bud to bloom growth stage.
- Include ammonium sulfate in the tank to improve control of weeds and be sure to read the label to determine if additional adjuvants are required or recommended.
- Observe maximum rates per application and per crop.
- If glyphosate-resistant weeds are present or Palmer amaranth is in the vicinity, include a second, highly effective herbicide to control these species.
- Avoid drift to adjacent crops or other desirable vegetation.

¹Consult specific product label for active ingredient concentration and application rate; various formulations of this herbicide are available (e.g., 1 qt/A glyphosate = 22 fl oz/A WeatherMax).

Harmony SG 50DF	thifensulfuron	2	at least 1st trifoliolate (V1)	0.125 oz wt (1/8 oz)	0.004
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- Harmony SG is a very concentrated formulation. Be sure to use proper application rate otherwise soybean injury may occur.
- Various formulations of Harmony 50SG and generic 75DF thifensulfuron are available, be sure proper rate is applied.
- Apply when weeds are actively growing and before they reach maximum size listed on product label.
- Any crop may be planted within 45 days following Harmony SG application.
- For adequate velvetleaf control, add 1 gallon of liquid nitrogen solution per acre.
- Use of STS or Bolt varieties will reduce the risk of injury.
- Harmony SG plus Classic is available as a pre-packaged mixture called Synchrony XP.
- Harmony SG plus Sandea/Permit is available as a pre-packaged mixture called Permit Plus.
- Synchrony XP can be applied to non-STS soybean varieties at 0.375 oz/A use rate or to STS or Bolt varieties at rates up to 1.125 oz/A rate.
- Harmony SG, generic thifensulfuron products, Permit Plus, and Synchrony XP labels state that the first trifoliolate leaf of the soybean is fully expanded before the application is made.
- Apply Harmony 7 days before harvesting forage green; 30 days before harvesting dried forage; and 60 days before harvesting for grain.
- Harmony is a Group 2 herbicide, and there is wide-spread resistance in the region to this family of herbicides.

Table 5.54 - Comments on Postemergence Herbicides for Soybean (cont.)

Trade Name	Herbicide Common Name	Site of Action Number	Application	Product/A	Active Ingredient (ai) lb/A
Intermoc	S-metolachlor + glufosinate	15 10	postemergence	64 fl oz	1.79
<ul style="list-style-type: none"> • Apply over-the-top to glufosinate-resistant soybean varieties (e.g., LibertyLink) only. • Apply a minimum of 64 fl oz/A to young, actively growing weeds. • Include AMS 2-4 lb/A. • Do not use nitrogen solutions as spray carriers. • Do not apply more than 2 applications per year, and do not apply more than 5 days apart. • Do not apply more than 122 fl oz/A per year. • <i>Water quality advisory.</i> 					
Liberty/Interline/ Scout/Others 2.34L	glufosinate	10	emergence to bloom stage (R1)	32–43 fl oz	0.59–0.79
<ul style="list-style-type: none"> • Apply over-the-top to glufosinate-resistant soybean varieties (e.g., LibertyLink) only. • For best results, plant in narrow rows and apply up to 43 fl oz Liberty about 4 weeks after residual herbicides were applied, when weeds are 2–4 inches tall, and before soybean canopy begins to interfere with spray coverage. • If using sequential applications, apply 10–14 days apart and do not apply more than 87 fl oz/A/season and before soybean bloom stage. • A residual soil-applied product or a sequential POST application may be necessary depending on weed species and severity. • Liberty provides no soil residual activity. • Tank-mixing Liberty with other herbicides including residual products (e.g., Dual, Outlook, Warrant) is allowed. Local university research has not observed increased injury with most herbicide combinations; some stunting and leaf burn was observed when Liberty was tank-mixed with Prefix. • Liberty must be applied with ammonium sulfate at the rate of 3 lb/A. • Use of surfactants or crop oils may increase risk of crop response. • Uniform, thorough spray coverage is necessary to achieve consistent weed control; do not use nozzles that produce large droplets; use at least 15 gal/A, 20 gal/A if dense vegetation is present. • Applications should be made between 2 hours after sunrise and 1 hour before sunset to avoid the possibility of reduced weed control. • Liberty has been observed to antagonize grass control with postemergence grass herbicides. • Apply 70 days before harvesting for grain or forage. • A premix with quizalofop (Assure II) is available as Zalo. 					
Permit Plus 74WDG	halosulfuron + thifensulfuron	2 2	1st trifoliolate to R2 stage	0.75 oz wt	0.031 0.004
<ul style="list-style-type: none"> • Permit Plus is labeled only for STS or Bolt varieties. • Permit Plus can be applied from V1 stage up till 88 days before harvest. • Permit Plus is excellent for yellow nutsedge control. • Can be tank-mixed with glyphosate. • See Harmony entry for more information. • Permit Plus contains two Group 2 herbicides, and there is wide-spread resistance in the region to this family of herbicides. 					

Table 5.54 - Comments on Postemergence Herbicides for Soybean (cont.)

Trade Name	Herbicide Common Name	Site of Action Number	Application	Product/A	Active Ingredient (ai) lb/A
Poast 1.5E	sethoxydim	1	postemergence	0.75–1.5 pt	0.14–0.28

- Application should be made when grasses are actively growing and within the recommended stage of growth on the Poast label. Perennial grasses may require a second application to achieve complete control.
- Nitrogen fertilizer additives may improve control of some species.
- To avoid antagonism (reduced grass control) from broadleaf herbicides, spray 2-3 days before the broadleaf herbicide or wait 7 days after the broadleaf herbicide application.
- Poast must be applied at least 75 days before harvest.

Pursuit 2S	imazethapyr	2	before bloom (R1)	4 fl oz	0.063
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- A prepackaged mixture with glyphosate is available as Extreme. The amount of glyphosate is lower than the rate commonly used with glyphosate is applied alone.
- Only one application of Pursuit can be made per soybean growing season.
- Extreme can only be applied to soybean varieties designated Roundup Ready.
- Observe rotational restrictions for products containing imazethapyr.
- Pursuit is a Group 2 herbicide, and there is wide-spread resistance in the region to this family of herbicides.
- Apply at least 85 days prior to grain harvest.
- *Water quality advisory.*

Raptor/Beyond Xtra 1S	imazamox	2	before bloom (R1)	4–5 fl oz	0.031–0.039
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- Occasionally, internode shortening and/or temporary yellowing of soybeans may occur, especially if under environmental stress.
- When adequate soil moisture is present, Raptor will provide residual activity of susceptible germinating weeds.
- Apply when weeds are actively growing and before they reach the maximum size listed on product label. Add a nonionic surfactant and fertilizer solution as directed).
- Less persistent than Pursuit, but follow labeled rotational crop restrictions
- Raptor is a Group 2 herbicide, and there is wide-spread resistance in the region to this family of herbicides.
- Apply at least 85 days prior to grain harvest.

Table 5.54 - Comments on Postemergence Herbicides for Soybean (cont.)

Trade Name	Herbicide Common Name	Site of Action Number	Application	Product/A	Active Ingredient (ai) lb/A
Reflex 2E or Flexstar 1.88E	fomesafen	14	postemergence	1.0–1.5 pt	0.25–0.375 or 0.235–0.35

- Do not apply Reflex or Flexstar or other fomesafen containing products more than once every 2 years.
- Follow labeled rotation restrictions (see Table 5.3).
- Flexstar can cause more soybean injury than Reflex.
- Prefix is a premix of Reflex and Dual and must be applied at least 90 days before grain harvest.
- Tankmixing Reflex with glyphosate formulated as a potassium salt can cause compatibility issues; glyphosate formulations as isopropyl or diammonium salts do not have this issue.
- Flexstar GT contains glyphosate plus fomesafen and should be applied only to glyphosate-resistant soybeans.
- Marvel is prepackaged mixture with Reflex and Cadet; but rate of Reflex is below what is typically recommended and needed for effective weed control.
- Prefix is a premix of Reflex and Dual and must be applied at least 90 days before grain harvest; Warrant Ultra is a premix of Reflex with Warrant and must be applied at least 45 days before grain harvest. Both have low ratio of Reflex and is below what is typically recommended for effective control.
- Apply Reflex 45 days prior to grain harvest.
- Do not apply within 14 days of an application of saflufenacil (Kixor or Sharpen).
- *Water quality advisory.*

Resource 0.86EC	flumiclorac	14	postemergence	4–12 fl oz	0.027–0.08
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- Apply to actively growing weeds at growth stages recommended on the label.
- Tank-mixing broadens the weed-control spectrum use higher rates for larger velvetleaf. Resource has activity against several other weeds when they are in the two- to three-leaf stage, including cocklebur, lambsquarters, common ragweed, jimsonweed, pigweed species, and prickly sida, but control declines on larger weeds.
- Apply in a minimum of 10 gal of water/A and a minimum pressure of 30 psi.
- In most cases, use a crop oil concentrate or other additive according to produce label.
- Apply at least 60 days prior to grain harvest.

Select 2E or Select Max 0.97EC/ Shadow 3EC	clethodim	1	postemergence	6–16 fl oz or 6–32 fl oz/ 4–10.67 fl oz	0.094–0.25 or 0.05–0.25/ 0.094–0.25
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- Clethodim is also available as Select Max, which contains a specialized adjuvant system, thus nonionic surfactant plus ammonium sulfate (AMS) is the standard adjuvant recommendation. Also, Select Max does not require additional adjuvants (other than AMS) when tank-mixed with a “loaded” glyphosate product and provides greater flexibility in additive selection when tank-mixed with other products.
- Select 2E should always include crop oil concentrate at 1 qt/A. Add ammonium sulfate at 2.5 lb/A to improve quackgrass control.
- Shadow 3EC should always include crop oil concentrate at 1 qt/A and ammonium sulfate at 2.5 to 4 lb/A or urea ammonium nitrate at 1 to 2 qt/A..
- To avoid antagonism (reduced grass control) from broadleaf herbicides, spray 2-3 days before the broadleaf herbicide or wait 7 days after the broadleaf herbicide application.
- Apply at least 60 days prior to grain harvest.

Table 5.54 - Comments on Postemergence Herbicides for Soybean (cont.)

Trade Name	Herbicide Common Name	Site of Action Number	Application	Product/A	Active Ingredient (ai) lb/A
Storm	bentazon + acifluorfen	6 + 14	postemergence	1–1.5 pt	0.33–0.5 0.167–0.25

- Prepackaged mixture of Basagran plus Ultra Blazer; refer to comments in those sections for more information.
- Apply at least 50 days prior to grain harvest.

Synchrony XP 28.4XP	chlorimuron + thifensulfuron	2 + 2	fully expanded 1 st trifoliolate (V1)	0.375–1.125 oz	0.005–0.015 + 0.0016–0.0045
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- Synchrony XP may be applied postemergence to STS or Bolt soybeans at a use rate of 0.375–1.125 oz/A; and to non-STS soybeans at 0.375 oz/A.
- Synchrony XP may be tank-mixed to improve weed control spectrum.
- Carefully observe crop rotation intervals and note that extended crop rotation intervals apply when Synchrony XP is applied following preemergence applications of other sulfonylurea or imidazolinone herbicides.
- Synchrony contains two Group 2 herbicides, and there is wide-spread resistance in the region to this family of herbicides.
- Apply at least 60 days before harvest.

Ultra Blazer 2S	acifluorfen	14	at least 1 trifoliolate (V1)	0.5–1.5 pt	0.125–0.38
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- Apply in a minimum of 20 gal of water/A and at a minimum pressure of 40 psi.
- Do not apply when weeds or crop are under stress; applications made under these conditions generally will be less satisfactory than those made under optimum conditions.
- Tank-mixing with Basagran improves velvetleaf and common lambsquarters control.
- Apply at least 50 days prior to grain harvest.
- *Water quality advisory.*

¹ Various glyphosate formulations exist; see Table 5.1 (glyphosate formulations for more information).

Table 5.55 - Spray Additives and Rainfastness for “Burndown” or Postemergence Soybean Herbicides

Spray additives, or adjuvants, are products included in the spray tank to improve the performance of herbicides. These include non-ionic surfactants (NIS), crop oil concentrate (COC), methylated or ethylated seed oil (MSO or ESO), or nitrogen solutions. In general, NIS should contain at least 80% active ingredient and COC should contain at least 15% emulsifier. Nitrogen solutions can be 28, 30, or 32% ammonium-based fertilizer solutions; ammonium sulfate (AMS) should be spray-grade dry ammonium sulfate (21-0-0) or other equivalent liquid formulation of AMS (refer to product label for use rate information).

Trade Names	Adjuvant(s)	Rate	Rainfastness (hours)
2,4-D (burndown)	none recommended		1
	or non-ionic surfactant	1 qt/100 gal	
	or crop oil concentrate	1–2 qt/A	
Aim, Cadet, Marvel	non-ionic surfactant	2 pt/100 gal	1
	or crop oil concentrate plus	1 gal/100 gal	
	ammonium sulfate or	2–4 lb/A	
	nitrogen solution (optional)	2–4 gal/100 gal	

Table 5.55 - Spray Additives and Rainfastness for “Burndown” or Postemergence Soybean Herbicides (cont.)

Spray additives, or adjuvants, are products included in the spray tank to improve the performance of herbicides. These include non-ionic surfactants (NIS), crop oil concentrate (COC), methylated or ethylated seed oil (MSO or ESO), or nitrogen solutions. In general, NIS should contain at least 80% active ingredient and COC should contain at least 15% emulsifier. Nitrogen solutions can be 28, 30, or 32% ammonium-based fertilizer solutions; ammonium sulfate (AMS) should be spray-grade dry ammonium sulfate (21-0-0) or other equivalent liquid formulation of AMS (refer to product label for use rate information).

Herbicide	Adjuvant(s)	Rate	Rainfastness (hours)
Assure II/Targa	non-ionic surfactant	1 qt/100 gal	1
	or crop oil concentrate	4 qt/100 gal	
Basagran	crop or vegetable oil concentrate	5 qt/100 gal (2 pt/A maximum)	8
	or nitrogen solution	2–4 qt/A	
	or ammonium sulfate (for velvetleaf)	2.5 lb/A	
Classic	non-ionic surfactant	1 qt/100 gal	1
	or crop oil concentrate	1 gal/100 gal	
	plus nitrogen solution	2–4 pt/A	
	or ammonium sulfate (for velvetleaf)	2–4 lb/A	
Cobra ¹	noni-onic surfactant	1 qt/100 gal	0.5
	or crop oil concentrate	1–2 pt/100 gal	
	plus/or nitrogen solution	4 qt/A	
	or ammonium sulfate	2.5 lb/A	
Elevore (burndown)	crop oil concentrate or	4–8 pt/100 gal	1
	methylated seed oil	4–8 pt/100 gal	
Enlist One	consult https://www.enlist.com/en/herbicides/approved-tank-mix.html		1
Enlist Duo	consult https://www.enlist.com/en/herbicides/approved-tank-mix.html		1
Envive (burndown)	crop oil/modified seed oil	1 gal/100 gal	1
	or nonionic surfactant	1 qt/100 gal	
FirstRate	non-ionic surfactant	1–2 pt/100 gal	2
	plus nitrogen solution	2.5 gal/100 gal	
	or ammonium sulfate	2 lb/A	
	or crop oil concentrate	1.2 gal/100 gal	
	plus nitrogen solution (optional)	2.5 gal/100 gal	
Flexstar	non-ionic surfactant	1–2 qt/100 gal	1
	or crop oil concentrate	2–4 qt/100 gal	
	plus nitrogen solution	1 gal/100 gal (minimum)	
	or ammonium sulfate	4 lb/100 gal (minimum)	
Flexstar GT	ammonium sulfate	8.5–17 lb/100 gal	1
Fusilade	non-ionic surfactant	1–2 qt/100 gal	1
	or crop oil concentrate	2–4 qt/100 gal	
	plus nitrogen solution	1 gal/A	
	or 10–34–0 (optional)	2 pt/A	

Table 5.55 - Spray Additives and Rainfastness for “Burndown” or Postemergence Soybean Herbicides (cont.)

Spray additives, or adjuvants, are products included in the spray tank to improve the performance of herbicides. These include non-ionic surfactants (NIS), crop oil concentrate (COC), methylated or ethylated seed oil (MSO or ESO), or nitrogen solutions. In general, NIS should contain at least 80% active ingredient and COC should contain at least 15% emulsifier. Nitrogen solutions can be 28, 30, or 32% ammonium-based fertilizer solutions; ammonium sulfate (AMS) should be spray-grade dry ammonium sulfate (21-0-0) or other equivalent liquid formulation of AMS (refer to product label for use rate information).

Herbicide	Adjuvant(s)	Rate	Rainfastness (hours)
Fusion	non-ionic surfactant	1–2 qt/100 gal	1
	or crop oil concentrate	2–4 qt/100 gal	
	plus nitrogen solution (optional)	4 gal/100 gal	
Glyphosate	non-ionic surfactant	2 qt/100 gal	1–6
	plus ammonium sulfate (optional)	8.5–17 lb/100 gal	
Gramoxone SL 2.0 or 3.0	non-ionic surfactant	1 qt/100 gal	0.5
	or crop oil concentrate	1 gal/100 gal	
Harmony Extra/ FirstShot/Audit (burndown)	non-ionic surfactant	0.5–2/100 gal	
	or crop oil concentrate	1 gal/100 gal	
	or methylated seed oil	1 gal/100 gal	
	plus ammonium nitrogen fertilizer	2 qt/acre	
Harmony SG ²	non-ionic surfactant	1–2 pt/100 gal	1
	or crop oil concentrate	2 qt/100 gal	
	plus nitrogen solution	4 gal/100 gal	
	or ammonium sulfate (for velvetleaf)	2–4 lb/A	
Liberty/Interline/Scout/ Others	ammonium sulfate	3 lb/A	4
Permit Plus	non-ionic surfactant	1–2 pt/100 gal	4
	or crop oil concentrate	2 qt/100 gal	
	plus nitrogen solution	4 gal/100 gal	
	or ammonium sulfate (for velvetleaf)	2–4 lb/A	
Perpetuo	crop oil concentrate or	1 pt/A	1
	methylated seed oil	1 pt/A	
Poast	crop or vegetable oil concentrate	2 pt/A	1
	or Dash HC	1 pt/A	
	plus nitrogen solution	2–4 qt/A	
	or ammonium sulfate (certain species)	2.5 lb/A	
Prefix	non-ionic surfactant	1 qt/100 gal	1
	DO NOT use crop oil concentrate	–	
Pursuit	non-ionic surfactant	1 qt/100 gal	1
	or crop oil concentrate	2 pt/A	
	or vegetable oil concentrate	1.5–2 pt/A	
	plus nitrogen solution	1–2 qt/A	
	or ammonium sulfate	2.5 lb/A	

Table 5.55 - Spray Additives and Rainfastness for “Burndown” or Postemergence Soybean Herbicides (cont.)

Spray additives, or adjuvants, are products included in the spray tank to improve the performance of herbicides. These include non-ionic surfactants (NIS), crop oil concentrate (COC), methylated or ethylated seed oil (MSO or ESO), or nitrogen solutions. In general, NIS should contain at least 80% active ingredient and COC should contain at least 15% emulsifier. Nitrogen solutions can be 28, 30, or 32% ammonium-based fertilizer solutions; ammonium sulfate (AMS) should be spray-grade dry ammonium sulfate (21-0-0) or other equivalent liquid formulation of AMS (refer to product label for use rate information).

Herbicide	Adjuvant(s)	Rate	Rainfastness (hours)
Raptor/Beyond Xtra	crop oil concentrate	2 pt/A	1
	or vegetable seed oil	1.5–2 pt/A	
	or nonionic surfactant	1 qt/100 gal	
	plus nitrogen solution	1–2 qt/A	
	or ammonium sulfate	2.5 lb/A	
Reflex	non-ionic surfactant	1–2 qt/100 gal	1
	or crop oil concentrate	2–4 qt/100 gal	
	plus nitrogen solution (optional)	4 qt/A	
Resource	crop oil concentrate	2–4 qt/100 gal	1
	plus nitrogen solution (optional)	2–4 qt/A	
Reviton	methylated seed oil	1 gal/100 gal	1
	plus ammonium sulfate	8.5 lb/100 gal	
	or nitrogen solution	2.5 gal/100 gal	
Roundup WeatherMax/ PowerMax	no NIS/COC required		<1
	ammonium sulfate (optional)	8.5–17 lb/100 gal	
Select	crop oil concentrate	2–4 qt/100 gal	1
	plus nitrogen solution (optional)	1–2 qt/A	
Sharpen (burndown)	methylated seed oil	1 gal/100 gal	1
	plus ammonium sulfate	8.5–17 lb/100 gal	
	or nitrogen solution	1.25–2.5 gals/100 gal	
Storm	non-ionic surfactant	1–2 pt/100 gal	8
	or crop oil concentrate	1–2 pt/A	
	or nitrogen solution	2 qt/A	
	or ammonium sulfate (for velvetleaf or pigweed)	2 lb/A	
Synchrony XP	crop oil concentrate	1 gal/100 gal	1
	plus nitrogen solution	2–4 qt/A	
	or 10-34-0	1–2 qt	
	or ammonium sulfate (for velvetleaf)	2–4 lb/A	
Ultra Blazer	non-ionic surfactant	1–2 pt/100 gal	6
	or crop oil concentrate	1–2 pt/100 gal	
	or ammonium sulfate	2.5 lb/A	
	or nitrogen solution (for velvetleaf)	2–4 qt/A	

Table 5.55 - Spray Additives and Rainfastness for “Burndown” or Postemergence Soybean Herbicides (cont.)

Spray additives, or adjuvants, are products included in the spray tank to improve the performance of herbicides. These include non-ionic surfactants (NIS), crop oil concentrate (COC), methylated or ethylated seed oil (MSO or ESO), or nitrogen solutions. In general, NIS should contain at least 80% active ingredient and COC should contain at least 15% emulsifier. Nitrogen solutions can be 28, 30, or 32% ammonium-based fertilizer solutions; ammonium sulfate (AMS) should be spray-grade dry ammonium sulfate (21-0-0) or other equivalent liquid formulation of AMS (refer to product label for use rate information).

Herbicide	Adjuvant(s)	Rate	Rainfastness (hours)
Valor SX/EZ (burndown)	crop oil concentrate	1–2 pt/A	1
	or methylated seed oil	1 gal/100 gal	
	or non-ionic surfactant	1 qt/100 gal	
	plus ammonium sulfate (optional)	8.5–17 lb/100 gal	
Valor XLT (burndown)	crop oil concentrate	1–2 pt/A	1
	or non-ionic surfactant	1 qt/100 gal	
	plus ammonium sulfate (optional)	8.5–17 lb/100 gal	
Warrant Ultra	non-ionic surfactant	1–2 qt/100 gal	1
	or crop oil concentrate	2–4 qt/100 gal	

¹ Adjuvants for use with Cobra depend on relative humidity and weed species.

² Use crop oil concentrate (COC) under drought-stressed conditions.

Table 5.56 - Grain Harvesting Interval and Forage Restrictions for Soybean Herbicides

Trade Name	Forage (ok to feed)	Grain (days to harvest)
2,4-D	no	—*
2,4-DB	60 days	60
Afforia	no	—
Aim, Cadet	no	60
Antares Complete	40 days	—
Anthem Maxx	no	60
Assure II/Targa	no	80
Authority Edge	—	—
Authority Elite	30	—
Authority First/Sonic	no	65
Authority MTZ	no	—
Authority Supreme	—	—
Authority XL	no	—
Basagran	30 days	none
Boundary	40 days	—
BroadAxe XC	30 days	—
Canopy DF/Blend	no	—
Classic	no	60
Cobra	no	45
Command	no	—

Table 5.56 - Grain Harvesting Interval and Forage Restrictions for Soybean Herbicides (cont.)

Herbicide	Forage (ok to feed)	Grain (days to harvest)
Dual II Magnum	no	—
Elevore	—	—
Enlist One/Enlist Duo	56 days	30
Envive	no	—
Fierce/Fierce EZ/Fierce XLT	no	—
FirstRate	14 days	65
Flexstar GT	no	45
Fusilade	no	before bloom
Fusion	no	before bloom
Gangster	no	—
Glyphosate	no	14
Gramoxone (preharvest)	no	application restriction ¹
Harmony SG	7 days (green), 30 days (dried)	60
Intermoc	no	90
Liberty	70 days	70
Lorox	yes	—
Marvel	no	60
Metribuzin	40 days	—
OpTill	no	85
OpTill PRO	no	85
Outlook	no	—
Panther MTZ	no	90
Panther Pro	no	85
Permit Plus	30 days	88
Perpetuo	no	60
Poast/Poast Plus	yes ²	75
Prefix	no	90
Preview 2:1	no	—
Prowl	yes	—
Pursuit	no	85
Python	no	—
Raptor/Beyond Xtra	no	85
Reflex/Flexstar	no	45
Resource	no	60
Reviton	—	—
Roundup (in-crop) ³	14 days	14
Select	no	60
Sequence	no	90

Table 5.56 - Grain Harvesting Interval and Forage Restrictions for Soybean Herbicides (cont.)

Herbicide	Forage (ok to feed)	Grain (days to harvest)
Sharpen	65 days	—
Storm	no	50
Surveil	no	—
Synchrony XP	no	60
Tendovo	45 days	75
Treflan	yes	—
Trivence	no	—
Ultra Blazer	no	50
Valor SX/Valor EZ/Valor XLT	no	—
Warrant/Enversa	no	no
Warrant Ultra	no	45
Zidua	yes	—
Zidua PRO	no	85
Zone Defense	no	—

* — = not addressed on the label.

¹ When at least 65% of the seed pods have reached a mature brown, or when seed moisture is 30% or less.

² Do not feed green forage.

³ Allow 7 days between preharvest application and grain harvest.

Table 5.57 - Comments on Harvest Aids for Soybeans

Treatments are based on broadcast application, not wiper-bar or rope-wick applications.

Trade Name	Common Name	Site of Action		Product/A	lb ai/A
		Number	Timing		
Aim 2EC	carfentrazone	14	At least 3 days before harvest	1.5 fl oz	0.024

- Use as a harvest aid to desiccate a limited number of broadleaf weed species.
- Use a non-ionic surfactant at 2 pt/100 gal spray solution or crop oil concentrate at 1 gal/100 gal spray solution plus ammonium sulfate at 2-4 lb/A or nitrogen solution at 2-4 gal/100 gal spray solution.
- Application shall be made when the crop is mature and the grain has begun to dry down. Do not apply within 3 days of harvest.
- Apply in 10 gal/A water.
- Do not feed treated soybean forage or hay to livestock.
- Include necessary adjuvants and make sure spray coverage is sufficient, otherwise poor control will result.

Table 5.57 - Comments on Harvest Aids for Soybeans (cont.)

Treatments are based on broadcast application, not wiper-bar or rope-wick applications.

Trade Name	Common Name	Site of Action Number	Timing	product/A	lb ai/A
Clarity 4S	dicamba	4	At least 7 days before harvest	8–64 fl oz	0.25–2.0
<ul style="list-style-type: none"> • Apply Clarity to actively growing weeds after soybean pods have reached mature brown color and at least 75% leaf drop has occurred. • Use a non-ionic surfactant at 1 qt/100 gal spray solution or crop oil concentrate at 1 gal/100 gal spray solution plus nitrogen solution at 2-4 qt/A. • Do not feed soybean fodder or hay following a pre-harvest application of Clarity. • <i>Water quality advisory.</i> 					
Defol 5	sodium chlorate		7 to 10 days before harvest	4.8 qts	6.0
<ul style="list-style-type: none"> • Labeled to dry weeds in early maturing soybeans and to facilitate harvest. • Apply to soybeans 7 to 10 days before anticipated harvest, when beans are mature and ready to harvest. • No adjuvant recommended. • Do not graze treated field or feed treated fodder. • Apply in at least 5 gals of water by air, and 20 gals of water with ground application. 					
Glyphosate	glyphosate	9	At least 7 days before harvest	varies with formulation	Up to 0.75
<ul style="list-style-type: none"> • Refer to individual herbicide label to be sure the formulation used is labeled for this type of application. • Apply glyphosate to soybeans after pods have set and lost all green color (80–90% drop of leaves has occurred). • Use a non-ionic surfactant at 2 qt/100 gal spray solution plus ammonium sulfate (optional) at 8.5-17 lb/100 gal spray solution. • Apply glyphosate in 10–20 gallons of water/A to control weeds that may interfere with harvest or to control perennials such as quackgrass or Canada thistle. • Do not graze or harvest the treated crop for livestock feed within 25 days of application. • Do not use on soybeans grown for seed. • Will not control glyphosate-resistant weeds, nor dry down Roundup Ready varieties. • See Table 5.1 (glyphosate table) for more information on glyphosate formulations. 					

Table 5.57 - Comments on Harvest Aids for Soybeans (cont.)

Treatments are based on broadcast application, not wiper-bar or rope-wick applications.

Trade Name	Common Name	Site of Action Number	Timing	product/A	lb ai/A
Gramoxone SL 2.0 Gramoxone SL 3.0	paraquat	22	At least 15 days before grain harvest; at least 3 days before soybean grown for seed harvest	8–16 fl oz 5.4–10.7 fl oz	0.125–0.25

- Gramoxone may be used for drying certain weeds and quickening berry drop of Eastern black nightshade just before soybean harvest.
- Soybean plants must be mature. For indeterminate varieties: 65% or more of the seed pods have reached mature brown color or seed moisture is 30% or less. For determinate varieties: beans are fully developed, half of leaves had dropped, and remaining leaves are yellowing.
- Use a non-ionic surfactant at 1 pt/100 gal spray solution or crop oil concentrate at 1 gal/100 gal spray solution.
- Do not graze or harvest for forage or hay.

Paraquat Use Restrictions

- *Restricted-use pesticide.*
- Only certified applicators, who successfully complete the paraquat-specific training, can mix, load or apply paraquat.
- Application of paraquat "under the direct supervision" of a certified applicator is no longer allowed; registered technicians cannot apply.
- Required training link (<http://usparaquattraining.com>); certified applicators must repeat training every three years.

Sharpen 2.85SC	saflufenacil	14	At least 3 days before harvest	1.0–2.0 fl oz	0.022–0.044
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- Apply after physiological maturity when greater than 50% leaf drop has occurred and remaining leaves are yellow.
- Include methylated seed oil (MSO) at 1 gal/100 gals (1% v/v) plus ammonium sulfate (AMS) at 8.5 to 17 lbs/100 gals or urea ammonium nitrate (UAN) at 1.25 to 2.5 gals/100 gals.
- Do not apply to soybeans grown for seed production.

Table 5.58 - Soybean Herbicide Half-Lives and Their Potential to Injure Fall Cover Crops

This table does not directly address preharvest establishment of cover crops such as interseeding or aerial seeding, which may be more restrictive. Cover crops that are harvested are subject to herbicide residue restrictions, which are not addressed in this table.

Herbicide	Active ingredient	Normal Rate/acre	Half life (days) ¹	Fall cover crops OK to plant	Concern for Fall cover crops	Other
2,4-D Amine 4 (2,4-D LV 4)	2,4-D	1-2 pt	7	All grasses	Wait 30 days before planting sensitive broadleaves	Amine formulations more water soluble and can leach into seed zone
Assure II/Targa	quizalofop	8 oz	60	Most broadleaves	All grasses if less than 120 days or at high rates	Plant anything after 120 days

Table 5.58 - Soybean Herbicide Half-Lives and Their Potential to Injure Fall Cover Crops (cont.)

This table does not directly address preharvest establishment of cover crops such as interseeding or aerial seeding, which may be more restrictive. Cover crops that are harvested are subject to herbicide residue restrictions, which are not addressed in this table.

Herbicide	Active ingredient	Normal Rate/acre	Half life (days) ¹	Fall cover crops OK to plant	Concern for Fall cover crops	Other
Authority 75DF (Authority First, BroadAxe XC, Sonic, Spartan)	sulfentrazone	4 oz	32-302	Cereals and ryegrass	Small seeded legumes, mustards, sorghum ²	Labeled on tobacco, sunflowers, transplanted tomato
Classic (Authority XL, Canopy, Envive, Fierce, Fierce XLT, Synchrony, Trivence, Valor XLT, etc.)	chlorimuron	0.5-2 oz	40	Cereals and ryegrass	Small seeded legumes, mustards, sorghum	More persistent in high pH soils (> 7) and with higher soil applied rates
Dual II Magnum	metolachlor	1.67 pt	15-50	Cereal grains, legumes	Annual ryegrass or other small seeded grasses	Higher rates and later applications more of a potential problem
FirstRate (Authority First, Sonic)	cloransulam	0.3 to 0.6 oz	8-33	Wheat, triticale, rye	Small seeded legumes, mustards, sorghum	The restriction for transplanted tobacco is 10 mo. for 0.3 oz/acre. Sugarbeet and sunflower have a 30 month restriction.
Glyphosate 4 Plus	glyphosate	0.75 to 1.25 lb ae	47 ³	All	None	Glyphosate does not have soil activity at normal use rates
Gramoxone SL 2.0	paraquat	2 pt	1000 ³	All	None	Paraquat does not have soil activity at normal use rates
Harmony SG	thifensulfuron	1/8 oz	12	No restrictions for wheat, barley, and oats	None with 45 day waiting interval	Harmony Extra also contains tribenuron
Liberty 280 SL	glufosinate	22 - 36 fl. oz	7 ³	All	Food or feed residues rather than crop injury may be a concern	Glufosinate does not have soil activity at normal use rates

Table 5.58 - Soybean Herbicide Half-Lives and Their Potential to Injure Fall Cover Crops (cont.)

This table does not directly address preharvest establishment of cover crops such as interseeding or aerial seeding, which may be more restrictive. Cover crops that are harvested are subject to herbicide residue restrictions, which are not addressed in this table.

Herbicide	Active ingredient	Normal Rate/acre	Half life (days) ¹	Fall cover crops OK to plant	Concern for Fall cover crops	Other
Metribuzin 75DF 4L	metribuzin	0.33 lb ai	14-60	Cereal grains and ryegrass	Slight risk for small seeded legumes and mustards	Nonfood/feed winter cover crops allowed
Outlook (Verdict)	dimethenamid	16 fl. oz	20	Most crops should be fine	Food or feed residues rather than crop injury may be a concern	Nonfood/feed winter cover crops should be OK after corn harvest
Prowl H ₂ O	pendimethalin	3 pt	44	Cereal grains	Small seeded legumes and annual ryegrass	We have not seen this herbicide carryover in Mid-Atlantic; nonfood/feed winter cover crops should be OK
Pursuit (Authority Assist, Optill, Zidua Pro)	imazethapyr	4 fl. oz	60-90	Wheat, triticale, rye, alfalfa, clover	Oats, ryegrass, sorghum. Do not plant mustards.	Conduct field bioassay for crops not list
Python WDG	flumetsulam	1 oz	14-120	Cereal grains	Small seeded legumes, mustards, and annual ryegrass	Cover crops and forage grasses are restricted for 9 mo.
Raptor/Beyond Xtra 1S	imazamox	5 fl. oz	20-30	Wheat, triticale, rye, alfalfa, clovers	Slight risk for mustards	Most cash crops allowed 9 mo. following application
Reflex/Flexstar (Warrant Ultra)	fomesafen	1.5 pt	100	Cereal grains	Small-seeded legumes, sorghum. Do not plant mustards.	Since fomesafen is often applied postemergence, soil activity can surprise users
Scepter 70 DG	imazaquin	0.66 pt	60-90	Cereal grains	Small seeded legumes, mustards	Carryover much more of a risk with drought
Select 2EC	clethodim	10 oz	3	All broadleaves	None assuming at least 30 days.	Plant anything after 30 days
Sharpen (Optill, Verdict, Zidua Pro)	saflufenacil	3 fl. oz	7-35	All	None	This product has been reported more persistent in western Canada

Table 5.58 - Soybean Herbicide Half-Lives and Their Potential to Injure Fall Cover Crops (cont.)

This table does not directly address preharvest establishment of cover crops such as interseeding or aerial seeding, which may be more restrictive. Cover crops that are harvested are subject to herbicide residue restrictions, which are not addressed in this table.

Herbicide	Active ingredient	Normal Rate/acre	Half life (days) ¹	Fall cover crops OK to plant	Concern for Fall cover crops	Other
Spartan 4F (Authority First, BroadAxe, Sonic)	sulfentrazone	4 oz	32-302	Cereals and ryegrass	Small-seeded legumes, mustards, sorghum ²	Labeled on tobacco, sunflowers, transplanted tomato
Valor SX (Afforia, Envive, Fierce, Surveil, Trivence, Valor XLT, etc.)	flumioxazin	2.5 oz	12-20	All grasses	Small seeded legumes and mustards	Based on the half-life, all nonfood/feed winter cover crops should be OK
Warrant/Enversa	acetochlor	2 pt	10-20	Most crops should be fine	Food or feed residues rather than crop injury may be a concern	Nonfood/feed winter cover crops are allowed after corn harvest
Zidua (Fierce, Anthem etc.)	pyroxasulfone	2.5 oz	20	Most crops should be fine	Food or feed residues rather than crop injury may be a concern	Nonfood/feed winter cover crops should be OK after corn harvest

¹ The herbicide half-life is defined the time it takes for 50% of the herbicide active ingredient to dissipate. See the Managing Herbicides Section for additional information. The herbicide half-life estimates are derived for the *WSSA Herbicide Handbook* and other scientific literature.

² Common small-seeded legumes include alfalfa, clovers, and hairy vetch.

³ This herbicide does not have soil residual activity at normal application rates.

Small Grains Weed Management

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Integrated Weed Management

A well-planned weed management program for small grains involves using multiple strategies. These strategies include preventive techniques such as monitoring, cultural controls, mechanical or physical controls, biological controls, and chemical control tactics. Preventive techniques start with planting weed-free crop seed or choosing an alternative field or planting date. Regularly monitoring for pests is an important predictive tool. Rotating crops to disrupt weed life cycles and planting adapted varieties are good examples of cultural controls. Mechanical or physical controls may include tillage and mowing. Biological controls may include using insect or disease organisms or even grazing animals in pasture production systems. Finally, chemical controls are an important component of many IPM systems, but their use should be based on sound management decisions. See the introductory chapter of this guide for more information on an IPM system.

A good small-grain stand is highly competitive and may not require herbicides to control weeds. Planting an adapted variety at recommended populations into a weed-free field should serve as the foundation for weed control in small grains. Winter annuals such as chickweed and henbit are becoming more common in small-grain fields.

This guide provides chemical control suggestions based on university research and manufacturer recommendations. Management information for common small grain weed problems is outlined in the following pages. This publication strives for accuracy; however, omissions, inaccuracies, or dated information can occur because of the dynamics of pests and pest management. Seek out additional information from the manufacturer or other reliable sources when making important management decisions. Remember, this guide is not a substitute for the manufacturer's product label.

Fall-planted Small Grains

This chapter pertains to fall planted small grains for the Mid-Atlantic region. Herbicide application timing, expected control levels, and comments are based on fall planting. See below for spring oats.

Fields should be scouted in late fall or early spring to determine if weed populations warrant treatment. Early application while weeds are still small is the key to successful control of weeds in small grains. Apply herbicides only at recommended stages of crop growth in order to avoid crop injury. See Figure 5.1 and Tables 5.3 to 5.5.

Wheat and barley are sensitive to triazine residues; therefore, use a short residual herbicide program in crops preceding small grains. See the corn weed-control section for information on the effect of pH on triazine residues, and for weed-control programs that reduce triazine residues.

Specific Weed Issues:

Downy brome control is listed on Finesse, Outrider, Olympus Flex, and PowerFlex labels. (Refer to label to determine if chess or cheat species will be controlled.) Outrider, PowerFlex, and Olympus Flex provide control of downy brome when applied in the fall and suppression when applied in the spring. Soybeans can be planted 3 months after PowerFlex application. However, be cautious of crop rotation intervals when using Finesse, Outrider, or Olympus Flex. Aside from STS soybeans and IR corn, most other rotational crops cannot be planted for at least 12 to 18 months or more after application depending on the herbicide used.

5-200 Weed Control in Field Crops: *Small Grains*

Group 2 (ALS) resistant common chickweed populations have been identified in the Mid-Atlantic region since Group 2 herbicides such as Harmony Extra are routinely used in small grains. If Group 2-resistant chickweed is suspected, contact your local county educator to report the incident. Starane Ultra (fluroxypyr) at 0.3 to 0.4 pint per acre up to flag leaf growth stage on wheat, barley, and oats has resulted in good chickweed control in university trials. However, it will not control other key species such as wild garlic, mustards, and henbit. (It will, however, injure/kill underseeded legumes.) Starane Ultra can be tank-mixed with Harmony Extra to broaden the spectrum of control. Valor also provides very effective residual control of common chickweed and can be used in an early preplant burndown program before seeding wheat. Apply up to 2 ounces per acre of Valor (plus other burndown herbicides) at least 7 days before planting wheat (see Table 5-8 for specific comments). Metricor and TriCor (metribuzin) have a 24(c) use label and at 2 to 4 ounces per acre have provided excellent control of Group 2-resistant chickweed in university trials when applied in either fall or spring (see Table 5-6 for specific comments). See Table 5-6 for comments on crop safety with metribuzin and Valor.

Herbicide-resistant annual ryegrass (or Italian ryegrass) in the region is resistant to Group 1 (ACCase) herbicides, which includes Axial and Hoelon. Other populations are resistant to Group 2 (ALS herbicides) such as Osprey, PowerFlex, and Finesse. There is concern about developing populations resistant to both herbicide groups. Valor and Zidua (or Anthem Flex) have fair to good residual control of annual ryegrass but will not control it if emerged seedlings are present at time of application. POST applications of Osprey or PowerFlex or Axial XL will control susceptible populations. Do not rely on these herbicide groups to control annual ryegrass in rotation crops to reduce the risk of developing resistant populations.

Spring Oats: Oats are sensitive to triazine residues; therefore, use a short residual herbicide program when small grains follow in the crop rotation. Read the corn weed-control section for information on the effect of pH on triazine residues, and for weed-control programs that reduce triazine residues.

In addition to comments for other small grains, the following comments regarding herbicide use in small grains pertain:

2,4-D: Use only 0.5 pt/A for oats. Certain varieties, especially ‘Pennuda,’ are more sensitive to 2,4-D than other small grains.

Callisto: For use on to oats only (Callisto should not be applied to other small grains). If PRE, apply 6 fl oz/A Callisto prior to oat emergence. If POST, apply 3 fl oz/A Callisto after oat emergence but before weeds reach 5 inches tall. Callisto controls many broadleaf weeds. Callisto may cause temporary injury of the oat crop. Callisto has a 10-month rotation restriction to soybeans and an 18-month rotation restriction to most vegetables.

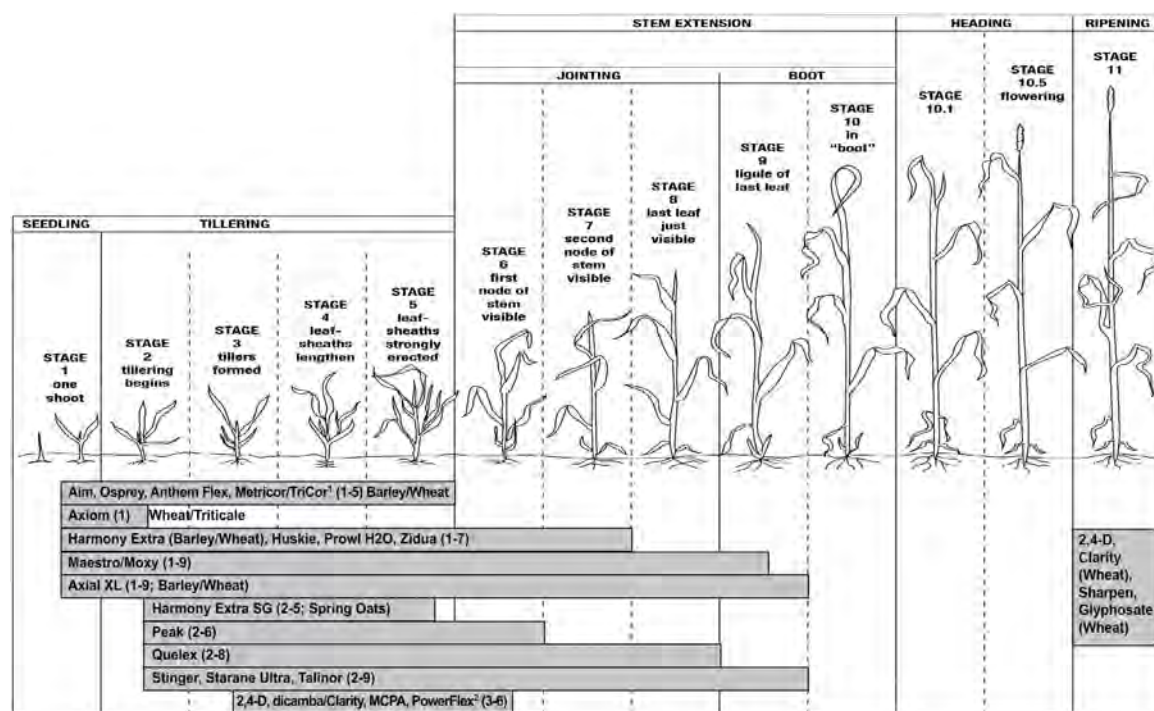
Clarity/dicamba: On spring-seeded oats, apply before five-leaf stage.

Harmony Extra: On spring-seeded oats, apply three-leaf to before jointing (growth stages 2–5). Apply at 0.45 oz to 0.6 oz/a. Do not use on Ogle, Porter, or Premier oat varieties.

Harmony SG: On spring-seeded oats, apply three-leaf to before jointing (growth stages 2–5). Apply at 0.45 oz to 0.6 oz/a. Do not use on Ogle, Porter, or Premier oat varieties.

MCPA amine or ester: Safer on oats underseeded with legumes than 2,4-D (amine formulation only) but use the lower rate (0.25–0.5 pt) and apply in 5–10 gal water/A; legumes should be 2–3 inches tall and cereal should be 8 inches tall to provide canopy to protect legume.

Fig. 5.59 - Growth stages in cereals when herbicides may be applied.



¹Local research has demonstrated that Metricor/TriCor should be applied during "greenup" period in early spring to reduce risk of crop injury.

²Local research has found fall applications of PowerFlex is best timing to reduce risk of crop injury.

Table 5.60 - Small Grain Herbicides and their Restrictions

Trade Name ¹	Common Name	Manufacturer	Site of Action Number	Restricted-Use Pesticide ²	Water Quality Advisory ³	Worker Reentry ⁴ (hours)
2,4-D 4 lb/gal	2,4-D	Several	4	—	—	12–48
Aim 2EC	carfentrazone	FMC	14	—	—	12
Anthem Flex 4SE	pyoxasulfone + carfentrazone	FMC	15, 14	—	yes	12
Axial Bold 0.69L	pinoxaden + fenoxaprop	Syngenta	1, 1	—	—	48
Axial Star 1.15L	pinoxaden + fluroxypyr	Syngenta	1, 4	—	—	48
Axial XL 0.42L	pinoxaden	Syngenta	1	—	—	48
Axiom 68DF	flufenacet + metribuzin	Bayer CropScience	15, 5	—	—	12
Beyond Xtra 1L	imazamox	BASF	2	—	yes	4
Callisto 4SC ⁵	mesotrione	Syngenta	27	—	—	12
Clarity 4S/Banvel 4S	dicamba	BASF	4	—	—	24
Curtail 2.38L	clopyralid + 2,4-D	Corteva	4, 4	—	yes	48
Elevore 0.57L	halauxifen	Corteva	4	—	yes	12
Express 50SG	tribenuron	FMC	2	—	—	12

Table 5.60 - Small Grain Herbicides and their Restrictions (cont.)

Trade Name ¹	Common Name	Manufacturer	Site of Action Number	Restricted-Use Pesticide ²	Water Quality Advisory ³	Worker Reentry ⁴ (hours)
Finesse Cereal and Fallow 75DF	chlorsulfuron + metsulfuron methyl	FMC	2, 2	—	—	4
Gramoxone SL 2 Gramoxone SL 3	paraquat	Syngenta	22	yes	—	12
Harmony SG 50DF	thifensulfuron	FMC	2	—	—	4
Harmony Extra 50DF/ Audit 1:1/T-Square	thifensulfuron + tribenuron	FMC/UPL	2	—	—	12
Huskie 2.06L	pyrasulfotole + bromoxynil	Bayer CropScience	27, 6	—	yes	24
Huskie Complete 2.4L	pyrasulfotole + bromoxynil + thiencazabone	Bayer CropScience	27, 6, 2	—	yes	24
MCPA 4 lb/gal	MCPA	Several	4	—	—	12–48
Maestro 2EC	bromoxynil	Nufarm	6	—	—	24
Metricor ⁶ 75DF/TriCor ⁶ 75DF	metribuzin	UPL	5	—	yes	12
Moxy 2EC	bromoxynil	WinField United	6	—	—	24
Osprey 4.5WDG	mesosulfuron	Bayer CropScience	2	—	—	4
Outrider 75WDG	sulfosulfuron	Valent	2	—	—	12
Pixxaro 2.43 EC	fluroxypyr + halauxifen	Corteva	4, 4	—	—	12
Peak 57WDG	prosulfuron	Gowan	2	—	yes	12
PowerFlex HL 13WDG	pyroxsulam	Corteva	2	—	—	12
Prowl H ₂ O 3.8CS	pendimethalin	BASF	3	—	—	24
Quelex 20.4WDG	halauxifen + florasulam	Corteva	4, 2	—	yes	12
Reviton 2.83SC	tiafenacil	Helm	14	—	—	12
Rezulant 1.3EC	halauxifen + fluroxypyr + pinoxaden + safener	Corteva	4, 4, 1	—	yes	48
Roundup Powermax 4.5S/Roundup Weather Max 4.5S/ other glyphosates	glyphosate	Bayer CropScience/ others	9	—	—	4–12
Sentrallas 1.55L	thifensulfuron + fluroxypyr	FMC	2, 4	—	—	24
Sharpen 2.85SC	saflufenacil	BASF	14	—	yes	12
Shieldex 400 SC	tolpyralate	Summit Agro	27	—	—	12

Table 5.60 - Small Grain Herbicides and their Restrictions (cont.)

Trade Name ¹	Common Name	Manufacturer	Site of Action Number	Restricted-Use Pesticide ²	Water Quality Advisory ³	Worker Reentry ⁴ (hours)
Starane Flex 0.875L	florasulam + fluroxypyr	Corteva	2, 4	—	—	24
Starane Ultra 2.8L	fluroxypyr	Corteva	4	—	—	24
Stinger 3S	clopyralid	Corteva	4	—	yes	12
Talinor 1.77EC	bicyclopyrone + bromoynil	Syngenta	27, 6	—	yes	24
Tarzac 31.95WG	halauxifen + pyroxsulam	Corteva	4, 2	—	—	12
Tolvera 1.7EC	tolpyralate + bromoxynil	Corteva	27, 6	—	yes	24
Valor SX 51WDG/ Valor EZ 4L	flumioxazin	Valent	14	—	—	12
Zidua 85WDG / Zidua 4.17SC	pyroxasulfone	BASF	15	—	yes	12

¹ Generic alternatives to some of these products are available. See table in the introductory chapter of this guide.

² Only licensed applicators may purchase and apply restricted-use pesticides.

³ These herbicides have an “Environmental Hazard Warning” on their label and have been detected in water supplies from normal agricultural use. Special precautions apply for their use on coarse-textured soils or where water tables are shallow. See the product label for specific restrictions.

⁴ If soil-applied products are injected or incorporated at application time, under certain circumstances the Worker Protection Standard allows workers to enter the treated area if they will have no contact with anything that has been treated. Personal protective equipment is required for early entry to treated areas if contact with treated soil, plants, or water is involved.

⁵ Callisto is only registered for use in spring oats.

⁶ Tricor/Metricor have 24c Local Needs Label for use in specific states. Only approved brands of metribuzin can be used in approved states. Refer to the labels.

Table 5.61 - Herbicides Labeled for Use in Small Grains by Small Grain Species

	Fall Seeded				
	Wheat	Barley	Rye	Triticale	Spring Oats
2,4-D ¹	X	X	X	X ¹	X
Aim	X	X	X	X	X
Anthem Flex	X	X	X	X	X
Audit 1:1	X	X	X	X	X
Axial Star	X	X			
Axial XL, Axial Bold	X	X			
Axiom	X			X	
Callisto					X
Clarity/dicamba	X	X	X	X	X
Curtail	X	X			
Express	X	X	X	X	X
Finesse Cereal and Fallow	X	X		X	
Gramoxone	X	X			
Harmony Extra	X	X		X	X
Harmony SG	X	X		X	X
Huskie	X	X	X	X	
Huskie Complete	X				
MCPA	X	X	X		X
Maestro	X	X	X	X	X
Metricor/TriCor	X	X			
Osprey	X			X	
Outrider	X				
Peak	X	X	X	X	X
Powerflex HL	X			X	
Prowl H2O	X			X	
Quelex	X	X		X	
Roundup	X	X	X	X	X
Sentrallas	X	X			X
Sharpen	X	X	X	X	X
Shieldex	X	X			
Starane Flex	X	X	X	X	X
Starane Ultra	X	X		X	X
Stinger	X	X			X
Talinor	X	X			
Tolvera	X	X			
Valor	X				
Zidua	X				

¹ 2,4-D is manufactured by various companies; labels may vary among manufacturers.

Table 5.62 - Small Grain Herbicide Prepackaged Mixes, or Co-packs, and Equivalents

Trade Name	Components (ai or ae/gal or lb)	Site of Action Number	If You Apply (per acre)	You Have Applied (ai or ae lb / A)	An Equivalent Tank-mix of
Anthem Flex 4SE	3.733 lb pyroxasulfone 0.267 lb carfentrazone	15 14	2.75 fl oz	0.08 lb pyroxasulfone 0.006 lb carfentrazone	2.46 fl oz Zidua 4.17SC 0.4 fl oz Aim 2EC
Audit 1:1 50WDG	0.25 thifensulfuron 0.25 tribenuron	2 2	0.75 oz wt	0.0117 lb thifensulfuron 0.0117 lb tribenuron	0.37 oz Harmony SG 50DF 0.37 oz Express 50DF
Axial Bold 0.69L	0.457 lb pinoxaden 0.228 lb fenoxaprop	1 1	15 fl oz	0.053 lb pinoxaden 0.027 lb fenoxaprop	16.4 fl oz Axial 0.42L 0.44 oz ai fenoxaprop
Axial Star 1.15L	0.42 lb pinoxaden 0.73 fluroxypyr	1 4	16.4 fl oz	0.053 lb pinoxaden 0.094 lb fluroxypyr	16.4 fl oz Axial 0.42L 4.3 fl oz Starane Ultra 2.8L
Axiom 68DF	0.544 lb flufenacet 0.136 lb metribuzin	15 5	6 oz wt	0.2 lb flufenacet 0.05 metribuzin	6.4 oz Define 4SC 1.1 oz Metribuzin 75DF
Curtail 2.4L	0.38 lb clopyralid 2 lb 2,4-D	4 4	1 qt	0.095 lb clopyralid 0.5 lb 2,4-D	4.1 fl oz Stinger 3S 16 fl oz 2,4-D amine 4L
Finesse Cereal and Fallow 75DF	0.625 chlorsulfuron 0.125 metsulfuron	2 2	0.25 oz wt	0.001 chlorsulfuron 0.125 metsulfuron	0.12 oz Glean XP 75DF 1.2 oz Ally XP 60DF
Harmony Extra 50DF	0.333 thifensulfuron 0.167 tribenuron	2 2	0.75 oz wt	0.015 thifensulfuron 0.0078 tribenuron	0.5 oz Harmony SG 50DF 0.25 oz Express 50DF
Huskie 2.06L	0.31 lb pyrasulfotole 1.75 bromoxynil	27 6	13 fl oz	0.031 lb pyrasulfotole 0.178 bromoxynil	0.5 oz ai pyrasulfotole 11.4 fl oz Maestro 2EC
Huskie Complete 2.4L	0.26 lb pyrasulfotole 2.09 bromoxynil 0.042 lb thien carbazone	27 6 2	13.7 fl oz	0.027 lb pyrasulfotole 0.224 lb bromoxynil 0.004 lb thien carbazone	0.44 oz ai pyrasulfotole 14.3 fl oz Maestro 2EC 0.072 oz ai thien carbazone
Pixxaro 2.43EC	0.1 fluroxypyr 2.33 halauxifen	4 4	6 fl oz	0.109 lb fluroxypyr 0.0047 lb halauxifen	5 fl oz Starane Ultra 2.8EC 1.06 fl oz Elevore 0.57SC
Quelex 20.4WDG	0.1 lb halauxifen 0.1 florasulam	4 2	0.75 oz wt	0.005 lb halauxifen 0.005 lb florasulam	1.1 fl oz Elevore 0.57L 0.075 oz ai florasulam
Sentrallas 1.55L	0.25 lb thifensulfuron 1.3 fluroxypyr	2 4	12 fl oz	0.02 lb thifensulfuron 0.1221 b fluroxypyr	0.5 oz Harmony SG 50DF 5.6 fl oz Starane Ultra 2.8L
Starane Flex 0.875 L	0.042 florasulam 0.833 fluroxypyr	2 4	13.5	0.004 lb florasulam 0.088 lb fluroxypyr	0.07 oz ai florasulam 4 fl oz Starane Ultra 2.8L
Supremacy 42WDG	0.36 fluroxypyr 0.045 thifensulfuron 0.015 tribenuron	4 2 2	5 oz wt	0.113 lb fluroxypyr 0.014 lb thifensulfuron 0.005 lb tribenuron	5.2 fl oz Starane Ultra 2.8L 0.5 oz Harmony SG 50DF 0.16 oz Express 50DF
Tarzec 31.95WG	0.067 lb halauxifen 0.25 lb pyroxsulam	4 2	1 oz wt	0.00435 lb halauxifen 0.0156 lb pyroxsulam	0.09 fl oz Elevore 0.57SC 1.9 oz wt PowerFlex HL 13.1WG
Tolvera 1.7EC	0.156 lb tolpyralate 1.557 lb bromoxynil	27 6	11 fl oz	0.0134 lb tolpyralate 0.1338 lb bromoxynil	0.5 oz Shieldex 400SC 8.5 oz Maestro 2EC
T-Square 75WG	0.5 thifensulfuron 0.25 tribenuron	2 2	0.5 oz wt	0.015 lb thifensulfuron 0.0078 lb tribenuron	0.5 oz Harmony SG 50DF 0.25 oz Express 50DF

Table 5.63 - Relative Effectiveness of “Burndown” Treatments for No-Till Small Grains

Table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rates and weed size (young weeds) or growth stage. Treatments are rated only for control of vegetation existing at the time of application.

Weed control rating

10 = 95–100% 9 = 85–95% 8 = 75–85% 7 = 65–75% 6 = 55–65%

N = less than 55% or no control L = Labeled but no university data - = no information available

Weed	Trade Name						
	Clarity/ dicamba	Finesse	Gramoxone	Harmony Extra (Fall-Applied)	Roundup/ Glyphosate (Fall-Applied)	Roundup/ Glyphosate (Spring-Applied)	Sharpen
Site of Action Number	4	2, 2	22	2	9	9	14
Chickweed, Common ¹	7	9	8+	9	9	9	6
Clover, Red	9	8	8	6	8+	7	–
Dandelion	7	7+	N	6	8+	6	7
Dogbane, Hemp; Dewberry; Milkweed; etc.	6	N	6	N	8+	6	N
Foxtail spp.	N	N	9	N	9	9	N
Lambsquarters, Common	9	8	8	9	9	9	8
Marestail ²	8	9	7	7	9	9	9+
Mustard spp.	9	8+	8	9	9	9	L
Ragweed, Common ³	9	N	8	6	9	9	8
Rye Cover, Volunteer Small Grains	N	N	9	N	10	10	N
Smartweed	9	6	7	9	7	7	L
Sod, Alfalfa	8	–	N	N	8+	7	N
Sod, Bromegrass or Quackgrass	N	N	6	N	9	7	N
Sod, Orchardgrass or Fescue	N	N	N	N	9	7	N
Thistle, Canada	8	6	6	7	9	7	6
Timothy or Bluegrass	N	N	7	N	10	10	N
Vetch, Hairy	9	–	7	7	8	6	6

¹ Common chickweed biotypes resistant to Group 2 herbicides are found in the region; if you suspect resistant biotypes in your area, do not rely on herbicides from these groups to control resistant biotypes.

² Horseweed biotypes resistant to Group 9 (glyphosate) and Group 2 herbicides are widespread in the region; do not rely on herbicides from these groups to control resistant biotypes.

³ Common ragweed biotypes resistant to Group 9 (glyphosate) and Group 2 herbicides are found in the region; if you suspect resistant biotypes in your area, do not rely on herbicides from these groups to control resistant biotypes.

Table 5.64 - Comments on “Burndown” Herbicides for No-Till Small Grains

See specific product label to determine correct rate for soil type and weed species found in each field.

These treatments may be used in conventional, reduced-till, and no-till systems.

Tables 5.62 and 5.65 list characteristics and efficacy of “burndown” herbicides.

Trade Name ¹	Common Name	Site of Action Number	Application	Product/A	lb ai/A
numerous	dicamba DMA Salt	4	Preplant or preemergence to postemergence	2-4 fl oz	0.06-0.125
Clarity 4S	dicamba DGA Salt			2-4 fl oz	

- The 4 fl oz rate controls small annual broadleaf weeds and there is no waiting period prior to planting at this rate.
- Clarity/dicamba may be used at greater than 4 fl oz prior to planting wheat; however, for each pt/A of dicamba applied, delay crop planting for 20 days.

Finesse 75DF	chloransulam	2	preplant or preemergence to postemergence		0.0078-0.0156
Cereal and Fallow	metsulfuron	2		0.2-0.4 oz	0.0016-0.0031

- Do not apply preplant or preemergence to barley or triticale
- Plant seed at least 1 inch deep to reduce risk of injury.
- Should be tankmixed with another burndown herbicide to broaden spectrum of control.
- Rotation to Bolt or STS soybeans is 4 months; Plenish trait is 6 months.
- Rotation for field corn and all other soybeans is 18 months.
- Include a nonionic surfactant at 0.125 to 0.5% v/v.

Gramoxone SL 2			Preplant,	2-4 pt	0.5-1.0
Gramoxone SL 3	paraquat	22	Preemergence,	1.3-2.6 pt	0.5-1.0

- Apply in 20–60 gal/A for control of emerged annual weeds.
- Add 8–32 oz nonionic surfactant/100 gal of spray.
- Phosphate-containing liquid fertilizer solutions diminish paraquat activity if used as a carrier.
- Use appropriate precautions when handling paraquat to minimize exposure to the herbicide.
- Do not use flood jet tips larger than size 20 or spacing greater than 40 inches.

Paraquat Use Restrictions

- *Restricted-use pesticide.*
- Only certified applicators, who successfully complete the paraquat-specific training, can mix, load or apply paraquat.
- Application of paraquat “under the direct supervision” of a certified applicator is no longer allowed; registered technicians cannot apply.
- Required training link (<http://usparaquattraining.com>); certified applicators must repeat training every three years.

Harmony Extra SG	thifensulfuron +	2	Preplant or preemergence to postemergence	0.45-0.9 oz	0.014-0.028
50DF	tribenuron	2			

- For use on wheat, barley, and oats only.
- Audit 1:1 and T-Square contain similar active ingredients but at different ratios, see label for more use details.
- Apply burndown treatment before or shortly after planting but before small grain emergence.

Roundup 3S/ glyphosate ²	glyphosate	9	Preplant or preemergence	1-3 qt	1.0-3.0 lb ae/A
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- Apply before, during, or after planting but before crop emergence.
- Use the low rate for annual weeds up to 6 inches tall and higher rates for weeds taller than 6 inches.

Table 5.64 - Characteristics of “Burndown” Herbicides for No-Till Small Grains. (cont.)

See specific product label to determine correct rate for soil type and weed species found in each field.

- These treatments may be used in conventional, reduced-till, and no-till systems.
- Tables 5.56 and 5.58 list characteristics and efficacy of “burndown” herbicides.

Herbicide Trade name ¹	Herbicide Common name	Herbicide group # (site of action)	Application	product/A	lb ai/A
Sharpen 2.85SC	saflufenacil	14	Preplant or preemergence	1-2 fl oz	0.022-0.044

- Should be tankmixed with another burndown herbicide to broaden spectrum of control.
- For optimum burndown activity, include methylated seed oil (MSO) plus ammonium sulfate (AMS) at 8.5 to 17 lbs/100 gallons.
- Apply 1 to 2 oz/A for burndown activity. Sequential applications are allowed prior to crop emergence but do not apply more than 4 fl oz/A total per cropping season.

¹ The legitimate use of 2,4–D for burndown in wheat is uncertain. None of the 2,4–D ester or amine labels specify application just prior to wheat seeding or emergence. Some research suggests a minimum delay of 7–10 days after application at rates up to 1 pt/A 2,4–D ester. However, use of 2,4–D burndown in wheat is ambiguous at best and, if injury occurs, liability rests with the consultant or applicator.

² Various formulations of this product are available. See table in the introductory chapter of this guide. Refer to current product label for active ingredient concentration, application rate, and other restrictions.

Table 5.65 - Relative Effectiveness of Fall Planted Small Grain Herbicides for Winter Annuals

Table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rates and weed size or growth stage. Results may differ with variations in weed size, temperature, rainfall, and soil moisture. Crop tolerance rating of VG or E is rarely significant.

Weed control rating	Crop tolerance
10 = 95–100%	E = excellent; almost never any crop injury observed
9 = 85–95%	VG = very good; on rare occasion is crop injury observed
8 = 75–85%	G = good; seldom is crop injury observed as long as proper management practices are followed (e.g., seedling depth, seed slit closure, herbicide rate and application timing, adjuvants)
7 = 65–75%	FG = fair to good; occasionally crop injury is observed even with proper management practices; injury is often due to herbicide interactions with environmental conditions
6 = 55–65%	F = fair; some crop injury is commonly observed
N = less than 55% or no control	
L = labeled but no university data	
-- = not applicable or no information available	
+ = upper end of rating range	

	Grasses										Broadleaves														
Site of Action Number	Bluegrass, Annual ¹	Bluegrass, Roughstalk	Brome, spp. ²	Oatgrass, Bulbous ⁷	Ryegrass, Annual ²	Buckwheat, Wild	Carrot, Wild	Catchweed Bedstraw	Chickweed, Common ²	Corn, Chamomile	Cornflower	Field Pansy	Groundsel, Common	Henbit/purple Dead Nettle	Horseweed/Marestail ⁸	Knawel	Lettuce, Prickly	Mustard spp.	Pennycress, Field	Shepherdspurse	Speedwell spp. ³	Vetch, Hairy/Annual	Crop Tolerance		
Preplant																									
Finesse	2/2	6	–	6	–	6	6	8	N	9	9	–	–	L	9	8	9	9	8+	8	9	7+	6	FG	
Sharpen	14	N	N	N	N	N	N	N	N	L	N	–	N	8	–	L	N	L	L	L	L	–	–	E	
Valor	14	6	–	6	N	7	6	N	–	8	–	–	N	L	8	9	N	L	7	8	8	–	–	FG	
Delayed Preemergence																									
Axiom	5/15	8+	N	7	–	8+	–	N	–	8+	8+	–	N	–	9	8	9	–	8+	8	6	–	–	FG	
Prowl	3	6	–	–	–	8	–	N	–	7+	–	–	N	–	8+	N	N	–	7+	–	7+	N	N	VG	
Zidua / Anthem Flex	15	9	–	8	–	8+	–	N	–	7	–	–	N	–	8	8	6	–	–	–	–	–	N	VG	
Delayed Preemergence to Early Postemergence																									
Axial	1	N	N	N	N	9 ⁴	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	G
Osprey	2	8+	8+	8	–	9	N	–	N	7	7	N	6	N	7	N	8	N	8	N	N	N	8+	G	
Postemergence																									
2,4-D ⁵	4	N	N	N	N	N	6	7	7	6	–	6	N	6	6	8+	N	9	9	9	9	6	8 ⁷	F	
Aim	14	N	N	N	N	N	6	N	8	N	–	N	–	N	6	N	6	6	6	8	6	6	6	VG	
Clarity/dicamba	4	N	N	N	N	N	8+	6	N	7	–	6	N	7	7	8	7	8	7	7	8	6	9	F	
Finesse	2/2	7+	–	6	–	7+	N	8	6	8+	7	–	–	L	8+	7	9	8	8	8	8	7	7	G	
Harmony SG	2	N	N	N	N	N	8	N	N	7	–	N	–	9	7	N	–	7	9	9	9	N	6	VG	

Table 5.65 - Relative Effectiveness of Fall Planted Small Grain Herbicides for Winter Annuals (cont.)

Site of Action Number	Grasses							Broadleaves														Crop Tolerance		
	Bluegrass, Annual ¹	Bluegrass, Roughstalk	Brome, spp. ²	Oatgrass, Bulbous ⁷	Ryegrass, Annual ²	Buckwheat, Wild	Carrot, Wild	Catchweed Bedstraw	Chickweed, Common ²	Corn Chamomile	Cornflower	Field Parsley	Groundsel, Common	Henbit/Purple Dead Nettle	Horseweed (Marestail)	Knawel	Lettuce, Prickly	Mustard spp.	Pennycress, Field	Shepherdspurse	Speedwell spp. ³		Vetch, Hairy/Annual	
Harmony Extra	2/2	N	N	N	N	8	7+	N	8 ³	-	N	7	9	9	7	8+	8	9	9	9	N	7	VG	
Huskie	6/27	N	N	N	N	L	-	L	7	N	7	N	-	8+	8+	N	-	L	L	L	N	-	VG	
Maestro/Moxy	6	N	N	N	N	9	-	N	6	-	-	-	9	6	7	N	6	9	8	8	N	6	VG	
MCPA	4	N	N	N	N	8	6	N	6	-	-	N	6	6	8+	-	9	9	9	8+	6	7	FG	
Metricor/TriCor	5	8+	6	6+	8	N	-	N	-	9	-	8	N	-	9	N	8+	-	7	L	N	8	6	FG ⁶
Peak	2	N	N	N	N	8	-	N	7	-	-	-	N	6+	8	-	8+	9	9	8	N	9	G	
Powerflex	2	N	7+	8	-	9	6	-	7	8	9+	8	7	N	7	6	9	6	9	9	8	8	9	FG
Quelex	2/4	N	N	N	N	L	-	L	8	L	8	N	-	7	L	8+	6	L	L	L	N	L	VG	
Starane Ultra	4	N	N	N	N	-	-	L	7+	-	8	N	-	8	L	6	-	L	L	-	N	8+	G	
Stinger	4	N	N	N	N	9	-	N	N	-	-	N	9	N	9+	-	9	N	N	N	N	9	FG	

¹ Annual bluegrass control is listed on Osprey Flex label. Fall applications are best.

² See the introduction of this chapter for more detailed information on these weeds.

³ There are several speedwell (Veronica) species, including corn, common, ivy leaf, and others. Depending on the species, their life cycle is either annual or perennial. Many of the commonly used small grain herbicides provide little or no control of speedwell. Finesse has a few annual and perennial speedwells listed on its label and usually provides 80–90 percent control of them. PowerFlex has provided control of certain speedwell species in some university trials. Be cautious of crop rotation intervals if using Finesse. If speedwell is small, Aim provides some control/suppression.

⁴ Will not control group 1 (ACCCase) resistant annual ryegrass biotypes.

⁵ 2,4-D ester provides better control of hairy vetch than 2,4-D amine.

⁶ Crop tolerance with Dimetric Metricor/TriCor is dependent on weather at time of application and variety. Crop tolerance is improved if applications are made in the early spring rather than in the fall or late spring.

⁷ Outrider provides fair to good control (8) of bulbous oatgrass.

⁸ Horseweed biotypes resistant to Group 2 herbicides are widespread in the region; do not rely on herbicides from these groups to control resistant biotypes.

Table 5.66 - Relative Effectiveness of Fall Planted Small Grain Herbicides for Postemergence Perennial Weed Control

Table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rates and weed size or growth stage. Results may differ with variations in weed size, temperature, rainfall, and soil moisture. Crop injury rating of VG or E is rarely significant.

Weed control rating	Crop tolerance
10 = 95–100%	E = excellent; almost never any crop injury observed
9 = 85–95%	VG = very good; on rare occasion is crop injury observed
8 = 75–85%	G = good; seldom is crop injury observed as long as proper management practices are followed (e.g., seedling depth, seed slit closure, herbicide rate and application timing, adjuvants)
7 = 65–75%	FG = fair to good; occasionally crop injury is observed even with proper management practices; injury is often due to herbicide interactions with environmental conditions
6 = 55–65%	F = fair; some crop injury is commonly observed
N = less than 55% or no control	
L = labeled but no university data	
-- = no information available	
+ = upper end of rating range	

	Site of Action Number	Cockle, White	Dandelion	Dock spp.	Garlic or Onion, Wild	Smooth Bedstraw	Thistle, Canada	Crop Tolerance
Postemergence								
2,4-D	4	7+	7+	6+	7	6	7	FG
Aim	14	N	N	N	N	6	N	VG
Clarity/dicamba	4	8	6	7	6	N	7	F
Finesse	2/2	8	7+	8+	8+	N	7	G
Harmony SG	2	–	6	7	9	N	N	VG
Harmony Extra	2/2	–	6	8	9	N	7	VG
Huskie	6/27	L	L-s	L-s	–	L-s	–	VG
MCPA	4	N	8	6+	6	6	7	FG
Maestro	6	6	6	6	N	N	6	G
Metricor/TriCor	5	–	L	N	N	–	N	FG ¹
Peak	2	–	6	8	9	N	6+	VG
Powerflex	2	N	N	N	N	N	N	FG ²
Quelex	2/4	–	L-s	–	–	L	L-s	VG
Starane Ultra	4	–	7	–	–	L	N	VG
Stinger	4	7+	7+	7	N	N	8	FG

¹ Crop tolerance with Dimetric Metricor/TriCor is dependent on weather at time of application and variety. Crop safety is improved if applications are made in the spring rather than in the fall.

² Based on University of Delaware trials, Powerflex applications in the spring can result in significant stunting.

Table 5.67 - Comments on Herbicides for Small Grains

See specific product label to determine correct rate for soil type and weed species found in each field.

- Tables 5.64, 5.65, and 5.66 list characteristics and efficacy of herbicides.
- A good small grain stand is very competitive and normally does not require a herbicide treatment.
- It is important to control all existing vegetation at planting time, prior to no-till production.

Trade Name	Common Name	Site of Action Number	Application	Product/A	lb ai/A
2,4-D amine 4S	2,4-D	4	Full tiller to prejointing (growth stages 3–6)	0.5–2.0 pt	0.25–1.0

- For use on wheat, barley, rye, and oats.
- Use lower rates for small annual weeds.
- Use lower rate (0.25–0.5 pt/A) if underseeded with legume (alfalfa, red or white clover are labeled; vetch and sweet clover will be severely injured).
- Spraying small grains too young or after jointing can result in reduced yields or uneven ripening.
- In general, apply when small grain is 4 to 8 inches tall.
- May be tank-mixed with Harmony Extra SG, Banvel, or Maestro (Buctril).
- No rotation restriction to soybeans; 3 month rotation restriction to vegetables; see Table 5.26.

2,4-D LVE 4E	2,4-D	4	Full tiller to prejointing (growth stages 3–6)	0.5–2.0 pt	0.25–1.0
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- For use on wheat, barley, rye, and oats.
- Use lower rates for annual weeds.
- For wild garlic or onion control, apply 1.5 to 2.0 pt.
- Avoid use if temperatures are expected to exceed 75°F.
- No rotation restriction to soybeans; 3 month rotation restriction to vegetables; see Table 5.26.

Aim 2EC	carfentrazone	14	Up to the jointing stage (growth stages 1–5)	0.5–2 fl oz	0.008–0.016
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- For use on wheat, barley, and oats to control certain broadleaves.
- Apply before weeds are 4 inches tall.
- Aim provides control/suppression of a limited number of weeds species; should be tank-mixed other common small grain herbicides to improve control and increase weed spectrum. Some research has shown that Aim provides suppression of Star-of-Bethlehem and speedwell.
- No rotational restrictions to soybeans or vegetables; see Table 5.24.

Table 5.67 - Comments on Herbicides for Small Grains (cont.)

See specific product label to determine correct rate for soil type and weed species found in each field.

- Tables 5.64, 5.65, and 5.66 list characteristics and efficacy of herbicides.
- A good small grain stand is very competitive and normally does not require a herbicide treatment.
- It is important to control all existing vegetation at planting time, prior to no-till production.

Trade Name	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Anthem Flex – see Zidua					
Axial XL 0.42L	pinoxaden	1	Two-leaf to preboot (growth stages 2–8)	16.4 fl oz	0.053

- For use on wheat or barley only.
- Do not apply within 60 days of harvest. Controls certain grassy weeds such as annual ryegrass, foxtails, barnyardgrass, and wild oat. Apply Axial XL before weeds have more than 5 leaves on the main stem.
- Axial XL does not control downy brome or ACCase-resistant grasses.
- Axial XL will not control broadleaf weeds and should be tank-mixed with other labeled herbicides to enhance weed control spectrum.
- Axial TBC is a premix of pinoxaden (Axial) + florasulam (in Orion) and Axial Star is a combination of pinoxaden (Axial) + fluroxypyr (Starane); both products control annual grasses and broadleaves.
- Rotation to grain crops (including soybeans) is 90 days; to leafy and root crops is 30 days, all other vegetables after 90 days; see Table 5.24.
- Axial Star is a premix containing pinoxaden plus fluroxypyr (Starane Ultra), and Axial Bold is a premix containing pinoxaden plus fenoxaprop.

Axiom 68 DF	flufenacet + metribuzin	5/15	Spiking to 2 leaf (growth stage 1)	4–10 oz	0.133–0.333 0.033–0.083
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- For use on fall-seeded wheat and triticale.
- Plant seeds 1 to 2 inches deep to improve crop safety; use only when wheat is planted with a drill.
- Apply when crop is between full germination and 2-leaf stage; apply before broadleaf weeds reach the 1-leaf stage. Axiom will not control grasses after they have emerged.
- Use rate depends on soil texture; see product label.
- Some crop varieties are more sensitive; see product label.
- No rotation restriction to soybeans. 12 month rotation restriction to vegetables; see Table 5.24.
- *Water Quality Advisory.*

BeyondXtra	imazamox	2	postemergence		
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- For use on Clearfield or Clearfield Plus wheat only.
- Apply early postemergence before broadleaf weeds exceed a height of 3 inches and grasses exceed 4 to 5 leaves.
- Nonionic surfactant and nitrogen based fertilizer must be added to the spray solution for optimal weed control.
- Use a water/liquid fertilizer solution of at least 50% water.
- Weed control may be improved by substituting nonionic surfactant for control, COC, MSO, or HSOC.
- Use of COC, MSO, or HSOC in place of NIS in Clearfield Plus spring wheat may result in crop injury.
- When Beyond Xtra is tank mixed with another herbicide, using COC, MSO, or HSOC in Clearfield Plus spring wheat is only advised when a Beyond Xtra tank mix partner allows use of COC, MSO, or HSOC.

Table 5.67 - Comments on Herbicides for Small Grains (cont.)

See specific product label to determine correct rate for soil type and weed species found in each field.

- Tables 5.64, 5.65, and 5.66 list characteristics and efficacy of herbicides.
- A good small grain stand is very competitive and normally does not require a herbicide treatment.
- It is important to control all existing vegetation at planting time, prior to no-till production.

Trade Name	Common Name	Site of Action Number	Application	Product/A	lb ai/A
dicamba (numerous)	dicamba DMA Salt	4	Full tiller to jointing (growth stages 3–6)	2–4 fl oz	0.06–0.12
Clarity 4S	dicamba DGA Salt			2–4 fl oz	

- For use on fall-seeded barley and wheat only.
- Crop safety and weed control will be similar for all dicamba formulations.
- Spraying small grains after jointing can result in reduced yields or uneven ripening. May be tank-mixed with Maestro or 2,4-D to broaden spectrum of control.
- Do not use if legumes are underseeded.
- No rotation restrictions.

Finesse 75DF Cereal and Fallow	chloransulam metsulfuron	2 2	preemergence to postemergence (after 1-leaf but before boot stage)	0.2–0.4 oz	0.0078–0.0156 0.0016–0.0031
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- Do not apply preplant or preemergence to barley or triticale.
- Plant seed at least 1 inch deep to reduce risk of injury.
- Finesse will not control ALS-resistant weed populations; control of susceptible ryegrass populations can be erratic.
- Rotation to Bolt or STS soybeans is 4 months; Plenish trait is 6 months.
- Rotation for field corn and all other soybeans is 18 months.
- Include a nonionic surfactant at 0.125 to 0.5% v/v.
- Two applications can be used, but do not exceed 0.4 oz per crop.

Table 5.67 - Comments on Herbicides for Small Grains (cont.)

See specific product label to determine correct rate for soil type and weed species found in each field.

- Tables 5.64, 5.65, and 5.66 list characteristics and efficacy of herbicides.
- A good small grain stand is very competitive and normally does not require a herbicide treatment.
- It is important to control all existing vegetation at planting time, prior to no-till production.

Trade Name	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Harmony Extra SG 50DF	thifensulfuron	2	Two-leaf to before visible flag leaf (growth stages 1– 7)	0.45–0.9 oz	0.009–0.018
	+ tribenuron	2			0.005–0.009

- For use on wheat, barley, and oats.
- Do not apply within 45 days of harvest.
- Controls wild garlic and broadleaf weeds. Tank-mix with Express 50SG for improved wild carrot control. Not recommended for cornflower.
- Rates depend on type of weeds and severity.
- Fall applications have been more consistent than spring applications for weed control in regional trials.
- For garlic control use higher rates of Harmony Extra SG plus 2,4-D when garlic is less than 12 inches tall.
- Always premix Harmony Extra SG in water before adding to the spray tank.
- Tank-mix with other herbicides to increase weed control spectrum; improve control of ALS-R common chickweed with Quelex or Starane Ultra.
- Tank-mixing with dicamba or Maestro may result in reduced control of certain broadleaf weeds.
- Do not tank-mix with Malathion.
- Be aware many products contain thifensulfuron plus tribenuron, but often not at the same concentration as Harmony Extra.
- Any crop may be planted 45 days after application; see Table 5.24.

Harmony SG 50DF	thifensulfuron	2	Two-leaf to before visible flag leaf (growth stages 1– 7)	0.45–0.9 oz	0.014–0.028
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- Harmony SG can be used on fall-seeded wheat, barley, triticale, and oats.
- Do not apply within 45 days of harvest.
- Harmony SG controls wild garlic and broadleaf weeds. Not recommended for cornflower or common chickweed.
- The common rate for wheat, barley, and triticale is 0.75 oz/A, but higher or lower rates may be used. Apply 0.45 to 0.6 oz/A to oats.
- Sequential applications may be applied to wheat, barley, and triticale. Do not apply more than exceed 1.5 oz/a per year.
- Tank-mix with other herbicides to increase weed control spectrum; Quelex or Starane Ultra improve control of ALS-R common chickweed.
- Harmony SG also may be used as a preplant burndown application before small grain emergence.
- Any crop may be planted 45 days after application; Table 5.24.

Table 5.67 - Comments on Herbicides for Small Grains (cont.)

See specific product label to determine correct rate for soil type and weed species found in each field.

- Tables 5.64, 5.65, and 5.66 list characteristics and efficacy of herbicides.
- A good small grain stand is very competitive and normally does not require a herbicide treatment.
- It is important to control all existing vegetation at planting time, prior to no-till production.

Trade Name	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Huskie 2.06L	pyrasulfotole + bromoxynil	6 27	First-leaf to flag-leaf emergence (growth stage 1-7)	11-15 oz	0.026-0.036 0.151-0.205

- For use on wheat, barley, rye, and triticale.
- Huskie controls small annual broadleaf weeds.
- Pre-harvest interval is not specified on label.
- In some university trials, Huskie provided control of marestail at the rosette stage when applied in the spring.
- 4 month rotation restriction to soybean; >9 months for vegetables; see Table 5.24.
- *Water quality advisory.*

MCPA amine or ester 4L	MCPA	4	Full tiller to prejoint stage (growth stages 3-6)	0.5-1.0 pt	0.25-0.5
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- For use on wheat, barley, rye, and oats.
- Safer on small grains underseeded with legumes than 2,4-D (amine formulation only) but use the lower rate (0.25-0.5 pt) and apply in 5-10 gal water/A; legumes should be 2-3 inches tall and cereal should be 8 inches tall to provide canopy to protect legume.
- For best results, apply while weeds are small, typically when cereal is 4-8 inches tall.
- No rotation restrictions are indicated.

Maestro 2EC	bromoxynil	6	Emergence to boot stage (growth stages 1-9)	1-2 pt	0.25-0.5
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- For use on fall-seeded wheat, barley, rye and oats.
- May be applied to a small-grain/alfalfa under-seeding.
- Apply before weeds have more than four leaves or are 2 inches tall, or rosettes exceed 1 inch in diameter.
- Use flat fan nozzles and a minimum of 10 gal/A for best results.
- Weak on chickweed and henbit.
- May be tank-mixed with Harmony Extra SG, MCPA, 2,4-D, or Banvel/Clarity.
- 30 day rotation restriction for all crops; see Table 5.24.
- Tolvera is a premix containing tolpyralate and bromoxynil.

Table 5.67 - Comments on Herbicides for Small Grains (cont.)

See specific product label to determine correct rate for soil type and weed species found in each field.

- Tables 5.64, 5.65, and 5.66 list characteristics and efficacy of herbicides.
- A good small grain stand is very competitive and normally does not require a herbicide treatment.
- It is important to control all existing vegetation at planting time, prior to no-till production.

Trade Name	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Metricor 75DF/ TriCor 75DF	metribuzin	5	2-leaf to 4-tiller (growth stages 1–5)	2–4 oz	0.047–0.19

- For use on wheat and barley.
- For control of Group 2 (ALS) resistant common chickweed: Metricor and Tricor are approved for use under 24(c) labels in Delaware, Maryland, Pennsylvania, and Virginia (expires December 2025).
- The typical use rate is 2–4 oz/A (3 oz/A is recommended) either in the fall or spring when the crop is in the 2-leaf to 4-tiller growth stage.
- Rate depends on soil texture; see product label.
- Local research has shown wheat safety is best with an early spring application (at greenup). Potential for injury increases with late spring applications or fall applications.
- Plant wheat at least 1 inch deep.
- Metribuzin can be tank-mixed with other small grain herbicides to broaden control spectrum.
- Certain wheat and barley varieties are sensitive to metribuzin. Refer to the respective label for additional details on varieties and other use restrictions.
- In general, fall-applied herbicide generally provided more consistent common chickweed control, but spring metribuzin treatments were adequate as well.
- For best results, apply metribuzin when chickweed is small (4–6 inches in diameter).
- Metricor may be applied more than once per crop season. Do not apply more than 8 oz/A per year.
- Allow a minimum of 21 days between applications when wheat is actively growing and 45 days if wheat is growing under adverse conditions.
- No rotation restriction to soybean; 4 to 18 months for vegetables; see Table 5.24.
- *Water quality advisory.*

Osprey 4.5 WDG	mesosulfuron	2	Emergence to jointing stage (growth stages 1-5)	4.75 oz	0.013
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- For use in winter wheat and triticale.
- Pre-harvest interval is not specified on label.
- In our region, Osprey will be primarily targeted for control of annual ryegrass, including ACCase-resistant biotypes and downy brome. Can provide control/suppression of annual bluegrass.
- Applications should be made when weeds are young and actively growing at the one-leaf to two-tiller stage.
- To broaden weed control spectrum, Osprey may be tank-mixed with other herbicides including Harmony Extra SG, Harmony SG, MCPA, Maestro (Buctril), and Stinger.
- Do not topdress with nitrogen fertilizer within 14 days following an Osprey application.
- Do not apply more than 4.75 oz/A in a single application, or 4.75 oz/A per year.
- Certain insecticides and fungicides may be tank-mixed.
- Soybeans can be planted after 90 days of application; corn after 3 months; vegetables after 10 months, and alfalfa after 10 months; see Table 5.24.

Table 5.67 - Comments on Herbicides for Small Grains (cont.)

See specific product label to determine correct rate for soil type and weed species found in each field.

- Tables 5.64, 5.65, and 5.66 list characteristics and efficacy of herbicides.
- A good small grain stand is very competitive and normally does not require a herbicide treatment.
- It is important to control all existing vegetation at planting time, prior to no-till production.

Trade Name	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Peak 57WDG	prosulfuron	2	Three-leaf to before visible second node (growth stages 2-6)	0.25–0.5 oz (1 pack/6-12 A)	0.009–0.018 oz

- For use on wheat, barley, oats, rye, and triticale
- Peak controls wild garlic and broadleaf weeds.
- Peak can be tankmixed with glyphosate as a burndown plus residual treatment; can be used prior to planting.
- For best results apply when weeds are small and use the 0.5 oz/A rate if used alone.
- May be tank-mixed with Banvel/Clarity, 2,4-D, MCPA, or Maestro (Buctril) to broaden weed spectrum; however, certain application timing restrictions may apply.
- Do not apply organophosphate (op) insecticide 15 days before or 10 days after Peak application.
- Be cautious of crop rotation restrictions (10 mo. for soybeans and 22 mo. for alfalfa; see label for other cropping restrictions); see Table 5.24.
- *Water quality advisory.*

PowerFlex HL 13WDG	pyroxsulam	2	Three-leaf to jointing (growth stage 6)	2.0 oz	0.016
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- For use on wheat and triticale only.
- Do not apply within 60 days of harvest. Crop stunting and chlorosis is commonly observed with spring applications; and stunted wheat can be observed for weeks after application. Stunting and chlorosis has not been observed with fall applications.
- Do not apply more than 2 oz/A in a single application, or 2 oz/A per year.
- The PowerFlex activity on certain grass and broadleaf weeds, including annual ryegrass, downy brome and annual bluegrass is improved with fall applications.
- Tarzec is a premix containing halauxifen plus pyroxsulam.
- Soybeans can be planted 3 months after application. Vegetables can be planted after 9 to 12 months; see Table 5.24.

Prowl H₂O 3.8SC	pendimethalin	3	First-leaf to before the flag leaf is visible (growth stages 1-7)	1.5–3 pt	0.7–1.4
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- For use on wheat or triticale only.
- Wheat or triticale must be planted 0.5–1 inch deep to avoid crop injury.
- Must be applied prior before weed emergence. Any emerged weeds will not be controlled, so use a tank mix to control them.
- For best results, apply Prowl H₂O once the wheat rows are visible and before weeds have emerged.
- Prowl controls many annual grass and broadleaf weeds.
- No rotation restriction to soybeans or vegetables; see Table 5.24.

Table 5.67 - Comments on Herbicides for Small Grains (cont.)

See specific product label to determine correct rate for soil type and weed species found in each field.

- Tables 5.64, 5.65, and 5.66 list characteristics and efficacy of herbicides.
- A good small grain stand is very competitive and normally does not require a herbicide treatment.
- It is important to control all existing vegetation at planting time, prior to no-till production.

Trade Name	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Quelex 20.4WDG	halauxifen	4	2-leaf to flag leaf emergence (growth stages 2-8)	0.75 oz	0.005
	florasulam	2			0.005

- For use on wheat, barley, or triticale only.
- Best to apply to small, actively growing weeds (2 to 4-leaf stage).
- Quelex is a slow-acting herbicide.
- Quelex provides good control of Group 2 (ALS) resistant common chickweed; Harmony Extra plus Quelex has provided control of ivyleaf speedwell and henbit (better than either herbicide applied alone).
- Do not compost any plant material from the treated area.
- Do not apply within 60 days of crop harvest.
- Rotation is 3 months in Pennsylvania, 45 days in Delaware, Maryland, Virginia to soybeans and 15 months to most vegetables; see Table 5.24.
- *Water quality advisory.*

Sharpen 2.85SC	saflufenacil	14	Preplant or preemergence	1–4 fl oz	0.022–0.088
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- For use on wheat, barley, oats, rye, and triticale.
- Be sure seed row is sufficiently covered with soil to avoid washing and concentrating the herbicide in the seed zone.
- Apply Sharpen for burndown (see Table 5.3) and/or limited residual control of certain annual broadleaf weeds.
- Sharpen does not control grass weeds.
- Do not apply Sharpen if crop has emerged.
- No rotation restriction to soybeans; 1 to 5 months for vegetables, depending on species; see Table 5.24.

Starane Ultra 2.8L	fluroxypyr	4	Two-leaf to early boot (growth stages 2-9)	4.8–6.4 fl oz	0.09–0.13
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- For use on wheat, barley, triticale, and oats.
- Do not apply within 90 days of harvest.
- The Starane Ultra label lists control of bedstraw, chickweed, hemp dogbane, prickly lettuce, ragweed, and velvetleaf and to suppress bindweed, wild buckwheat, mustard species, and others.
- Starane Ultra provides fair to good control of group 2 (ALS) resistant common chickweed. Harmony Extra plus Starane Ultra has provided control of ivyleaf speedwell, henbit, and jagged chickweed (better than either herbicide applied alone).
- Axial Star is a premix containing pinoxaden (Axial) plus fluroxypyr, Starane Flex is a premix containing fluroxypyr plus florasulam, Supremacy is a premix containing thifensulfuron plus tribenuron plus fluroxypyr. Pixaro is a premix containing halauxifen plus fluroxypyr.
- 120 rotation restriction to crops not listed, which includes soybeans. 24(c) labels in Delaware and Virginia permits 90 day rotation to soybeans.

Table 5.67 - Comments on Herbicides for Small Grains (cont.)

See specific product label to determine correct rate for soil type and weed species found in each field.

- Tables 5.64, 5.65, and 5.66 list characteristics and efficacy of herbicides.
- A good small grain stand is very competitive and normally does not require a herbicide treatment.
- It is important to control all existing vegetation at planting time, prior to no-till production.

Trade Name	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Stinger 3S	clopyralid	4	Three-leaf to early boot (growth stages 2-9)	0.25–0.33 pt	0.1–0.125

- For use on wheat, barley, and oats only.
- For best results, apply while weeds are actively growing.
- For Canada thistle, apply when thistle is 1 to 2 feet tall.
- Pre-harvest interval is not specified on label.
- May be tank-mixed with any other small-grain herbicide to increase weed spectrum. (Curtail is a premix of clopyrid and 2,4-D. See product label for details.)
- Do not use plant residues or manure from animals that consumed forage from treated areas for compost or mulch where susceptible plants may be grown the following season.
- 10.5 month rotation restriction to soybeans for soils >2% organic matter; 18 month restriction for soils <2% organic matter. See label as vegetable rotation varies greatly by species; see Table 5.24.
- *Water quality advisory.*

Valor SX 51WDG or Valor EZ 4L	flumioxazin	14	Early-preplant	1.0–2 oz	0.032–0.064
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- For use in wheat only in DE, MD, NJ, PA, and VA.
- Must be applied 7 days prior to planting in no-till or minimum till wheat; 30 days preplant restriction from conventionally tilled wheat.
- When using as a burndown, apply 2 oz/A.
- Wheat must be planted a minimum of 1 inch deep.
- Valor improves control of horseweed and other broadleaf weeds when tank-mixed with other herbicides that broaden control spectrum.
- With sandy soils, stunting and stand loss can occur if seed is not planted at least 1 inch deep and heavy rain occurs shortly after application.
- No rotation restriction to soybeans; more than 4 months for vegetables; see Table 5.24.

Table 5.67 - Comments on Herbicides for Small Grains (cont.)

See specific product label to determine correct rate for soil type and weed species found in each field.

- Tables 5.64, 5.65, and 5.66 list characteristics and efficacy of herbicides.
- A good small grain stand is very competitive and normally does not require a herbicide treatment.
- It is important to control all existing vegetation at planting time, prior to no-till production.

Trade Name	Common Name	Site of Action Number	Application	Product/A	lb ai/A
Zidua 85WDG or Zidua 4.17SC	pyroxasulfone	15	Delayed pre- to early postemergence (4th tiller)	0.7–2.5 oz or 1.25–4 fl oz	0.04–0.13
Anthem Flex 4SE	pyroxasulfone + carfentrazone	15 14	(stages 1-3)	2–4.5 fl oz	0.004–0.01

- For use in wheat only.
- All products can be applied as a delayed preemergence (80% germination with 0.5-inch-long shoot to spiking) to control annual grasses and small-seeded broadleaf weeds. Application before wheat germination, followed by rainfall, can lead to significant stand loss.
- Do not use on broadcast seeded wheat; do not plant wheat deeper than 1.5 inches (but at least 1 one inch deep).
- Do not apply if more than 0.25 inches of rain is expected within 48 hours.
- Crop injury may result under prolonged wet soil conditions.
- Consult label as soil texture influences rate.
- If applied as an early postemergence (spike to 4 tillers) Zidua may be tank-mixed with Clarity, Prowl H₂O, metribuzin, or Axial XL; consult label as soil texture influences rate.
- Zidua alone will not control emerged weeds; Anthem Flex contains carfentrazone (Aim) which will provide control of certain weed species if they are very small at time of application.
- No rotation restriction to soybeans; 18 months for vegetables; see Table 5.24.
- *Water quality advisory.*

Table 5.68 - Spray Additives and Rainfastness for “Burndown” or Postemergence Herbicides in Small Grains

Trade Name	Adjuvant(s) ¹	Rate	Apply in N-carrier (50:50)	Rainfastness (hours)
2,4-D amine 4S/	nonionic surfactant or	1 qt/100 gal	Yes	1
2,4-D LVE 4E	crop oil concentrate	4 qt/100 gal		
Aim	nonionic surfactant or	1 qt/100 gal	Yes	6 to 8
	crop oil concentrate plus	1 gal/100 gal		
	ammonium sulfate or	2-4 lb/A		
	nitrogen solution (optional)	2-4 gal/100 gal		
Anthem Flex ²	non-ionic surfactant	1 qt/100 gal	N/A	1
	or crop oil concentrate	1-2 pt/A		
	or methylated seed oil	1-2 pt/A		
	plus nitrogen solution (optional)	1-2 pt/A		
	or ammonium sulfate (optional)	8.5 lb/100 gal		
Axial XL	none required		Yes	0.5
Axiom	Do not add crop oil concentrate, vegetable, or petroleum oils		No	
Clarity/dicamba	nonionic surfactant or	1 qt/100 gal	Yes	4
	crop oil concentrate plus	1 gal/100 gal		
	nitrogen solution	2-4 qt/A		
Finesse	non-ionic surfactant	0.5-2 qt/100 gal	Yes	6
Harmony Extra	nonionic surfactant	See table below	Yes	several
	nitrogen solution (optional)	2 qt/A		
Harmony SG	nonionic surfactant	See table below	Yes	several
	nitrogen solution (optional)	2 qt/A		
Huskie	ammonium sulfate or	0.5-1 lb/A	Yes	1
	Urea ammonium nitrate	1-2 qt/A		
MCPA	No information		Yes	No information
Maestro	nonionic surfactant or	1 qt/100 gal	Yes	No information
	crop oil concentrate or	1 gal/100 gal		
	nitrogen solution	2-4 gal/100 gal		
Metricor/TriCor	not recommended		not recommended	No information
Osprey	methylated seed oil (MSO) or	2 gal/100 gal	Yes, but no more than 15% of solution	4
	Nonionic surfactant plus	2 pt/100 gal		
	Nitrogen solution	1-2 qt/A		
Peak	nonionic surfactant or	1-2 qt/100 gal	yes	4
	crop oil concentrate	1-4 qt/A	Do not use crop oil with N-carrier	
	nitrogen solution (optional)	2-4 qt/A		

Table 5.68 - Spray Additives and Rainfastness for “Burndown” or Postemergence Herbicides in Small Grains (cont.)

Trade Name	Adjuvant(s) ¹	Rate	Apply in N-carrier (50:50)	Rainfastness (hours)
Powerflex	nonionic surfactant plus	1-2 qt/100 gal	Yes	4
	nitrogen solutions (optional) or	1-2 qt/A		
	crop oil concentrate (nitrogen solutions is not recommended with COC)	1 gal/100 gal		
Quelex	non-ionic surfactant	0.8-2 qt/100 gal	yes ³	4
	or crop oil concentrate	2-4 qt/100 gal		
	or methylated seed oil	2-4 qt/100 gal		
Sharpen	methylated seed oil	1 gal/100 gal	No information	1
	Nitrogen solution	1.25-2.5 gal/100 gals		
Starane Ultra	None recommended		No information	1
Stinger	None recommended		Yes	6
Tolvera	methylated seed oil	2-4 qt/100 gal	Yes	1
	or crop oil concentrate	2-4 qt/100 gal	Yes	1
	or high surfactant oil concentrate	2-4 qt/100 gal	Yes	1
Valor	methylated seed oil	1 qt/A	No information	1
	nitrogen solution	1-2 qt/A		
Zidua	None recommended		No information	N/A

¹ In general, nonionic surfactants should contain at least 80% surface active agent; crop or vegetable oil concentrates should be nonphytotoxic containing at least 15% approved emulsifier; nitrogen solution is ammonium-based fertilizer such as 28%, 30%, or 32% N; and ammonium sulfate should be spray-grade dry ammonium sulfate (21-0-0). You also may use 10-34-0 with some products.

² Anthem Flex label recommends an adjuvant if emerged weeds are present (and are susceptible to carfentrazone [Aim]) at time of application.

³ When applied with liquid nitrogen fertilizer use non-ionic surfactant at no more than 1 qt/100 gal instead of crop oil or methylated seed oil.

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Adjuvant recommendations for Harmony SG and Harmony Extra SG.

Carrier	Situation	Rate of NIS/100 gallons
Water	Normal	1 qt
Nitrogen diluted with water (>50% nitrogen)	Normal	0.5-1 pt
Liquid nitrogen fertilizer	Garlic over 8 inches	0.5 pt
Liquid nitrogen fertilizer	Garlic less than 8 inches	None
Liquid nitrogen fertilizer	With 8 fl oz of 2,4-D	None
Water	With 8 fl oz of 2,4-D	1 pt

Table 5.69 - Comments on Herbicides for Harvest Aid in Small Grains

Paraquat/Gramoxone is not labeled as a harvest aid in small grains.

Trade Name	Common Name	Site of Action Number	Product/A	lb ai/A
2,4-D LVE 4E	2,4-D	4	1.0–2.0 pt	0.5–1.0

- For use on wheat, barley, rye, and oats. (Only certain 2,4-D products have all of these small grains listed.)
- Apply when grains are in the hard dough stage.
- 2,4-D is generally not recommended as a harvest aid due to its volatility, and potential damage to the crop during application.
- Avoid use if temperatures are expected to exceed 75°F.
- No adjuvants are recommended.
- 14 day preharvest interval.

Aim 2EC	carfentrazone	14	2 fl oz	0.26 oz
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- Use as a harvest aid to desiccate a limited number of broadleaf weed species
- Application shall be made when the crop is mature and the grain has begun to dry down.
- Ensure spray coverage is sufficient, otherwise poor control will result.
- Methylated seed oil or crop oil concentrate at 1 to 2 gal/100 gal is required; liquid nitrogen fertilizer at 2 to 4 gal/100 gal or ammonium sulfate at 2 to 4 lb/A can be added to the methylated seed oil or crop oil.
- Allow at least 7 days between application and harvest.

dicamba (numerous)	dicamba DMA Salt	4	8 fl oz	0.25
Clarity 4S	dicamba DGA Salt		8 fl oz	

- For use on fall-seeded barley and wheat.
- Do not apply to grain grown for seed.
- Apply when grains are in the hard dough stage.
- Apply with a nonionic surfactant (1 qt/100 gal) or crop oil concentrate or methylated seed oil (1 to 2 qt/100 gal)
- Apply 7 days before harvest.

Table 5.69 - Comments on Herbicides for Harvest Aid in Small Grains (cont.)

Paraquat/Gramoxone is not labeled as a harvest aid in small grains.

Trade Name	Common Name	Site of Action Number	Product/A	lb ai/A
Roundup Powermax 4.5S¹/ Glyphosate¹	glyphosate	9	1–2 pt	0.5–1.0
Sharpen 2.85SC	saflufenacil	14	1–2 fl oz	0.022–0.044

- Do not apply to wheat grown for seed; and feed barley is only barley type labeled.
- Apply to feed barley after the hard dough stage when grain moisture is 20% or less; apply to wheat after the hard dough stage when grain moisture is 30% or less.
- Be cautious of drift.
- See specific glyphosate formulations for adjuvant recommendations.
- Apply at least 7 days before harvest.

- For use on wheat, barley (feed only), and triticale.
- Apply after hard dough stage and grain is less than 30% moisture.
- Ground applications require 10 gallons spray volume per acre; aerial requires 5 gallons.
- No rotation restriction to soybeans; 1 to 5 months for vegetables.
- Apply with methylated seed oil (1 gal/100 gal) plus ammonium sulfate (8.5 lb/100 gal) or urea ammonium nitrate (UAN) (1.25 to 2.5 gal/A).
- Apply at least 3 days before harvest; label recommends 10 days for optimum desiccation effect.
- *Water quality advisory.*

¹ Various formulations of this product are available; see table in the introductory chapter of this guide for various glyphosate products and rates. Refer to current product label for active ingredient concentration, application rate, and other restrictions. Adjust application rate if using Roundup WeatherMax 4.5S (e.g., 1 qt Roundup 4S = 22 fl oz WeatherMAX 4.5S).

Table 5.70 - Grazing and Feeding Restrictions for Small Grain Herbicides and Livestock Use

Herbicide	Days After Treatment Before:					Pre-harvest for Grain (PHI)
	Grazing		Feeding Straw	Withdraw for Meat	Silage	
	Beef	Dairy				
2,4-D ¹	0	14	0	14	— ²	14
2,4-D ¹ (late)	no	no	no	—	—	14
Aim	7	7	7	—	7	7
Anthem Flex	7	7	—	—	—	7
Axial Bold	30	30	30	—	30	70
Axial Star	30	30	30	—	30	60
Axial XL	30	30	60	—	30	60
Axiom	30	30	—	—	—	not specified
Callisto ³	30	30	30	—	30	50
Clarity/dicamba	0	7	37	30	37	7
Finesse	no	no	—	—	—	45
Harmony SG	7	7	yes	—	7/30	45
Harmony Extra	7	7	yes	—	7/30	45
Huskie	25	25	60	—	25	60
MCPA ¹	0	7	0	7	—	not specified
Maestro	30	30	30	30	30	not specified
Metricor/Tricor	14	14	no	—	21	not specified
Osprey	30	30	60	—	30	not specified
Peak	30	30	30	—	40	60
PowerFlex	7	7	28	—	28	60
Prowl H ₂ O	11	11	60	—	11	60
Quelex	7	7	21	—	—	60
Sharpen	30	30	30	—	30	3
Starane Ultra	7	7	40	—	14	120/90 ⁴
Stinger	0	7	no	7	—	not specified
Tolvera	21	21	50	—	21	50
Valor	5 inches in height	5 inches in height	—	—	—	not specified
Zidua	7	7	—	—	—	not specified

¹ 2,4-D and MCPA labels may vary depending on brand name. Consult label for restrictions.

² — = no information available.

³ Callisto is only labeled for use in spring oats only.

⁴ 24c label allows for 90 day plant back to soybeans for Delaware and Virginia only.

Forages, CRP, and Farmstead Weed Management

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Integrated Weed Management

Managing weeds in forages requires a different approach from managing weeds in row crops. Proper management to establish and maintain a dense stand of forage will render it competitive to most common weeds. Managing soil pH, nutrients, grazing or cutting, and insects, as well as using disease-resistant varieties and selective herbicides when necessary, will help the forage stand be competitive. A well-planned pest management program for forage crops involves using multiple strategies. These should include prevention, monitoring, cultural control, mechanical or physical control, biological control, and chemical control tactics. Preventive techniques may start with planting weed-free crop seed or choosing an alternative field or planting date. Regularly monitoring for pests is an important predictive tool. Mechanical or physical controls may include tillage and mowing to disrupt certain pests. Mixed grazing by including small ruminants into the livestock community will help manage brushy weeds in a pasture. Finally, chemical controls are an important component of many integrated pest management (IPM) systems, but their use should be based on sound management decisions. See Chapter 1 of this guide for more information about designing an IPM program.

This guide provides chemical control recommendations based on university research and manufacturer recommendations. Table 5.69 contains general information about herbicides available for use in legume or grass forages including pastures and hayfields.

This publication strives for accuracy; however, omissions, inaccuracies, or outdated information can occur because of the dynamics of pests and pest management. Seek out additional information from the manufacturer or other reliable sources when making important management decisions. Remember, this guide is not a substitute for the manufacturer's product label.

Legumes

If weeds become a problem, they can compete for or interfere with light, nutrients, water, and space, directly influencing yield and forage stand. For instance, winter annuals and perennials such as common or mouseear chickweed, henbit, and purple dead-nettle have been reported to reduce alfalfa stands by more than 30 percent. They emerge in the fall and winter, and develop a thick, lush mat early in the spring that can compete with the first forage cutting. Once they complete their life cycle in early summer, summer annuals, such as foxtails, lambsquarters, and pigweeds, or perennial weeds such as dandelion or dock species can fill in the bare spots and continue to reduce forage yield and quality.

Unlike most grain or fiber crops from which weeds are separated at harvest, weeds often are harvested along with the forage crop, potentially reducing hay quality. Reductions in quality often are in the form of low protein content and feed digestibility. Forage value of weeds may vary from species to species. For example, dandelion is comparable to alfalfa in protein and total digestible nutrients (TDN). Dandelion control may not necessarily improve the quality of hay, but it may be of some value in reducing the time necessary to dry the hay since dandelion dries more slowly than alfalfa. Increased drying time may mean greater harvest losses due to untimely rainfall.

Quality of monocot weeds (grasses) can also be similar to that of the forage. In general, weedy grasses have about 75 percent of the quality of alfalfa. Controlling quackgrass in alfalfa can increase forage protein levels 4 to 7 percent. Weeds with woody stems or flower stalks, such as yellow rocket, white cockle, rough fleabane, curly dock, and broadleaf dock, have lower protein levels (about 50 percent of the quality of alfalfa), so controlling them is even more important.

When weeds are present or persist in spite of good management, herbicides can help improve yield and quality. Weed control

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at establishment or in the seedling year is most critical for maintaining a healthy forage stand. When weeds are controlled during the seedling year, the forage crop seldom requires additional herbicide treatments for at least the first two years of the stand.

Weed management in legume forages can be divided into two phases: control in the establishment or seedling year and control in an established stand.

Control Before and During Establishment

Managing weeds in forages begins long before crop establishment. Certain types of weeds are potentially serious problems for forages, so it is important to eliminate them in advance. In particular, perennial broadleaf and grass weeds such as dandelion, curly dock, Canada thistle, horsenettle, and quackgrass are much easier to manage prior to planting a forage crop. While combating such weeds in the establishment year, prudent use of a genetically modified glyphosate tolerant (Roundup-Ready) alfalfa seed could be of value. Biennial weeds including musk thistle and burdock should be eliminated before establishing forage. If these weeds are not removed before the seeding is made, they commonly persist throughout the life of the forage. The cost of controlling weeds before or at the time of seeding should be considered an investment that will be returned for the life of the stand.

Below are some general rules for managing weeds at establishment or in the seedling year:

- Weeds that emerge with the crop are generally more destructive.
- Maintain the forage relatively weed-free for the first 60 days.
- Weeds that emerge beyond 60 days will not influence that year's forage yield.
- Later-emerging weeds may still influence forage quality.
- Winter-annual weed competition in early spring is most damaging to forages.
- Broadleaf weeds are generally more competitive against legumes than grassy weeds.

Herbicides are needed most often during establishment, and several options exist for managing weeds in pure legume seedings. Weed control is also very important while the forage is young and prone to competition from invading species. In no-till seedings, adequately controlling the existing vegetation, especially perennials, is very important. Burndown herbicides available for use in legume forage seedings are listed in Tables 5.69 and 5.70. Herbicides available for use in legumes are listed in Table 5.71. The effectiveness of various herbicides at or during establishment is included in Table 5.72. Herbicides available for use during the establishment year are included in Table 5.73.

Control in an Established Stand

The best weed control in an established forage stand is achieved by maintaining a dense healthy stand through proper fertilization, cutting management, and insect control. Controlling weeds in established forages is normally of greatest benefit in the first cutting. Weeds generally contribute much less to yield in the second and succeeding harvests. Before using an herbicide in established stands, evaluate the forage to ensure it is worth the cost of the herbicide.

Below are some general rules to follow before using an herbicide in established forage stands:

- Thin or irregular stands do not thicken once weeds are removed. Be sure there are sufficient desirable species to fill in the gaps. A minimum of five alfalfa plants per square foot should be present.
- Weeds tolerant of the herbicide may invade the space left by susceptible species, ultimately creating a new or more severe weed problem.
- Treat only well-established, vigorous stands with herbicides.
- If the forage stand is at least two years old and 25 percent to 30 percent of the plants are weeds, removing them with an herbicide application is of questionable value. Renovation is likely more economical.
- If 50 percent or more of the plants are weeds, it is time to rotate to a different crop, or renovate the existing crop.

If weeds become a problem in established forages, several herbicide options are available (Table 5.73). Chemical control in established forage legumes is often limited to late fall or early spring applications. Many herbicides require the addition of adjuvants for effective control (Table 5.74). Also, many products have harvesting, feeding, or grazing restrictions on their use (Table 5.75).

Grass Forages Including Pastures and Hayfields

Without proper management, broadleaf weeds can directly compete with forage grasses to reduce their nutritional value and longevity. Weeds can replace desirable grass species, filling in gaps or voids and reducing yield and overall quality of the hay or pasture. In addition, certain plants such as poison hemlock, white snakeroot, or black locust have toxic properties that can cause livestock injury or loss under certain circumstances (see poisonous weeds below).

Biennial and perennial weeds are considered especially troublesome by grass hay and pasture producers. Both biennials and perennials produce seed each year, potentially starting new infestations. In addition, perennial weeds such as hemp dogbane, Canada thistle, and multiflora rose reproduce from underground roots or rhizomes. Perennial rooting structures can survive for several years in the soil and are often unaffected by occasional mowing or livestock grazing.

Good cultural practices such as maintaining optimum soil fertility, using a competitive cutting schedule for forages, rotationally grazing pastures, and periodic clipping and/or coring pastures, can help keep the crop competitive with weeds. The most critical time for weed control is during the establishment year. If a no-till seeding is desired, be sure the preplant vegetation is adequately controlled. See Tables 5.68 and 5.69 for the information on burndown herbicides in controlling vegetation prior to planting.

In general, use preplant tillage or herbicides, companion seedings, mowing, and/or a postemergence herbicide to ensure that weeds are not a problem in the seeding year. To reduce weed shading, mow at a height above the grass seedlings when weeds are 8 to 10 inches tall. For warm-season grasses, do not mow after early August.

Certain application methods used in forage crops, including spot spraying and wiper applications, are not commonplace in row crops. With spot spraying, the herbicide is applied to weed-infested areas of the field, typically less than one-tenth of the total area. Spot applications are accomplished using a hand-held sprayer or a spray gun. Refer to the spot treatment section of the herbicide label and apply the recommended concentration on a spray-to-wet basis avoiding spray dripping or runoff (1 gal/1000 ft²) to provide thorough coverage. Most backpack sprayers hold only 1 to 3 gallons of spray solution. Specialized equipment capable of measuring a small volume or weight (i.e.: syringes, gram scales, etc.), are recommended to accurately dispense the desired quantity of herbicide product into small volumes of spray solutions (see Table 5.84). Apply all herbicides at least seven days before crop harvest, or harvest around weed patches, leaving them standing to be treated later. Apply all herbicides at least seven days before a killing frost. Spot treatment may kill desirable vegetation that is contacted by the herbicide. Select an herbicide based on its effectiveness on the target weed, safety to existing desirable vegetation, and grazing, overseeding, or rotational crop intervals.

Wiper applicators (weed wipers) are devices that physically wipe a concentrated solution of herbicide directly onto weeds by taking advantage of sufficient height difference between the weeds and crop canopy. The height difference in pasture can be increased by grazing the forage prior to wiper application and allowing some days for trampled weeds to recover. Sufficient contact from the wiper applicator while preventing contact with the crop controls weeds selectively is the goal. Since only the top several inches of the weeds are contacted with herbicide solution, a translocated herbicide such as dicamba or glyphosate is usually required for effective control. Repeat applications may be required to manage certain perennial weeds. A healthy actively growing crop that can develop a canopy over suppressed weeds is important to the success of wiper applications. There are several types of wiper applicators on the market. Wiper applicators must be designed and operated so that the rope, roller, sponge, or panel remains moist enough to transfer a sufficient amount of herbicide to the weed while not allowing drips to contact the crop. The two most common types are wick and roller applicators. Wick applicators use short braided ropes or appropriate fabric to “wick” the herbicide solution from inside a pipe to the plants that are wiped. With roller applicators, herbicide is manually sprayed intermittently onto a carpet covered roller that is rotated with a motor or a ground-driven shaft. The main advantage of the roller applicator is that more herbicide solution can be maintained on the roller. Compared to wick applicators, roller applicators provide consistent weed control. Bidirectional application is recommended to provide thorough control. Herbicides labeled for wiper application will usually provide specific application instructions on the label. In addition, research trials have indicated that a 5% solution applied in a wiper applicator is somewhat comparable to a broadcast application rate of 1 qt/A.

Controlling woody perennial species (brush) or vines can be very difficult with standard broadcast herbicide applications. Achieving acceptable weed control can require multiple years of intensive and persistent management. Product labels often have specific recommendations concerning herbicide rate, spray volume, seasonal application, retreatment, and growth stage. Recommendations are often species specific, and tank-mixes with other herbicides or alternative application methods may be required. Application methods may include basal bark, cut stump, dormant stem, oil-water emulsions, or high volume foliar applications. Carefully read and follow all herbicide label recommendations.

Management of Fence Rows

Proper weed management in fence lines will make them last longer and function better than where brush is allowed to grow. Weeds can stretch and bend fencing material and also cause electric fences to short-out. Nonselective herbicides like glyphosate (Roundup) can be used to control weeds. But, nonselective herbicides will also kill grasses, reducing grazable area and result in bare ground, which will allow weeds to re-infest the fence line. Bare ground also increases erosion along the fence. Conversely, selective herbicides can be used to control broadleaf weeds and brush while keeping grasses. Some herbicides have soil residual activity, such as tebuthiuron (Spike), prometon (Pramitol), and imazapyr (Arsenal), which will make control last longer than herbicides with no or only limited soil activity, such as 2,4-D, dicamba, and triclopyr (Remedy Ultra). Some herbicides, such as metsulfuron (a component of Chaparral, Cimarron, and other products) and imazapic (Plateau) will suppress tall fescue growth, which can be useful for electric fencing. These herbicides should only be applied every other year or less frequently, to reduce the risk of stand loss or thinning. Make sure to carefully read product labels to understand if the product is nonselective, has residual activity, and weed control spectrum. Also consider what crops are growing on the other side of the fence to avoid off-target injury.

Management of Autumn Olive

Autumn olive (*Elaeagnus umbellata*) is most easily managed through a proactive approach. Once plants become large, they are less easily and affordably controlled. Efficacy of broadcast applications is unknown; individual plant treatment is highly effective. For stems less than one inch in diameter at the base, apply a high volume foliar treatment of Remedy Ultra at 2 QT per 100 gallons of water after autumn olive leaves are fully expanded until prior to fall color. Apply to all foliage until wet but avoid dripping or runoff. For stems 1 to 6 inches in diameter, a basal bark treatment is most effective. Apply Remedy Ultra in bark oil in a 25% herbicide, 75% oil mixture to all sides every stem and exposed roots from the soil line up 12 to 18 inches on the stem. Apply any time of year except during spring. For stems greater than 6 inches in diameter, a cut-stump treatment is most effective. Cut the plant with a chain-saw and apply Remedy Ultra in bark oil in a 25% herbicide, 75% oil mixture less than 10 minutes after cutting. Cut-stump treatment is effective any time of year except during spring. For all treatment types, autumn olive wood is very brittle after death, making removal from fences much easier. Similarly, animals can trample small stems once dead. See Table 5.83 for additional information on timing of application. Mowing does not control autumn olive. For more information on basal bark applications go to <https://plantscience.psu.edu/research/projects/wildland-weed-management/publications/invasive-species-quicksheets/exotic-shrubs>.

Management of Brambles and Multiflora Rose

Brambles (*Rubus spp.*) and multiflora rose (*Rosa multiflora*) can be very difficult and generally requires an herbicide application in two consecutive years for eradication. Goats are an effective option to graze out brambles, but be prepared to graze for 2 to 3 years for complete control. Mowing is a waste of time and money and can lead to decreased herbicide efficacy when conducted up to 1 year preceding application as well as 6 months following application. Triclopyr containing herbicides (Remedy Ultra, PastureGard, and Crossbow) and metsulfuron containing herbicides (metsulfuron, Chaparral, and Cimarron) are most effective and a combination of triclopyr and metsulfuron are recommended. Apply a high volume foliar treatment of Remedy Ultra at 2 QT and metsulfuron 60DF at 1 oz per 100 gallons of water in mid- to late-September. Apply to all foliage until wet but avoid dripping or runoff. See Table 5.85 for additional information on timing of application. A second application is generally required for complete control of brambles. Application of metsulfuron in two consecutive years is not recommended due to tall fescue injury and stand thinning. In the second year, replace metsulfuron with GrazonNext at 7 fl oz/100 gallons of water.

Management of Weedy Grasses in Pasture and Hay

There are no selective postemergence grass herbicides labelled for use in cool-season grass pastures or hayfields. Therefore management practices that provide optimal growing conditions for desirable forages or minimizing bare spots that provide opportunities for weedy grasses could prevent their incidence and invasion. Some of these practices are discussed in earlier sections of this chapter. Scouting pastures to detect aggressive grasses such as Johnsongrass, Japanese stiltgrass, joint-head grass, etc., and taking appropriate steps is recommended to prevent their spread. Perennial grasses such as Johnsongrass may be controlled by applying a glyphosate product as a spot application (to provide 2 lb ae/A) or by applying glyphosate using a weed-wiper (solution strength vary with equipment; ~ 5% strength is required for rotary weed wiper and 1:3 ratio with water required for rope and other types of wipers). Late summer is a good time to apply so that the treated parts of the field can be reseeded in fall. For controlling annual grasses such as Japanese stiltgrass, joint-head grass, foxtails, barnyard grass etc., application of a

preemergence herbicide may be considered. Japanese stiltgrass germinates early, as the forsythias begin to bloom (before peak bloom), and joint-head grass germinates about one week to 10 days later. In established pastures and hayfields, pendimethalin (Prowl H2O) is effective to control most annual weedy grasses when applied prior to weed germination. Higher rates (4 qt/A) are required for Japanese stiltgrass control. Split application is recommended in hayfields (spring application followed by application after first-cut). Quinclorac (Facet L) is also effective to control certain annual grasses such as foxtails.

Find more information here: https://www.pubs.ext.vt.edu/content/pubs_ext_vt_edu/en/SPES/spes-58/SPES-58.html.

Poisonous Weeds

Health effects ranging from none to sickness or occasional death can occur when grazing animals contact or consume toxic plants. To protect animals, it is important to be aware of how toxic plant poisoning occurs commonly. Toxicity is usually derived from certain compounds synthesized by the plant to deter pests, to tolerate extreme soil or other environmental conditions, etc. The toxic potential (the ability to cause detrimental effects) of a given weed on a given day is dependent upon many factors including; the species, age, reproductive status, size, or health of animal consuming it; the plant part, growth stage, condition, and amount of the plant consumed; and the season or environmental conditions when consumed. Discrepancies on poisonous attributes of weeds noted by different sources may be attributed to these variables. Since most of the poisonous substances emit a repulsive odor or are inherently distasteful, the animals typically stay away from plants or plant parts that are poisonous. This is especially true if other more desirable forage species are available. Occasional cases of poisoning, however, do occur when the stand of desirable species is significantly lower than the harmful plants, when extreme weather conditions such as drought occur, with excessive soil fertility, when livestock are contained for extended periods where poisonous plants are prevalent, or when accidental ingestion is followed by lactation and subsequent poisoning of the offspring. Lastly, poisonous weeds are known to affect forage and hay quality as noted above.

With some weeds the toxic compound remains in harvested hay or silage (poison hemlock) while in others it is reduced (hairy vetch) or eliminated (buttercup). Some tree leaves are more toxic after wilting (red maple, wild cherry). Some toxic compounds occur naturally in plants, while others are released by fungi (fungal endophytes) growing in association with a living host forage plant (tall fescue toxicosis, ryegrass staggers, red clover slobbers); by fungi in molded hay or clippings (aflatoxin, botulism, sweet clover poisoning); or by undesirable bacteria in silage (listeriosis). Applications of some herbicides may increase the palatability of certain poisonous plants. Blister beetle poisoning in horses results from consuming a toxin in dead beetles that are baled into alfalfa hay. Certain weeds such as wild garlic or wild onion, while not toxic, may impart a disagreeable flavor to the milk of lactating animals.

About 200 to 300 plant species have been listed as poisonous to animals. While a complete list of poisonous plants is beyond the scope of this publication, a sampling of plant families and species with toxic potential are included here.

- Beech family – oak species
- Boxwood family (**highly toxic**) – boxwood, pachysandra
- Buckwheat family – buckwheat, dock species, rhubarb
- Buttercup family – buttercup species, baneberry, larkspur species
- Heath Family (**highly toxic**) – azalea, rhododendron, mountain laurel
- Legume family – black locust, crown or hairy vetch, golden chain tree, lupine species, pea species, alsike clover, sweet clover, red and white clover
- Lily family – autumn crocus, lily-of-the-valley, star-of-Bethlehem, hyacinth species, skunk cabbage, onion and garlic (both wild and cultivated), tulip, asparagus
- Maple family – red maple
- Nightshade family – nightshade species, jimsonweed, ground cherry, horsenettle, tomato, potato
- Rose family – wild black cherry, chokecherry
- Yew family (**highly toxic**) – English or American Yew
- Other species – black walnut (shavings used as bedding), bleeding heart, bouncing bet, bracken fern, burning bush, cocklebur, dogbane species, foxglove, ground-ivy, horse chestnut species, horsetail, johnsongrass, milkweed species, hemp dogbane, oleander, pigweed (amaranthus species), poison hemlock, pokeweed, privet, ryegrass species, shattercane, St. John's wort, tall fescue, water hemlock species, white snakeroot, and others.

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Toxic weed consumption most often occurs when animals are undernourished, when they are introduced to new grazing areas, when toxic plants are fed directly to them, or when they escape enclosures and feed on toxic plants. It can also occur when the forage provided is not suitable for the species, or is grazed at the wrong growth stage (prussic acid poisoning), while experiencing environmental stress (nitrate poisoning), or during rapid growth with imbalanced fertility (grass tetany). In addition, otherwise suitable feed, hay, or forage can have toxic effects when animals are transitioned to the new source too quickly.

Provide grazing animals with adequate pasture to meet their nutrient and energy requirements, or supplement their diets with a balanced ration, to reduce the chance that they will consume toxic plants. Make gradual transitions to new food sources. Be aware of environmental, seasonal, and fertility conditions that may cause forages to accumulate toxic compounds and test if necessary. Scout for toxic plants (inside and outside the fence), implement good forage and weed management practices, spray for weed control when needed, wait after herbicide treatment until plants are no longer palatable, and remove dangerous plants from your property. Minimize the potential for accidental introductions of toxic plants via downed tree limbs, yard cuttings (especially ornamentals), or others feeding your animals. Provide animals with safe bedding materials.

If you suspect plant poisoning has occurred, call a veterinarian immediately. Remove all animals from the area. Identify the suspected plants. Remove accidentally introduced plant material, or eradicate toxic plant species by hand-weeding, herbicide applications, pasture renovation, or other recommended practices. Monitor the grazing area over time to assure the toxic species has been eradicated. Remove animals from herbicide treated infestations of toxic plant species until dead and unpalatable, as herbicide treatment may increase palatability.

Discussion of toxic ingredients within plants, their specific effects on grazing animals, or toxic dosages (amount required to cause toxicity symptoms) is beyond the scope of this publication. More information can be found in the following sources:

- Burrows, G. E., and R. J. Tyrl, *Handbook of Toxic Plants of North America* (Oxford: Blackwell Publishing, 2006)
- Colorado State University – Veterinary Internal Medicine. <https://poisonousplants.cvmb.colostate.edu/home>
- Cornell University - Animal Science. <https://poisonousplants.ansci.cornell.edu/index.html>
- Knight, A.P., and R.G. Walter. 2001. *A Guide to Plant Poisoning of Animals in North America*. Teton NewMedia, Wyoming, USA.

Table 5.71 - Forage and Pasture Herbicides, their Characteristics, and their Restrictions

Trade Name ¹	Common Name	Manufacturer	Crop	Group # (site of action)	Restricted-Use Pesticide ²	Water Quality Advisory ³	Worker Reentry ⁴ (hours)
2,4-D amine or ester (3.8 lb ae/gal)	2,4-D	Several	grass	4	—	yes	48 or 12
Aim 2EC	carfentrazone	FMC	grass and legume	14	—	—	12
Balan 60DF	benefin	Loveland	legume	3	—	—	12
Beyond Xtra 1AS	imazamox	BASF	legume	2	—	—	4
Butyrac 200 2E	2,4-DB	several	legume	4	—	yes	48
Chaparral 71.6WG	aminopyralid + metsulfuron	Corteva	grass	4, 2	—	yes	48
Chateau 51WDG	flumioxazin	Valent	alfalfa	14	—	—	12
Cimarron Max (co-pack)	metsulfuron + 2,4-D + dicamba	Bayer	grass	2, 4, 4	—	—	48
Cimarron Plus 63WDG	metsulfuron + chlorsulfuron	Bayer	grass	2, 2	—	—	4
Clarity/dicamba 4S	dicamba	BASF/several	grass	4	—	yes	24

Table 5.71 - Forage and Pasture Herbicides, their Characteristics, and their Restrictions (cont.)

Trade Name ¹	Common Name	Manufacturer	Crop	Group # (site of action)	Restricted-Use Pesticide ²	Water Quality Advisory ³	Worker Reentry ⁴ (hours)
Crossbow 3L	2,4-D + triclopyr	several	grass	4, 4	—	yes	until dry
Curtail 2.38L	clopyralid + 2,4-D	Corteva	grass	4, 4	—	yes	48
DuraCor 0.73SC	aminopyralid + florpyrauxifen	Corteva	grass	4, 4	—	yes	48
Engenia	dicamba (BAPMA)	BASF	grass	4	yes	yes	24
Eptam 7E/20G	EPTC	Gowan	legume	8	—	—	12
Escort XP 60DF	metsulfuron	Bayer	grass	2	—	—	4
Facet 1.5L	quinclorac	BASF	grass	4	—	yes	12
Freelexx 3.7 SL	2,4-D (Choline)	Corteva	grass	4	—	yes	48
Gramoxone SL 2.0/3.0	paraquat	Syngenta	legume	22	yes	—	12
GrazonNext HL 3.74E	aminopyralid + 2,4-D	Corteva	grass	4, 4	—	yes	48
Grazon P+D 2.54SL	picloram + 2,4-D	Corteva	grass	4, 4	yes	yes	48
GrazonPD3 3.81SL	picloram + 2,4-D	Corteva	grass	4, 4	yes	yes	48
Huskie 2.06EC ⁵	pyrasulfotole + bromoxynil	Bayer	grass	27, 6	—	yes	24
Imiflex 1AS	imazamox	UPL	legume	2	—	—	4
Kerb 50W	pronamide	Corteva	legume	3	yes	—	24
Maestro 2E	bromoxynil	Nufarm	legume	6	—	—	24
MCPA amine or ester (3.7 lb ae/gal)	MCPA	Several	grass and legume	4	—	yes	48 or 12
Metribuzin 75DF/4L	metribuzin	Several	legume	5	—	yes	12
Metsulfuron 60WG	metsulfuron	Several	grass	2	—	—	4
Milestone 2L	aminopyralid	Corteva	grass	4	—	yes	48
Overdrive 70WDG	dicamba + diflufenzopyr	BASF	grass	4, 4	—	yes	12
PastureGard HL 4SL	triclopyr + fluroxypyr	Corteva	grass	4, 4	—	yes	12
Plateau 2AS	imazapic	BASF	legume and grass	2	—	yes	12
Poast 1.5E	sethoxydim	BASF	legume	15	—	—	12
Prescott 3E	triclopyr + clopyralid	Alligare	grass	4, 4	—	yes	48

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Table 5.71 - Forage and Pasture Herbicides, their Characteristics, and their Restrictions (cont.)

Trade Name ¹	Common Name	Manufacturer	Crop	Group # (site of action)	Restricted-Use Pesticide ²	Water Quality Advisory ³	Worker Reentry ⁴ (hours)
Prowl H ₂ O 3.8CS	pendimethalin	BASF	alfalfa and grass	3	—	—	24
Pursuit 2AS	imazethapyr	BASF	alfalfa/ and grass mix	2	—	yes	4
Raptor 1AS	imazamox	BASF	legume	2	—	—	4
Remedy Ultra 4L	triclopyr	Corteva	grass	4	—	yes	until dry
Roundup 3S/ Roundup WeatherMax 4.5S/ glyphosate ⁶	glyphosate	Bayer/others	grass and legume	9	—	—	4-12
Sandea 75DF/Permit	halosulfuron	Gowan	grass	2	—	yes	12
Satellite HydroCap 3.8CS	pendimethalin	UPL	alfalfa	3	—	—	24
Select Max 1E/ Select 2E	clethodim	Valent	legume	15	—	—	24
Sharpen 2.85SC ⁷	saflufenacil	BASF	grass and alfalfa	14	—	yes	12
Sinbar 80W	terbacil	NovaSource	legume	5	—	yes	12
Spike 20P/80DF	tebuthiuron	Corteva	grass	7	—	yes	—
Starane Ultra 2.8L	fluroxypyr	Corteva	grass	4	—	—	12
Stinger 3S	clopyralid	Corteva	grass	4	—	yes	12
Surmount 1.34E	picloram + fluroxypyr	Corteva	grass	4, 4	yes	yes	12
Tordon 22K 2SL	picloram	Corteva	grass	4	yes	yes	48
Vastlan 4SL	triclopyr	Corteva	grass	4	—	yes	24
Velpar AlfaMax 77.7WG	hexazinone + diuron	NovaSource	alfalfa	5, 7	—	yes	24
Velpar 2L/90DF	hexazinone	NovaSource	legume	5	—	yes	24
Warrant 3L	acetochlor	Bayer	alfalfa	15	—	yes	12
Weedmaster 3.87L	dicamba + 2,4-D	Nufarm	grass	4	—	yes	48
Xtendimax	dicamba (DGA+ VaporGrip)	Bayer	grass	4	yes	yes	24
Yukon 67.5WG	halosulfuron + dicamba	Gowan	grass	2, 4	—	—	24

Table 5.71 - Forage and Pasture Herbicides, their Characteristics, and their Restrictions (cont.)

Trade Name ¹	Common Name	Manufacturer	Crop	Group # (site of action)	Restricted-Use Pesticide ²	Water Quality Advisory ³	Worker Reentry ⁴ (hours)
¹ Generic or post-patent alternatives to some of these products are available.							
² Only licensed applicators may purchase and apply restricted-use pesticides. To become licensed, contact your state's Department of Agriculture.							
³ These herbicides have properties that may result in ground or surface water contamination. Do not apply them in areas where soils are permeable or coarse and groundwater is near the surface. Practices should be followed to minimize the potential for dissolved runoff and/or runoff erosion. See the herbicide label for specific restrictions.							
⁴ If soil-applied products are injected or incorporated at application time, under certain circumstances the Worker Protection Standard allows workers to enter the treated area if they will have no contact with anything that has been treated. Personal protective equipment is required for early entry to treated areas if contact with treated soil, plants, or water is involved.							
⁵ Huskie is recently registered on grass forage; there is little local experience for this use.							
⁶ Various formulations available. Refer to product label application rates and other restrictions.							
⁷ This use is listed on a supplemental label for use in dormant alfalfa.							

Table 5.72 - Relative Effectiveness of “Burndown” Treatments for No-Till Forages

Table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rates and weed size or growth stage. Treatments are rated only for control of vegetation existing at the time of application.

Weed control rating

10 = 95–100% 9 = 85–95% 8 = 75–85% 7 = 65–75% 6 = 55–65% N = less than 55% or no control

Species	Gramoxone	Roundup/glyphosate	
		(Fall-applied)	(Spring-applied)
Alfalfa sod	N	8+	7
Bromegrass or Quackgrass Sod	6	9	9
Chickweed	8+	9	9
Clover, Red	8	8+	7
Dandelion	N	8+	6
Foxtail spp.	9	9	9
Hemp Dogbane, Dewberry, Milkweed, etc.	6	8+	6
Horseweed (Marestail)	7	9	9
Lambsquarters	8	9	9
Mustard spp.	8	9	9
Orchardgrass or Fescue Sod	N	9	7
Ragweed, Common	8	9	9
Rye Cover, Volunteer Small Grains	9	10	10
Smartweed, Annual	7	7	7
Thistle, Canada	6	9	8
Timothy, Bluegrass	7	10	10
Vetch, Hairy	7	8	6

Table 5.73 - Comments on Burndown Herbicides for No-Till Legume Forages

See specific product label to determine correct rate for the weed species found in individual fields.

Trade Name ¹	Common Name	Crop(s)	Product/A	lb ai/A
Gramoxone SL 2S	paraquat	Alfalfa, clovers	2–4 pt	0.5–1.0
<ul style="list-style-type: none"> • Gramoxone SL controls emerged weeds only (no residual activity). • Apply in a minimum of 10 gal/A (ground, 20-60 gal/A preferred) or 5 gal/A (aerial) of water. • Apply before, during, or after planting but before crop emerges. • Phosphate-containing liquid fertilizer carrier solutions diminish Gramoxone activity if used as a carrier. • Gramoxone SL is effective on small annual weeds. • Improved activity on perennial grass sods can be achieved when two applications are made. Graze or mow sod to a height of 3 inches or less and apply 2 pt/A followed in 10 to 14 days by 1.5 pt/A. • Use appropriate precautions when handling Gramoxone to minimize exposure to the herbicide. • Do not use flood jet tips larger than size 20 or spacing greater than 40 inches. • See Table “Adjuvants and rainfast intervals for postemergence herbicides in grass pasture or hay”. • See Table “Grazing, harvest, haying, and slaughter restrictions for grass forage and pasture herbicides”. • <i>Restricted Use Pesticide.</i> 				
Roundup 3S² or Roundup WeatherMax 4.5S²	glyphosate	Alfalfa, clover, and alfalfa or clover-grass mixtures	1.5–4 qt or 1–3 qt	1.0–3.0

- Glyphosate controls emerged weeds only (no residual activity).
- Make ground applications in 10 to 40 gal/A of water. Increase the spray volume within this range as the weed density increases.
- Glyphosate may be applied in clear liquid nitrogen fertilizers and clear liquid complete-analysis fertilizers. Do not use Roundup/glyphosate with suspension-type liquid fertilizers.
- Preplant applications can be made before, during, or after planting but before the crop emerges.
- Glyphosate is effective on annual, biennial, and perennial weeds as well as small grain cover crops.
- Repeated applications may be needed for effective perennial weed control.
- Fall applications are better than spring applications for control of orchardgrass sods and quackgrass.
- Spring applications may be used for control of annual weeds.
- Existing perennial grass stands can be renovated by applying 0.7 to 3.3 qt/A (consult the label for rates for specific species). The existing crop can be grazed or harvested for feed after applications totaling 2 qt/A or less. For applications greater than 2 qt/A, remove livestock before application and wait 8 weeks before grazing or harvest.
- See Table “Adjuvants and rainfast intervals for postemergence herbicides in grass pasture or hay”.
- See Table “Grazing, harvest, haying, and slaughter restrictions for grass forage and pasture herbicides”.

¹ See Table 5.68 for additional formulations or trade names containing these same active ingredients.

² Various formulations of this product are available. Refer to current product label for active ingredient concentration, application rate, and other restrictions.

Table 5.74 - Application Timings for Herbicides Used in Legume Forages

Establishment: Herbicide is applied preplant in no-till establishment to control existing weeds, preplant in existing stands of alfalfa or clover to kill the existing crop and plant a new one (renovation), or preplant incorporated (PPI) or preemergence (PRE) in conventional tillage for residual weed control.

Seedling stand POST: Herbicide is applied postemergence (POST) to seedling alfalfa or clover that has reached a specific growth stage and is actively growing.

Established stand POST: Herbicide is applied POST to alfalfa or clover that has been established for a minimum length of time and is actively growing.

Fall/spring dormant: Herbicide is applied POST to dormant alfalfa or clover legume; may be for seedling legume at a specific growth stage, for legume established for a minimum length of time, or for either. Herbicide rate may be different for seedling or established stands.

Post-cutting: Herbicide is applied to alfalfa or clover between forage or hay cuttings, but within a certain time period after cutting or before the legume achieves a specified level of regrowth.

Spot-spray application: Herbicide is applied only to weed-infested areas of the field; usually with hand-held equipment.

Herbicide	Crop ^a (s)	Establishment	Seedling Stand POST	Established Stand POST	Fall/Spring Dormant (seedling)	Fall/Spring Dormant (established)	Post-Cutting	Spot-Spray or Wiper Applicator
2,4-DB	alfalfa/ clovers		NR ⁵	NR ⁵				
AIM 2EC	alfalfa/ clovers					NR	< 3 inches regrowth	
Balan	alfalfa / clovers	PPI						
Chateau	alfalfa					<6"regrowth	< 6" regrowth	
Eptam	alfalfa / clovers	PPI						
Glyphosate	alfalfa / clovers	preplant renovation						spot spray and wiper
Gramoxone SL	alfalfa / clovers	preplant			< 1 yr	> 1 yr	within 5 days of cut ⁶	spot spray
Kerb	alfalfa / clovers				1-trif ^{1,3}	> 1 season ⁴		
Maestro	alfalfa		4-trif ¹					
MCPA	alfalfa / clovers		2-trif ^{1,7}			> 1 season ⁶		
Metribuzin	alfalfa					> 1 yr		
Poast	alfalfa / clovers		NR ⁵	NR ⁵				spot spray
Prowl H ₂ O/ Satellite HydroCap	alfalfa		2-trif ¹ to 6"		2-trif ¹	after 1 cut	< 6" regrowth	
Pursuit	alfalfa / clovers		2-trif ¹	fall	2-trif ¹	> 1 season	< 3" regrowth	

Table 5.74 - Application Timings for Herbicides Used in Legume Forages (cont.)

Herbicide	Crop ^a (s)	Establishment	Seedling Stand POST	Established Stand POST	Fall/Spring Dormant (seedling)	Fall/Spring Dormant (established)	Post-Cutting	Spot-Spray or Wiper Applicator
Raptor/ Beyond Xtra/Imiflex	alfalfa		2-trif ¹		2-trif ¹	> 1 season	< 3" regrowth	
Roundup PowerMax/ WeatherMax	Round -up ready alfalfa	preplant renovation	emergence to first cut ²	after first cut; 1 appl/cut ²				spot spray and wiper
Select Max	alfalfa		NR ⁵	NR ⁵				spot spray
Sinbar	alfalfa					> 1 yr	< 2" regrowth	
Velpar	alfalfa					> 1 yr ³	< 2" regrowth	
Warrant	alfalfa		4-trif	NR			within 7 days of cut	

¹#-trif = alfalfa trifoliolate leaf stage that must be reached before herbicide application.

²For use on Roundup-Ready alfalfa only; up to 5 days before cutting.

³Spring application.

⁴Fall application before soil freeze-up.

⁵NR = no alfalfa size restriction on label; application based on weed stage.

⁶Application labeled for alfalfa only, not clover.

⁷Application labeled for clover only, not alfalfa.

⁸See herbicide comments table or herbicide label to determine for which clovers herbicide application is labeled.

Table 5.75 - Relative Effectiveness of Herbicides on Weeds and Crop Tolerance in Legume Forages

Table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rates and weed size or growth stage. Results may differ with variations in weed size, temperature, rainfall, soil moisture, soil type, and soil pH. Crop tolerance rating of VG or less is rarely significant.

Weed control rating

10 = 95–100%

9 = 85–95%

8 = 75–85%

7 = 65–75%

6 = 55–65%

N = Less than 55% or no control

	Preemergence								Postemergence								
Trade Name	Balan	Chateau	Eptam	Kerb	Metribuzin	Prowl H2O	Sinbar	Aim	Butyrac / 2,4-DB	Gramoxone	Maestro	Poast	Pursuit	Raptor / Beyond Xtra / Imiflex	Roundup / glyphosate	Select/Clethodim	Velpar
Crop Tolerance¹	VG	F	FG	VG	F	FG	FG	G	G	FG	F	E	G	G	G	E	FG
Site of Action Number	3	14	8	3	5	3	5	14	4	22	6	1	2	2	9	1	5
Winter Annuals																	
Bluegrass, Annual	8+	7+	8+	8+	8	6+	7+	N	N	8+	N	6	6	6	9	7+	8
Brome, Downy	9	N	9	9	9	6	9	N	N	9	N	9	6	N	9	9	9
Chickweed, Common	8	8+	7	8	9	7	9	6	6	9	6	N	8+	8+	9+	N	9
Fleabane, Annual	N	7	N	N	7	N	N	N	7+	7+	N	N	7+	7	9	N	8
Henbit/Deadnettle	6	8+	9	8	9	8	9	7+	6	9	8	N	7	7	8	N	9
Horseweed/Marestail	N	8+	N	N	6	N	7	N	8	6	6	N	N	N	9	N	7
Mustard, Wild	N	7	6	6	9	6	9	8	10	9	8	N	9	9	9	N	9
Pennycress, Field	N	6	6	6	9	6	9	9	9	9	9	N	9	9	9	N	9
Pepperweed spp.	N	7	6	6	9	6	9	8	10	9	8	N	9	9	9	N	9
Radish, Wild	N	7	N	N	7	6	7	8	7	7	6	N	8+	8+	9	N	7
Rocket, Yellow	N	6	N	N	9	6	9	8+	8	8	7	N	8+	8+	9	N	9
Ryegrass, Annual	8+	N	9	8+	7	8	N	N	N	8	N	9	6	6	8	9	7
Shepherds Purse	6	6	7	6	9	6+	9	9	9	9	9	N	8+	9	9	N	9
Summer Annuals																	
Amaranth, Spiny	9	9	9	6	9	9	8+	8	8+	9	8	N	9	9+	9	N	9
Barnyardgrass	9	6	9	8	6	8+	6	N	N	8	N	9	8	8	9+	9	7
Crabgrass	9	6	9	8	6	9	7	N	N	6	N	9	8	8	9	9	7
Foxtails (annual spp.)	9	6	9	8	6	9	7	N	N	9	N	9	8+	8+	9+	9+	7
Goosegrass	9	6	9	8	6	9	7	N	N	9	N	9	8	6	9+	9+	7
Lambsquarters	9	9	9	6	9	9	9	9	8+	8	10	N	7	8+	9	N	9

Table 5.75 - Relative Effectiveness of Herbicides on Weeds and Crop Tolerance in Legume Forages (cont.)

	Preemergence								Postemergence								
	Balan	Chateau	Eptam	Kerb	Metribuzin	Prowl H2O	Sinbar	Aim	Butyrac / 2,4-DB	Gramoxone	Maestro	Poast	Pursuit	Raptor / Beyond Xtra	Roundup / glyphosate	Select	Velpar
Nightshade, Eastern Black	6	8+	9	N	6	N	8+	8	8+	9	9	N	7+	7+	9	N	7
Panicum, Fall	9	6	9	6	6+	9	6+	N	N	9	N	9	8	8+	9+	9	6+
Pigweed spp.	9	9	9	6	9 ²	9	8+	8	8+	9	8	N	9+	9+	9	N	9
Ragweed, Common	N	7	N	N	8	N	8	7	9	9	9	N	7	8	9	N	8+
Smartweed spp.	N	7	N	N	8+	8	8+	8	6	9	9	N	8+	8	9	N	8+
Stiltgrass, Japanese	-	-	-	-	-	8	-	N	N	9	N	9	8+	8+	9	9	-
Velvetleaf	N	7	N	N	8	8+	8	9	9	9	8	N	9	9	9	N	8+
Biennials																	
Carrot, Wild	N	N	N	N	6	N	N	N	6	8	6	N	6	7	7	N	L
Perennials																	
Aster spp.	N	N	N	N	6	N	6	N	6	6	N	N	7	7	8+	N	6
Bedstraw, Smooth	N	N	N	N	N	N	N	6	N	6	N	N	7	7	8	N	N
Bermudagrass	N	N	7	N	N	N	6	N	N	6	N	8	N	N	8	8	N
Bluegrass, Roughstalk	N	N	N	N	N	N	N	N	N	7+	N	8	6+	8	9	8+	8
Cockle, White	N	N	N	N	7	N	7	6	7	6	N	N	6	6	9	N	7
Dandelion	N	7+	N	N	7	N	6	6	7+	N	N	N	7	6	8	N	8
Dock spp.	N	N	N	N	6	N	6	6	6	N	N	N	7	7+	8	N	7
Dogbane, Hemp	N	N	N	N	N	N	6	N	N	6	N	N	N	N	8+	N	6
Fescue, Tall	N	N	N	8	N	N	7	N	N	6	N	6	N	N	9	7	7
Horsenettle	N	N	N	N	6	N	6	N	N	6	N	N	N	N	7	N	6
Johnsongrass	6	N	7	N	N	N	N	N	N	6	N	8	8	8	9	9	N
Milkweed, Common	N	N	N	N	N	N	6	N	N	N	N	N	N	N	7	N	6
Nutsedge, Yellow	N	N	8	N	N	6	N	N	N	N	N	N	7	6	7	N	N
Orchardgrass	N	N	6	7	N	N	6	N	N	6	N	6	N	N	8	7+	7
Plantain spp.	N	N	N	N	7	N	7	6	7	N	N	N	6	6	8	N	7
Quackgrass	N	N	8	8	N	N	6	N	N	6	N	7	6	N	9	8	6
Thistle, Canada	N	N	N	N	N	N	N	N	N	N	N	N	6	6	9	N	N

¹ Crop tolerance ratings are for forage crops listed under each herbicide in Table 5.76.

² Triazine-resistant biotypes exist in the region and are not controlled by metribuzin.

Table 5.76 - Comments on Herbicides for Legume Forages

See specific product label to determine correct rate for the soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Crop(s)	Application Timing	Product/A	lb ai/A
Aim 2EC	carfentrazone	Alfalfa, clover	Seedling-POST Established-POST	1–2 fl oz	0.016
<ul style="list-style-type: none"> • Aim only controls small, emerged weeds (no residual activity). It is not a rescue treatment. • Apply in spring or summer immediately after cutting but before 3 inches of new growth. • A 5 to 8-day or a 10 to 14-day delay in cutting may be observed with applications made to 3 and 6-inch alfalfa, respectively. • Apply when weeds are actively growing and no more than 3 inches in height or rosettes are less than 2 inches across. • Aim may be applied when crop, such as alfalfa, is in dormancy fall through early spring applications. • There are no crop rotation or overseeding restrictions for labeled crops; see label. • <i>Water quality advisory.</i> 					
Balan 60DF	benfenin	Alfalfa, birdsfoot trefoil, red clover, ladino clover, alsike clover	Preplant incorporated	2 lb	1.2
<ul style="list-style-type: none"> • Balan provides approximately one month of soil residual control of many annual grass weeds and some annual broadleaf weeds. • Apply in 5 to 40 gal/A of water or liquid fertilizer to clean, dry soil within three weeks of planting. • Soil incorporation must occur within 8 hours after application. Uniformly incorporate into the top 2 to 3 inches of soil; see product label. • Do not use with companion seedings of small grains or forage grasses. • Forage grasses, small grains, sorghum, and corn can be planted 10 months after application. 					
Butyrac 200 2E (2,4-DB)	2,4-DB	Alfalfa, birdsfoot trefoil, CRP	Seedling-POST Established-POST	1–3 qt	0.5–1.5 ae
<ul style="list-style-type: none"> • Butyrac 200 controls a relatively narrow spectrum of emerged broadleaf weeds, and is particularly effective on morningglory species. • Apply in spring or summer when seedling legumes have two to four trifoliolate leaves. • Apply by ground in a minimum of 10 gal/A or by air in 5 to 40 gal/A of water. • Apply when weeds are actively growing and no more than 3 inches in height, or rosettes are less than 2 inches across. • Do not apply if temperatures above 90°F or below 40°F are expected during or shortly after application. • 2,4-DB labels vary concerning overseeding or rotational crop restrictions or do not mention them. Unless specified on the label, most crops can be safely planted 3 months after application under normal environmental conditions. • <i>Water quality advisory.</i> 					

Table 5.76 - Comments on Herbicides for Legume Forages (cont.)

See specific product label to determine correct rate for the soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Crop(s)	Application Timing	Product/A	lb ai/A
Chateau 41.4 EZ			Established-dormant		0.054 -0.108
Chateau 51WDG	flumioxazin	Alfalfa	Between cuttings	2–4 oz	0.064–0.128

- Chateau provides 1 to 2 months of residual control of many annual broadleaf weeds and suppression of some annual grasses as they germinate.
- It will not control weeds that have already emerged at the time of application.
- Apply by ground in 10 to 30 gal/A or by air in 5 to 10 gal/A of water.
- Dormant applications can be made in the fall after the last cutting, during winter dormancy, or anytime in the spring prior to 6 inches of alfalfa regrowth.
- Postcutting applications should be made prior to 6 inches of regrowth or unacceptable crop injury may occur.
- Wait a minimum of 60 days between applications.
- Do not apply with any adjuvant or tank-mix with any products formulated as an emulsifiable concentrate (EC) unless the application follows the last cutting of the season.
- Application with paraquat can be used to burndown winter annuals prior to the winter dormant period.
- Do not apply to mixed alfalfa-grass stands.
- When applied at the 3 to 4 oz/A rate, forage grasses can be planted 6 months after application if soil is tilled or 12 months after application if planted no-tillage; at the 2 oz/A rate it is 4 months (tilled) and 8 months (no-till); see label for more details.

		Alfalfa, birdsfoot trefoil, clovers, lespedeza; not white Dutch clover	Preplant incorporated	3.5–4.5 pt	3.0–4.0
Eptam 7E	EPTC				

- Eptam provides approximately one month of soil residual control of many annual grass weeds, some annual broadleaf weeds, and yellow nutsedge.
- Apply in 10 to 50 gal/A of water or liquid fertilizer to clean, dry soil just before planting and incorporate immediately. Operate equipment to uniformly incorporate into the top 2 to 3 inches of soil. Refer to the product label for specific instructions on soil incorporation equipment and methods.
- Do not use if atrazine was applied within 12 months of planting.
- Do not use on white Dutch clover.
- Do not use on soils with greater than 10% organic matter.
- Forage grasses, small grains, sorghum, and corn can be planted after normal harvest of the legume forage.

Table 5.76 - Comments on Herbicides for Legume Forages (cont.)

See specific product label to determine correct rate for the soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Crop(s)	Application Timing	Product/A	lb ai/A
Extreme 2.17L	imazethapyr + glyphosate	Roundup Ready alfalfa	Seedling-POST	2.2–4.4 pt/A	0.41–0.81
			Established-dormant		
			Established-POST		

- Extreme controls or suppresses many annual and some perennial broadleaf and grass weeds.
- Extreme also provides 1 to 2 months of residual control of many emerging weeds.
- Apply over the top to Roundup Ready alfalfa varieties only.
- Apply to seedling Roundup Ready alfalfa at the second trifoliolate stage or larger.
- Apply to established Roundup Ready alfalfa in the fall, spring, or between cuttings before alfalfa regrowth reaches 3 inches.
- Apply when the majority of weeds are 1 to 3 inches (height or rosette diameter).
- Typical application rate is 3 pt/A.
- Due to breeding constraints, some alfalfa plants may not contain the glyphosate-resistant gene; thus, some seedlings may not survive the application.
- Do not apply more than 3 pt/A Extreme during the last year of the stand, or crop rotation options will be very limited.
- Forage grasses are not listed on the Extreme label in rotational crops section; small grains can be planted 4 months after application; see label.
- If replanting is necessary, do not plant alfalfa for 4 months following an Extreme application.

Gramoxone SL 2S	paraquat	Alfalfa, clover, or trefoil	Seedling-dormant	1–2 pt	0.25–0.5
			Established-dormant	2–3 pt	0.5–0.75
			Between cuttings	1 pt	0.25
			Spot treatment	0.2-0.7 fl oz/gal	0.15%–0.5% solution

- Gramoxone SL controls emerged weeds only (no residual activity).
- Dormant applications provide control of many winter annual weeds, and some seedling biennial and perennial weeds.
- Apply only one dormant application per year by ground in a minimum of 10 gal/A or by air in a minimum of 5 gal/A of water.
- To avoid injury, use only on seedling alfalfa or clover stands that are completely dormant, established clover stands with less than 2 inches of remaining fall regrowth that are completely dormant, or established alfalfa stands with less than 6 inches of remaining fall regrowth or 2 inches of new spring regrowth.
- On seedling alfalfa (first year), 2 between-cutting applications may be made. First-year alfalfa stands and yields may be reduced if alfalfa is allowed to regrow more than 2 inches after cutting and before application.
- On established alfalfa, 3 between-cutting applications may be made. Do not make between-cutting applications more than 5 days after cutting.
- Between-cutting applications are not allowed on other legumes or alfalfa-grass mixtures.
- There are no rotational crop restrictions when applying Gramoxone in legume forages.
- Spot spraying with Gramoxone SL is recommended when only small areas are to be sprayed with labeled applications. Refer to weed rate tables of the herbicide label for the recommended herbicide concentration and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff.
- Always add a nonionic surfactant at 0.5 fl oz/gal (15 ml/gal).
- 0.5 lb paraquat = 2 pt Gramoxone SL2.0 or 1.33 pt Gramoxone SL 3.0.
- *Restricted-use pesticide.*

Table 5.76 - Comments on Herbicides for Legume Forages (cont.)

See specific product label to determine correct rate for the soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Crop(s)	Application Timing	Product/A	lb ai/A
Kerb 50W	pronamide	Alfalfa, birdsfoot trefoil, crown vetch, clovers	Seedling-dormant Established-dormant	1–3 lb	0.5–1.5
<ul style="list-style-type: none"> • Kerb provides 1 to 2 months of residual control or suppression of several annual grass and some broadleaf weeds, and also has postemergence activity on several small annual grass weeds. • Apply by ground in 20 to 50 gal/A of water. Make applications in fall or winter when temperatures fall below 55F but before soil freeze-up. • Kerb may be applied to fall-seeded legumes after they reach the trifoliate leaf stage. • Do not apply to spring-seeded legumes until the following fall or early winter. • Do not use on alfalfa-grass mixtures. • Rainfall or overhead irrigation is required after application to activate the herbicide. • Do not use on soils with greater than 4% organic matter. • Forage grasses, as well as most other crops, can be planted 12 months after application; see label. • <i>Restricted-use pesticide.</i> 					
Maestro 2EC	bromoxynil	Alfalfa and alfalfa/ small grain companion seedings, CRP	Seedling-POST	1.0–1.5 pt	0.25–0.375
<ul style="list-style-type: none"> • Maestro controls emerged weeds only (no residual activity). • Apply in spring or fall to seedling alfalfa with at least 4 trifoliate leaves. • May be applied to a small grain companion seeding up to the boot stage. • Apply by ground in 10 to 20 gal/A or by air in a minimum of 5 gal/A of water or liquid fertilizer. Applications in liquid fertilizer may increase leaf burn to alfalfa. • Weeds should not exceed the four-leaf stage, 2 inches in height, or 1 inch in diameter (whichever comes first). • Maestro application where temperatures are expected to exceed 70°F at or 3 days following application can result in unacceptable crop injury. • Any crop can be planted 30 days after application. • Do not use an adjuvant unless a tank-mix partner requires it. See table 5.79. 					
MCPA amine 4S	MCPA	Alfalfa, clovers, or trefoil with small grain or forage grass companion seedings, CRP	Seedling-POST	0.25–0.5 pt	0.125–0.25
<ul style="list-style-type: none"> • MCPA controls or aids in control of some emerged annual, biennial, or perennial weeds. • Treat after the grain is tillered and legumes are 2–3 inches tall. • Do not use more than 5–10 gal/A of water; higher volumes may result in injury to legumes. • Do not spray when grain is in the boot to dough stage. • Do not use on sweet clover or vetch. • Some MCPA labels allow application to newly seeded clover and grass pastures; treat seedling stands after they have 2 or more true leaves (trifoliate stage). • Follow all label recommendations to reduce the potential for spray drift. • MCPA labels vary concerning overseeding or rotational crop restrictions or do not mention them. Unless specified on the label, most crops can be safely planted 3 months after application under normal environmental conditions. • See Tables 5.79 and 5.80. • <i>Water Quality Advisory.</i> 					

Table 5.76 - Comments on Herbicides for Legume Forages (cont.)

See specific product label to determine correct rate for the soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Crop(s)	Application Timing	Product/A	lb ai/A
Metribuzin 75DF	metribuzin	Alfalfa and alfalfa-grass mixtures	Established-dormant	0.5–1.3 lb	0.38–1.0
<ul style="list-style-type: none"> • Metribuzin provides both postemergence and 1 to 2 months of residual control of several annual broadleaf weeds and a few grasses (Brome species, annual bluegrass, green foxtail, and barnyardgrass). • Apply by ground in 10 to 40 gal/A or by air in a minimum of 2 to 10 gal/A of water or liquid fertilizer. • Apply in fall after alfalfa goes dormant or in the spring before new growth starts. Alfalfa may be severely injured if new growth is present at spring application. • May be applied after dormancy is broken, but before 3 inches of new growth, if impregnated on dry fertilizer. • Apply the appropriate rate from the label when weeds are less than two inches tall or two inches in diameter. • May be used on alfalfa-grass mixtures. Orchardgrass in mixed stands will generally tolerate Metribuzin at rates of up to 0.67 lb/A. Rates of 0.67 to 1.0 lb/A can be used in mixed stands of alfalfa and grass to reduce grass stands and prevent crowding out of alfalfa. • Do not use Metribuzin on sandy soils or serious crop injury can occur. Crop injury can also occur on loamy sand soils. • Forage grasses and corn can be planted 4 months, small grains 8 months, and sorghum 12 months after application. • Tripzin 4 ZC is a premix of pendimethalin + metribuzin labeled for alfalfa. • <i>Water quality advisory.</i> 					
Poast 1.5E	sethoxydim	Alfalfa, clovers, and birdsfoot trefoil	Seedling-POST Established-POST Spot treatment	1.0–2.5 pt 1.0–2.5 pt 1.3–1.9 fl oz/gal	0.19–0.47 0.19–0.47 1%–1.5% v/v solution
<ul style="list-style-type: none"> • Poast controls many annual and perennial grass weeds (emerged weeds only). • Apply to actively growing grasses by ground in 5 to 20 gal/A or by air in a minimum of 5 gal/A of water. • Refer to the herbicide label for the recommended herbicide concentration based on grass species and size (generally less than 8 inches tall) and apply the recommended concentration on a spray-to-wet basis (1 gal/1000 ft²) to provide thorough coverage. • Repeated applications may be needed for complete control of perennial species. • Any crop can be planted 30 days after application. • Spot applications are allowed, but do not make spot treatments in addition to broadcast treatments. Apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff. • Always add a crop oil concentrate at 1.3 fl.oz./gal (38 ml/gal). 					

Table 5.76 - Comments on Herbicides for Legume Forages (cont.)

See specific product label to determine correct rate for the soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Crop(s)	Application Timing	Product/A	lb ai/A
Prowl H₂O / Satellite HydroCap 3.8AS	pendimethalin	Alfalfa	Seedling-POST	0.5–1 qt	0.5–0.95
			Seedling-dormant	0.5–1 qt	0.5–0.95
			Established-dormant	1.1–4.2 qt	1.0–4.0
			Between cuttings	1.1–4.2 qt	1.0–4.0

- Prowl H₂O provides 1 to 2 months of residual control of most annual grasses and some annual broadleaf weeds as they germinate. It will not control any weeds that have already emerged at the time of application.
- Apply by ground in a minimum of 10 gal/A or by air in a minimum of 5 gal/A of water.
- Adequate rainfall or overhead irrigation is required after application to activate Prowl H₂O.
- Apply to seedling alfalfa after the legume has two fully expanded trifoliolate leaves but before it reaches 6 inches in height.
- Established alfalfa is defined by the label as alfalfa planted in the fall or spring which has gone through a first cutting/mowing.
- Apply to established alfalfa before weed emergence. Applications can be made in the fall after the last cutting, during winter dormancy, in the spring, or between cuttings. Applications should be made prior to the alfalfa reaching 6 inches in regrowth.
- Some stunting and yellowing of the alfalfa may occur with postemergence applications.
- Rotational restrictions are based on Prowl rate used, rainfall received, and time of year applied; see label.
- Tripzin 4 ZC is a premix of pendimethalin + metribuzin labeled for alfalfa.

Pursuit 2S	imazethapyr	Alfalfa and alfalfa-grass mixtures, birdsfoot trefoil, clover, CRP	Seedling-POST	3–6 fl oz	0.047–0.094
			Seedling-dormant		
			Established-POST		
			Established-dormant		
			Between cuttings		

- Pursuit controls or suppresses many annual and some perennial broadleaf weeds, as well as several grasses when they are small.
- Pursuit also provides 1 to 2 months of residual control of many emerging weeds.
- Apply by ground in a minimum of 10 gal/A or by air in a minimum of 5 gal/A of water.
- Seedling applications are for pure seeded alfalfa or clover only. Apply when legume has 2 fully expanded trifoliolate leaves or larger.
- Dormant applications can be made in the fall after the last cutting or anytime in the spring prior to 3 inches of alfalfa or clover regrowth.
- Between cutting applications should also be made prior to 3 inches of regrowth.
- Apply when weeds are 1 to 3 inches in height or in the rosette growth stage.
- Do not apply Pursuit to alfalfa-grass mixtures during the establishment year.
- Do not apply more than 4 oz/A to alfalfa or clover in the last year of the stand (crop rotation considerations).
- Forage grasses are not listed on the Pursuit label in rotational crops section; small grains can be planted 4 months after application; see label.
- *Water Quality Advisory.*

Table 5.76 - Comments on Herbicides for Legume Forages (cont.)

See specific product label to determine correct rate for the soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Crop(s)	Application Timing	Product/A	lb ai/A
Raptor 1AS Beyond Xtra 1AS Imiflex 1AS	imazamox	Alfalfa	Seedling-POST Seedling-dormant Established-dormant Between cuttings	4–6 fl oz	0.031–0.047

- Raptor controls or suppresses many annual and some perennial broadleaf weeds, as well as several grasses when they are small.
- Raptor also provides approximately one month of residual control of many emerging weeds.
- Apply by ground in a minimum of 10 gal/A or by air in a minimum of 5 gal/A of water.
- Do not apply Raptor in liquid fertilizer as a carrier.
- Apply when seedling alfalfa has 2 fully expanded trifoliolate leaves or larger.
- Seedling alfalfa may experience a temporary reduction in growth.
- Apply when weeds are 1–3 inches in height or rosette width.
- Apply to established alfalfa in the fall, winter, or spring to dormant or semi-dormant alfalfa or between cuttings.
- Any application should be made before significant alfalfa growth or regrowth (3 inches).
- Forage grasses can be planted 18 months, small grains 3-18 months (see label), and sorghum 9 months after application.
- Do not make more than one Raptor/Beyond Xtra application to alfalfa per year; but a sequential Pursuit application may be made after 60 days.
- Beyond Xtra is the new tradename for imazamox and will have the same utility as Raptor.
- Imiflex is another formulation of imazamox for use in alfalfa.

Roundup PowerMax or WeatherMax 5.5L	glyphosate	Roundup Ready alfalfa only	Seedling-POST Established-POST	22–44 fl oz	0.77–1.9
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- Roundup provides broad-spectrum control of existing grass and broadleaf weeds, but has no effect on weeds emerging after application.
- Some species of weeds may require retreatment for complete control, as will species with multiple germination flushes.
- Apply by ground in 3 to 40 gal/A or by air in 3 to 15 gal/A of water.
- Two applications may be made to seedling stands prior to the first cutting. The first application is from emergence up to the 4-trifoliolate leaf stage and is necessary to remove the small percentage of glyphosate-susceptible alfalfa plants that are present in the new seeding. The second application is from the 5-trifoliolate leaf stage to 5 days before the first cutting.
- After the first cutting, a single application per cutting may be made up to 5 days before cutting.
- In established stands, a single application per cutting may be made up to 5 days before cutting.
- The highest level of control is achieved when annual weeds are less than 4 inches tall.
- For perennial weed problems, glyphosate should be applied during early fall.
- Sequential applications of glyphosate should be at least 7 days apart.
- The combined total for all in-crop applications can not exceed 4.1 qt/A per year. The combined total for all applications (in-crop and establishment) can not exceed 5.3 qt/A per year.
- There are no rotational crop restrictions when applying glyphosate in legume forages.
- The Roundup Ready system in alfalfa is easy to use and very effective on most weeds common to alfalfa plantings. However, herbicide-resistant weeds are selected for by repeated use of the same or similar herbicide over a period of time. Weed species with a very high amount of seed production and a variable genetic pool are more likely to develop resistant populations—for example, horseweed, common lambsquarters, ragweed species, and pigweed species. Therefore, it is recommended that the Roundup Ready system be used during the establishment year when the most benefit can be recognized, and then rotate between Roundup and other herbicides with different modes of action through subsequent seasons.

Table 5.76 - Comments on Herbicides for Legume Forages (cont.)

See specific product label to determine correct rate for the soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Crop(s)	Application Timing	Product/A	lb ai/A
Roundup 3S ² or Roundup WeatherMax 4.5S ²	glyphosate	Alfalfa, clover, and alfalfa or clover-grass mixtures	Spot treatment or Wiper applicator	2% solution or 33–77% solution	

- Make applications with hand-held equipment or wiper applicator.
- Apply only to weed-infested areas of the field, and do not treat more than one tenth of the total area at any one time.
- Refer to weed rate tables of the herbicide label for the recommended herbicide concentration and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff.
- Apply to actively growing susceptible weeds.
- Avoid contact with desirable species as severe injury or death can occur.
- Further application may be made at 30-day intervals if necessary.
- Consult the herbicide label for specific wiper applicator recommendations.
- For best results, do not graze or harvest forage for seven days after application, and make applications at least seven days before a killing frost.
- There are no rotational crop restrictions when applying glyphosate in legume forages.

Roundup 3S or Roundup WeatherMax 4.5S ²	glyphosate	Alfalfa or alfalfa-grass mixtures	Preharvest	32–63 fl oz or 22–44 fl oz	0.77–1.5
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- For use on declining alfalfa stands prior to crop rotation.
- Apply before last cutting in fall or spring to control certain perennials such as quackgrass.
- Can be grazed or harvested in 36 hours. However, harvest should be delayed for 7 to 10 days after application to allow herbicide to have full effect.
- Deep tillage after harvest improves control.
- Fall applications are more effective on perennial grasses relative to spring applications.
- Refer to herbicide label for additional application information and use restrictions.
- There are no rotational crop restrictions when applying glyphosate in legume forages.

Table 5.76 - Comments on Herbicides for Legume Forages (cont.)

See specific product label to determine correct rate for the soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Crop(s)	Application Timing	Product/A	lb ai/A
Select 2EC or Select Max 1EC	clethodim	Alfalfa, birdsfoot trefoil	Seedling-POST	6–16 fl oz	0.09–0.25
				or	or
				12–32 fl oz	0.09–0.25
			Established-POST	6–16 fl oz	0.09–0.25
			or	or	
			Spot treatment	12–32 fl oz	0.09–0.25
				0.33–0.65	0.25%–0.5%
				fl oz/gal	v/v solution

- Select Max controls many annual and perennial grass weeds (emerged weeds only).
- Apply to actively growing grasses by ground in 10 to 40 gal/A or by air in a minimum of 10 gal/A of water.
- Apply to grasses at the size recommended on herbicide label (generally less than 6 inches tall).
- Repeated applications are required for complete control of perennial grasses. Allow a minimum interval of 14 days between repeat applications.
- For annual bluegrass control, apply 6–16 fl oz Select or 12-32 fl oz Select Max before the 4-leaf stage of bluegrass.
- Any crop can be planted 30 days after application.
- Select 2EC and Select Max 1EC require different adjuvants. See table 5.77.
- Spot treatments are allowed but do not exceed a total of 32 fl oz/A per season for Select or 64 fl oz/A per season for Select Max for spot treatments and broadcast treatments combined. Refer to weed rate tables of the herbicide label for the recommended herbicide concentration and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff.
- Always add a crop oil concentrate at 1.3 fl.oz./gal (38 ml/gal).

Sinbar 80WG	terbacil	Alfalfa	Established-dormant Between cuttings	0.75–1.5 lb	0.6–1.2
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- Sinbar provides postemergence control (small weeds) and 1 to 2 months of soil residual control of many annual weeds and some biennial and perennial weeds.
- Use only on alfalfa established for 1 year or more.
- Apply by ground in water with sufficient spray volume for uniform coverage.
- Dormant applications can be made in the fall through winter to dormant alfalfa or in the spring prior to 2 inches of alfalfa regrowth. Spring between cutting applications should also be made prior to 2 inches of regrowth.
- Two applications per year are allowed, but they must be separated by 60 days, and the total amount of Sinbar can not exceed 1.5 lb/A per year.
- Apply before weeds germinate or before they exceed 2 inches in height or width.
- Do not use on alfalfa-grass mixtures.
- Do not use on sand, loamy sand, or gravel soils, or on soils with less than 1% organic matter or serious crop injury can occur.
- No other crops can be planted for two years following an application of Sinbar.
- Do not use any spray adjuvants. See table “Adjuvants and Rainfast Intervals for Postemergence Herbicides in Alfalfa and Clover”.
- See Table 5.77.
- *Water Quality Advisory.*

Table 5.76 - Comments on Herbicides for Legume Forages (cont.)

See specific product label to determine correct rate for the soil type and weed species found in individual fields.

Trade Name ¹	Common Name	Crop(s)	Application Timing	Product/A	lb ai/A
Velpar 2L or 75DF	hexazinone	Alfalfa	Established-dormant Between cuttings	2–6 pt or 0.67–2 lb	0.5–1.5
<ul style="list-style-type: none"> • Velpar provides postemergence control (small weeds) and 1 to 2 months of soil residual control of many annual, biennial, and perennial weeds as well as suppression of some woody species. • Use only on alfalfa established for 1 year or more. • Apply by ground in a minimum of 20 gal/A or by air in a minimum of 5 gal/A of water. • Make a single application after alfalfa becomes dormant and before new growth begins in the spring. Where weeds have emerged, include a surfactant. Weeds should be less than two inches tall or two inches in diameter. • If no dormant application is made, a between cuttings treatment may be made; apply before 2 inches of alfalfa regrowth. Severe injury may result with between cutting applications if significant alfalfa foliage is present at application or air temperature exceeds 90°F. • Do not use an adjuvant with between cutting applications. • Do not use on gravelly or rocky soils, exposed subsoils, or hardpan, sand, or poorly drained soils or serious crop injury can occur. • Unacceptable weed control may occur on soils with greater than 5% organic matter. • When applied at 3 pt/A or less, corn can be planted 12 months after application. • Other crops may be planted 24 months after application. • See Tables 5.77 and 5.78. • <i>Water Quality Advisory.</i> 					
Warrant 3 SL	acetochlor	Alfalfa	Established-dormant Between cuttings	1.25–2 qt	0.94–1.5
<ul style="list-style-type: none"> • Warrant can be applied after alfalfa after emergence to control of several grass and broadleaf weeds prior to their emergence, but will not control weeds that are present at the time of application. • Can be used on newly established and established alfalfa stands. • Do not use this product on alfalfa grown for seed production. • Remove domestic livestock from alfalfa stands before making applications of this product. • Allow a minimum of 20 days between an application and subsequent cutting for forage or hay, or before open grazing of forage and livestock. • Do not exceed a total of 3 applications or a combined total of 4 qt (3 lb ai) per acre per year. • <i>Water Quality Advisory.</i> 					
<p>¹ See Table 5.71 for additional formulations or trade names containing these same active ingredients.</p> <p>² Various formulations of this product are available. Refer to current product label for active ingredient concentration, application rate, and other restrictions. Adjust application rate if using Roundup.</p>					

Table 5.77 - Adjuvants and Rainfastness for Postemergence Herbicides in Legume Forages

Adjuvants are products included in the spray tank to improve the performance of herbicides. These include non-ionic surfactant (NIS), crop oil concentrate (COC), methylated seed oil (MSO) or nitrogen solutions. In general, NIS should contain at least 80% active ingredient, and COC should contain at least 15% emulsifier. Nitrogen solutions can be 28%, 30% or 32% ammonium based fertilizer solutions; ammonium sulfate should be spray grade dry ammonium sulfate (21-0-0). Crop injury can occur with the use of adjuvants. Adding additional adjuvants other than what is labeled can increase the chance or severity of crop injury. Following are recommended adjuvants for broadcast postemergence applications; refer to herbicide labels for adjuvant recommendations with other application types.

Rainfastness is number of hours needed between time of application and rainfall or irrigation to ensure sufficient absorption in the plant.

Trade Name	Adjuvant(s)	Rate	Rainfastness (hours)
Aim 2EC	nonionic surfactant or crop oil concentrate	1 qt/100 gal 0.5-1 gal/100 gal	not specified
Butyrac 200 2L / 2,4-DB 2L	none		not specified
Glyphosate preplant or spot treatment	varies by product, check label	see label	
	ammonium sulfate (optional)	8.5–17 lb/100gal	1–6
Gramoxone 2SL	nonionic surfactant or crop oil concentrate	1 qt/100 gal 1 gal/100 gal	0.5
Kerb 50W	none		not specified
Maestro 2EC	not recommended (see label for instructions when tank-mixing)		1
MCPA 3.7L	none		not specified
Metribuzin 75DF	none		not specified
Poast 1.5EC	crop oil concentrate or	2 pt/A	
	methylated seed oil	1.5 pt/A	
	plus nitrogen solution or	2–4 qt/A or	
	ammonium sulfate (optional)	2.5 lb/A	1
Pursuit 2AS	nonionic surfactant or	1 qt/100 gal	
	crop oil concentrate or	1 gal/100 gal	
	methylated seed oil	1.25 gal/100 gal	
	plus nitrogen solution or	1.25–2.5 gal/100 gal	
	ammonium sulfate (required)	12-15 lb/100 gal	1
Raptor 1AS / Beyond Xtra 1AS / Imiflex 1AS	nonionic surfactant or	1 qt/100 gal	
	crop oil concentrate or	1–2 gal/100 gal	
	methylated seed oil	1–2 gal/100 gal	
	plus nitrogen solution or	2.5 gal/100 gal	
	ammonium sulfate (required)	12–15 lb/100 gal	1
Roundup PowerMax or WeatherMax 5.5L in RR alfalfa	ammonium sulfate (optional)	8.5–17 lb/100 gal	not specified

Table 5.77 - Adjuvants and Rainfastness for Postemergence Herbicides in Legume Forages (cont.)

Trade Name	Adjuvant(s)	Rate	Rainfastness (hours)
Select 2EC	crop oil concentrate	1 gal/100 gal	1
	plus nitrogen solution or	1–2 qt/A	
	ammonium sulfate (optional)	2.5–4 lb/A	
Select Max 1EC	nonionic surfactant or	1 qt/100 gal	1
	crop oil concentrate or	1 gal/100 gal	
	methylated seed oil	1 gal/100 gal	
Sinbar 80WP	do not use		not specified
Velpar 2L	nonionic surfactant on dormant alfalfa		not specified
	none on non-dormant alfalfa	1 qt/100 gal	
Warrant 3L	none		not specified

Table 5.78 - Grazing, Harvest, Haying, and Slaughter Restrictions for Herbicides in Legume Forages

Trade Name	Type	PHI Length	Comments
Aim (carfentrazone)	Grazing (forage) and haying (harvest)	21 days	May be used in established, mixed grass-clover stands as well as established pure forage legume stands
	Grazing or feeding	60 days	Seedling alfalfa
Butyrac (2,4-DB)		30 days	Established alfalfa
	Grazing or harvest	25 days	Established alfalfa; less than 6 inches of regrowth
Gramoxone (paraquat)	Grazing or harvest	60 days	Fall or spring dormant application alfalfa or clover
	Grazing or harvest	30 days	Between-cutting application alfalfa only
Kerb (pronamide)	Grazing or harvest	120 days	Fall or dormant application alfalfa or clover
Maestro (bromoxynil)	Grazing or harvest	30 days	After spring application
		60 days	After fall or winter application
MCPA	Forage or grazing	7 days	Do not forage or graze meat animals within 7 days of slaughter or dairy animals within 7 days of treatment, alfalfa or clover
Metribuzin	Grazing or harvest	28 days	Dormant application
Poast (sethoxydim)	Forage (grazing)	7/20 days	On the label, forage refers to green, undried alfalfa. Poast has 20-day restriction for clover hay only.
	Hay (harvest)	14/20 days	Hay is dried alfalfa. Poast has 20-day restriction for clover hay only.
Prowl H ₂ O (pendimethalin)	Forage or hay harvest	28 days	Apply before 6 inches of alfalfa regrowth. Has a 28-day restriction for 2.1 qt/A or less; 50-day restriction for >2.1 qt/A.
Pursuit (imazethapyr)	Feeding, grazing, or harvest	30 days	Alfalfa or clover, be cautious of rotational crop restrictions.
Raptor / Beyond Xtra / Imiflex (imazamox)	Feeding, grazing, or harvest	NA	Not specified on the label.
Roundup/glyphosate	Grazing or harvest (preplant)	0 days	Alfalfa or clover may be grazed or cut for hay immediately following preplant application.
	RR alfalfa only	5 days	In Roundup Ready alfalfa varieties, apply glyphosate up to 5 days before cutting.
	Grazing or harvest (spot treatment)	3–14 days	Spot treatment on alfalfa or clover depends on glyphosate product used.
Select (clethodim)	Feeding, grazing, or harvest	15 days	Increases when tankmix with 2,4-DB (60 days).
Sharpen (saflufenacil)	Feeding, grazing, or harvest	28 days	
Velpar (hexazinone)	Grazing or feeding	30 days	Plant only corn for 12 months following application of Velpar.
Warrant (acetochlor)	Grazing or feeding	20 days	Post-emergence application

Table 5.79 - Application Timings for Herbicides Used in Grass Pasture, Hay, and CRP Grassland

Use only in these states: If left blank these products are available in Delaware, Maryland, New Jersey, Pennsylvania, Virginia, and West Virginia.

Establishment: Herbicide is applied preplant in no-till establishment to control existing weeds. There are currently no herbicides registered for preplant incorporated (PPI) or preemergence (PRE) applications in grass forage for residual weed control.

Seedling stand POST: Herbicide is applied postemergence (POST) to seedling grass that has reached a specific growth stage and is actively growing, or at a maximum allowable rate.

Established stand POST: Herbicide is applied POST to grass that has been established for a minimum length of time and is actively growing.

Spot-spray application: Herbicide is applied only to weed-infested areas of the field; usually with hand-held equipment. If the herbicide is labeled for seedling or established stands postemergence, then herbicide use rates, application timing, and minimum establishment periods should be observed unless otherwise stated on the label. Grazing, harvest, slaughter, and transfer restrictions still apply for all spot-spray applications.

Grazed Fencerows: Herbicide is applied along a grazed fencerow to control emerged weeds and/or prevent seedling emergence. Use postemergence broadcast rates and timings unless grazed fencerows are specifically mentioned on the label. If the herbicide is labeled for spot applications, and the total area of the fencerows being treated is less than 10% of the total area inside the fencerows, spot application recommendations can be used. Grazing, harvest, slaughter, and transfer restrictions still apply for all applications to grazed fencerows.

Trade Name	Use Only in These States	Establishment	Seedling Stand POST	Established Stand POST	Spot-Spray or Wiper Applicator	Grazed Fencerows
2,4-D amine ¹				L ²	-- ³	yes
2,4-D ester ¹				L	-- ³	yes
Aim			L	L		yes
Arsenal						yes
Chaparral (aminopyralid + metsulfuron)	PA, VA, WV			after tillering ⁵	spot	yes
Clarity			1 pt/A max ⁴	L	spot and wiper	yes
2,4-D + dicamba tank-mix				L		yes
Crossbow (triclopyr + 2,4-D)				after tillering ⁵	spot	yes
DuraCor SC (aminopyralid + florpyrauxifen)		preplant	20 fl oz/A max	after tillering ⁵	spot	yes
Engenia				L	spot and wiper	yes
Facet L				L	spot	yes
Freelexx				L	spot	yes
		preplant				
Glyphosate		renovation			spot and wiper	yes
Gramoxone SL		preplant				no
GrazonNext HL (aminopyralid + 2,4-D)	PA, VA, WV			after tillering ⁵	spot	yes

Table 5.79 - Application Timings for Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Herbicide	Use Only in These States	Establishment	Seedling Stand POST	Established Stand POST	Spot-Spray or Wiper Applicator	Grazed Fencerows
Grazon P+D (picloram + 2,4-D)	VA, WV			after tillering ⁵		yes
GrazonPD3				after tillering ⁵	spot	yes
MCPA			½ pint/A max ⁶	L		yes
Metsulfuron				6-24 months ⁷	spot	yes
Milestone	PA, VA, WV			after tillering ⁵	spot	yes
PastureGard HL (triclopyr + fluroxypyr)				after tillering ⁵	spot	yes
Permit/Sandea				L	spot and wiper	yes
Prowl H2O				6 or more tillers		yes
Remedy Ultra				after tillering ⁵		yes
Sharpen				L		yes
Spike 20P (pelleted) ⁸				L	spot	yes
Stinger				L	spot	yes
Surmount (picloram + fluroxypyr)	VA, WV			after tillering ⁵	spot	yes
Tordon				L	spot	yes
Vastlan				after tillering ⁵	spot	yes
Weedmaster (dicamba + 2,4-D)			2 pt/A max ⁴	L	spot	yes
Xtendimax			22 fl oz/A max ⁴	L	spot	yes
Yukon			L	L	spot	yes

¹ 2,4-D is manufactured by various companies; labels may vary among manufacturers.

² L = allowed on herbicide label with no specific grass size or establishment period restrictions.

³ Most 2,4-D labels do not include spot-spray applications, while some do.

⁴ Labels state that “newly seeded areas” may be severely injured if rates greater than 1 pt/A (Clarity), 2 pt/A (Weedmaster), or 22 fl oz/A (XtendiMax) is applied, but no minimum size or growth stage is given. In practice, these products should not be applied until seedling grasses have attained the 3- to 4-leaf stage, have reached a minimum height of 6 inches, and are healthy and actively growing.

⁵ Grasses should be tillering and have developed a good secondary root system.

⁶ This is labeled for mixed clover/grass stands after 2-trifoliate clover.

⁷ Six months after establishment for bluegrass, bromegrass, and orchardgrass; 12 months for Timothy; 24 months for fescue.

⁸ Spike is labeled for broadcast applications, but because it can persist for several years in the soil, it is generally only recommended for hand treatment of single plants, multistem clumps, or small stands of woody vegetation in land (including fencerows) dedicated to long-term grass pasture.

Table 5.80 - Herbicides Used in Grass Pasture, Hay, and CRP Grassland, Prepackaged Mixes, or Co-packs, and Equivalents

Trade Name	Components (lb ai/gal or lb ae/gal)	If you apply (per acre)	You have applied (ai or ae)	Site of Action Number	An equivalent tank mixture of
Chaparral 71.6WG	0.6213 lb aminopyralid 0.0945 lb metsulfuron	2.5 oz	0.098 lb aminopyralid 0.015 lb metsulfuron	4 2	6.25 fl oz Milestone 2L 0.4 oz Metsulfuron 60DF
Cimarron Max (co-pack 60DF and 2.87L)	dry: 0.6 lb metsulfuron liquid: 1.87 lb 2,4-D + 1 lb dicamba	dry: 0.4 oz liquid: 1.6 pt	0.015 lb metsulfuron 0.57 lb 2,4-D 0.2 lb dicamba	2 4 4	0.4 oz Metsulfuron 60DF 1.2 pt 2,4-D amine 3.8L 6.4 fl oz Clarity 4S
Cimarron Plus 63WDG	0.48 lb metsulfuron 0.15 lb chlorsulfuron	0.5 oz	0.015 lb metsulfuron 0.0047 chlorsulfuron	2 2	0.4 oz Metsulfuron 60DF 0.1 oz Telar 75DF
Crossbow 3L	2 lb 2,4-D 1 lb triclopyr	4 qt	2 lb 2,4-D 1 lb triclopyr	4 4	2 qt 2,4-D ester 2 pt Remedy Ultra 4L
Curtail 2.38L	0.38 lb clopyralid 2 lb 2,4-D	3 qt	0.285 lb clopyralid 1.5 lb 2,4-D	4 4	12 fl oz Stinger 3L 1.5 qt 2,4-D amine 3.8L
GrazonNext HL 3.74E	0.41 lb aminopyralid 3.33 lb 2,4-D	2.1 pt	0.108 lb aminopyralid 0.9 lb 2,4-D	4 4	6.9 fl oz Milestone 2L 1 qt 2,4-D amine 3.8L
Grazon P+D 2.54SL	0.54 lb picloram 2 lb 2,4-D	4 pt	0.27 lb picloram 1 lb 2,4-D	4 4	1 qt Tordon 2L 1 qt 2,4-D amine 3.8L
GrazonPD3	0.81 lb picloram 3 lb 2,4-D	2 pt	0.203 lb picloram 0.75 lb 2,4-D	4 4	3.24 pt Tordon 2L 1.58 qt 2,4-D amine 3.8L
Huskie 2.06 EC	0.31 lb pyrasulfotole 1.75 lb bromoxynil	15 fl oz	0.036 lb pyrasulfotole 0.2 lb bromoxynil	27 6	0.31 lb pyrasulfotole 13 fl oz Maestro 2EC
PastureGard HL 4SL	3 lb triclopyr 1 lb fluroxypyr	1.5 pt	0.75 lb triclopyr 0.25 lb fluroxypyr	4 4	1.5 pt Remedy Ultra 4L 11 fl oz Vista XRT 2.8L
Prescott 3E	2.25 lb triclopyr 0.75 lb clopyralid	1.5 pt	0.42 lb triclopyr 0.14 lb clopyralid	4 4	0.84 pt Remedy Ultra 4L 0.37 pt Stinger 3S
Surmount 1.34E	0.67 lb picloram 0.67 lb fluroxypyr	3 pt	0.34 lb picloram 0.34 lb fluroxypyr	4 4	1.4 pt Tordon 2L 1 pt Vista XRT 2.8L
Weedmaster 3.87L	1 lb dicamba 2.87 lb 2,4-D	4 pt	0.5 lb dicamba 1.44 lb 2,4-D	4 4	1 pt Clarity 4S 3 pt 2,4-D amine 3.8L
Yukon 67.5WDG	0.125 lb halosulfuron 0.55 lb dicamba	6 oz	0.047 lb halosulfuron 0.206 lb dicamba	2 4	1 oz Permit 75WG 6.6 fl oz Clarity 4S

Table 5.81 - Relative Effectiveness of Herbicides Used in Grass Pasture, Hay, and CRP Grassland

This table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rates, weed size or growth stage, and proper timing of application (see Table 5.86). Results may differ with variations in weed size, temperature, rainfall, soil moisture, soil type, and soil pH. Spike 20P also is available for control of problem woody perennials as well as some herbaceous perennials. See a Spike label for additional information. Some products show for which states they are registered under the rate. These products should only be used in the listed states.

Weed control rating

10 = 95–100% 9 = 85–95% 8 = 75–85% 7 = 65–75% 6 = 55–65%

L = Weed is listed as control on herbicide label but local data is limited. N = Less than 55% or no control

- = not applicable or no local data available

Species	2,4-D ¹ 2-3 pt	2,4-D + dicamba ¹ 1 qt + 1 pt	Aim 1-2 oz	Chaparral ¹ 2-3 oz (VA, WV)	Dicamba ¹ 1 pt	Crossbow ¹ 2-4 qt	DuraCor (12 to 20 fl oz/a) (PA, VA, WV)	GrazonNext ¹ HL 1.5-2.6 pt (PA, VA, WV)	Grazon P+D ¹ 3-4 pt (VA, WV)	Metsulfuron 60DF 0.1-0.3oz	Milestone 5-7 oz	Pasture-Gard HL ¹ 1-1.5 pt	Remedy Ultra 2-4 pt	Roundup/glyphosate 1-2 qt (spot treatment)	Stinger 0.66-1.33 pt	Surmount ¹ 1.5-3 pt (VA, WV)
Site of Action Number	4	4	14	4/2	4	4/4	4/4	4/4	4/4	2	4	4/4	4	9	4	4/4
Winter Annuals																
Chamomile, Mayweed	7	10	6	L	8+	8	-	7+	-	10	-	-	-	9	9	-
Chickweed, Common	7	8	6	10	7	9	8+	9	8	10	7	8	7+	10	6	9
Cockle, Corn	8	10	9	L	10	8+	-	-	-	L	-	-	-	10	N	-
Cockle, Cow	8	10	9	9+	10	8+	-	-	-	9	-	-	-	10	N	-
Fleabane spp.	9	10	7	9	8	9+	L	8	9	9	L	-	-	8+	9	-
Henbit/ Deadnettle	6	8+	N	9	7+	9+	9	8	9+	9	8+	8+	7+	9+	-	9
Horseweed (maretail)	9	9	N	9	9	10	9	9	10	9	9+	6	6	9+	9+	9
Mustard, Garlic	N	8	7	8	7	8	-	-	-	8	-	-	8	8	N	-
Mustard spp.	9	10	8+	8	8	10	-	7+	7	8+	N	8	8	10	N	-
Pennycress, Field	9	10	8+	10	8	9+	-	8	10	9	-	L	-	10	N	9+
Pepper Weed spp.	9	10	8+	8	8	9+	L	8	7	10	N	8	8	10	N	-
Shepherdspurse	8+	10	9	10	8	9	-	8	-	10	-	-	-	10	N	-
Yellow Rocket	9	10	9	8+	9	10	-	8	-	9	-	-	-	9	6	-
Summer Annuals																
Amaranth, Spiny	9	10	9	8+	9	9	L	8	7+	8	8	N	N	9	6	9
Cocklebur, Common	9	10	8	10	10	10	9	9	10	8+	L	8+	8+	9	9	9

Table 5.81 - Relative Effectiveness of Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Species	2,4-D ¹ 2-3 pt	2,4-D + dicamba ¹ 1 qt + 1 pt	Aim 1-2 oz	Chaparral ¹ 2-3 oz (VA, WV)	dicamba ¹ 1 pt	Crossbow ¹ 2-4 qt	DuraCor (12 to 20 fl oz/a) (PA, VA, WV)	GrazonNext HL ¹ 1.5-2.6 pt (PA, VA, WV)	Grazon P+D ¹ 3-4 pt (VA, WV)	Metsulfuron 60DF 0.1-0.3oz	Milestone 5-7 oz	Pasture-Gard HL ¹ 1-1.5 pt	Remedy Ultra 2-4 pt	Roundup/glyphosate 1-2 qt (spot treatment)	Stinger 0.66-1.33 pt	Surmount ¹ 1.5-3 pt (VA, WV)
Groundsel, Common	7	7	8	9	6	8	-	7	-	9+	-	-	-	9	9	L
Jimsonweed	8	10	9	8+	10	9	8+	9	7	9	8+	-	-	9	8	7+
Lambsquarters, Common	10	10	9	9+	10	10	10	9	9+	9	9+	9	9	9	6	10
Lettuce, Wild/ Prickly	9+	10	9	10	8+	9	8	9	10	9	9+	9	-	9	9	9
Nightshade, Black	7+	8+	9	8+	8+	8+	-	7	6	8	9	6	-	9	8	L
Perilla mint	7	8	-	-	-	-	8	8	7	-	-	-	-	-	-	-
Pigweed spp.	9	10	9	9	9	9	8+	8	7	10	9	9	8	9	6	9+
Ragweed, Common	9	10	7	9	9	10	9	9	9+	N	9	9	8+	10	9+	9
Ragweed, Giant	8+	10	N	9	9	10	8+	9	9+	N	9	9	8+	10	9+	9
Smartweed spp.	7	9	N	9	8	9	L	9	9	7	8+	N	-	9	8+	9+
Stiltgrass, Japanese ²	N	N	N	N	N	N	7	7	N	N	7	N	N	9	N	N
Velvetleaf	8+	10	9	8	10	9	-	8	8+	8	-	9	-	9	6	9
Biennials																
Burdock, Common	9	10	N	8+	8	9	9	8	9+	7	9	9	9	9	9	8
Carrot, Wild	9	10	N	10	8	9+	10	8	9+	9	N	7	7	9	6	8+
Evening Primrose, Common	9	10	7+	9	8	9+	-	9	-	-	9	-	-	10	-	-
Evening Primrose, Cutleaf	9	10	N	8+	7	8	L	9	9	7+	9	8	8	6	-	-
Hemlock, Poison	7+	9	7+	N	8	9	L	8	8+	N	N	N	N	9	N	8
Mullein, Common	N	6	N	9+	N	N	L	-	7+	8	-	N	N	-	N	7+
Parsnip, Wild	9	10	N	9	9	10	9	8+	8+	7	7	-	-	9	N	-
Teasel	7+	10	8	9	9	8+	9	8+	8+	6	9	9	9	9	9	-
Stiltgrass, Japanese	N	N	N	8	N	N	-	7	-	N	7	-	N	10	N	N
Thistle, Bull	9+	10	N	9+	9	9+	10	9	9	6	9	6	7	9	9+	9
Thistle, Musk	8+	10	N	9+	9	9+	10	9	9	8	9+	6	7	9	9+	8+

Table 5.81 - Relative Effectiveness of Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Species	2,4-D ¹ 2-3 pt	2,4-D + dicamba ¹ 1 qt + 1 pt	Aim 1-2 oz	Chaparral ¹ 2-3 oz (VA, WV)	dicamba ¹ 1 pt	Crossbow ¹ 2-4 qt	DuraCor (12 to 20 fl oz/a) (PA, VA, WV)	GrazonNext HL ¹ 1.5-2.6 pt (PA, VA, WV)	Grazon P+D ¹ 3-4 pt (VA, WV)	Metsulfuron 60DF 0.1-0.3oz	Milestone 5-7 oz	Pasture-Gard HL ¹ 1-1.5 pt	Remedy Ultra 2-4 pt	Roundup/glyphosate 1-2 qt (spot treatment)	Stinger 0.66-1.33 pt	Surmount ¹ 1.5-3 pt (VA, WV)
Thistle, Plumeless	8+	10	N	9+	9	9+	10	9	9	8	9+	6	7	9	9+	8+
Herbaceous Perennials																
Aster spp.	9	10	N	9	8+	9	L	7	8	7	-	-	-	9	9+	-
Bedstraw, Smooth	7	7	6	9	N	8	L	9	7	N	9	L	-	9	7	L
Bindweed, Field	8	8+	6	-	8+	8	-	7	6	N	-	7	7	8	N	8
Bindweed, Hedge	9	10	N	-	9	9	-	8	8+	N	-	7+	8	8	N	8+
Brackenfern	7	7	N	7	N	7+	-	7	-	7	-	-	-	6	-	-
Buttercup spp.	8+	9	7	8+	8	10	10	9	10	9	8+	8	8	9	8	8+
Catsear, Common	7	9	N	9	7+	-	-	9	-	-	9	-	-	8+	-	-
Chickweed, Mouseear	6	8	6	10	7+	8+	9	7	9	10	8	8	8+	9	6	9
Chicory	9	10	7	9	8	9	9	9	9+	7+	9	9	8+	9	9	8+
Clover spp.	7	8+	N	10	8+	8+	9	9+	10	8+	9+	8+	9	10	9	10
Cockle, White	7	9	6	8	8+	9	-	N	-	8	-	L	-	9+	9	L
Daisy spp.	9	10	N	9	8+	9+	L	9	8	6	9	-	-	8+	8+	-
Dandelion	9+	10	6	8+	7	9+	9	9	9	7+	9	8	7+	7	7	9
Dock spp.	8	10	7	9	8	9	9	9	9	8+	9	8	8	9	7+	9
Dogbane, Hemp	6	7	N	N	7	8	-	6	7	N	N	7	7	8	6	8+
Dogfennel	7	7+	N	N	7	7	-	7	7+	6	N	9	8	8	6	9
Garlic or Onion, Wild	8	8+	N	9	7	8	-	6	N	9+	N	N	N	9	N	N
Goldenrod spp.	8	8+	N	8	7	8	N	8	9	8	6	7	7+	9	6	9
Groundcherry spp.	7	7+	7	9	7	8+	-	7	-	-	9	-	-	8	N	-
Hawkweed spp.	8	9	6	L	7+	9	L	8	6	7	L	-	-	9	8	-
Horsenettle	6	7+	N	9	7	8	9	8+	9	7	9	6	6	8	N	8+
Ironweed, Tall	8	9	N	8+	8+	9	9	9	9+	N	8	7	6	9	6	8+
Knapweed, Spotted	7	8	N	8+	7	7	9+	9	9	6	8+	6	6	9	9	8+

Table 5.81 - Relative Effectiveness of Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Species	2,4-D ¹ 2-3 pt	2,4-D + dicamba ¹ 1 qt + 1 pt	Aim 1-2 oz	Chaparral ¹ 2-3 oz (VA, WV)	dicamba ¹ 1 pt	Crossbow ¹ 2-4 qt	DuraCor (12 to 20 fl oz/a) (PA, VA, WV)	GrazonNext HL ¹ 1.5-2.6 pt (PA, VA, WV)	Grazon P+D ¹ 3-4 pt (VA, WV)	Metsulfuron 60DF 0.1-0.3oz	Milestone 5-7 oz	Pasture-Gard HL ¹ 1-1.5 pt	Remedy Ultra 2-4 pt	Roundup/glyphosate 1-2 qt (spot treatment)	Stinger 0.66-1.33 pt	Surmount ¹ 1.5-3 pt (VA, WV)
Knotweed, Japanese	7	7+	6	7+	7+	7	8+	7	N	-	7+	N	6	8	8	L
Lespedeza, Sericea	N	N	N	6	N	7+	-	N	6	6	N	8	8	7	N	7
Milkweed, Common	6	7	N	N	6	7	-	6	7	N	N	6	6+	7+	N	8+
Mugwort	6	7	6	8	7	8	L	8	7	7	8	-	-	7	8+	-
Nettle, Stinging	8	9	6	8	8	9	-	9	9	6	9	9	9	9	7	9
Nightshade, Bitter	7	8+	6	-	7	-	-	7	7	-	-	-	-	9	8	-
Plantain spp.	8	10	7	9	8	9	10	7+	9	9	N	9	8	9	N	8+
Pokeweed, Common	7	7	N	6	7	9	7	8	7+	N	7+	N	N	8	N	8+
Snakeroot, White	8	9	7	-	9	9	9	8	8	N	-	-	-	8	N	-
Sorrel, Red	6	10	8+	8	8+	-	-	-	9	8+	-	6	-	9	8	-
Sowthistle, Perennial	7	9	N	8+	8	8	9	9	9+	7	9	8	8	9	8	-
Star-of- Bethlehem	N	N	8+	-	N	-	-	-	-	-	-	-	-	8	-	-
Thistle, Canada	7	7+	N	9+	7	8	9	9	9	7	9	8	6	8	9	7
Toadflax, Yellow	7	8	8+	-	7+	-	-	7	-	-	-	-	-	8	N	-
Waterhemlock, Spotted	7+	9	N	-	8	9	-	7	-	N	-	-	-	9	N	-
Wingstem	8+	8+	N	9	6	7+	9	9	9	N	9	6	7+	-	6	8+
Woodsorrel, Yellow	7	7+	7	L	7	8	-	8+	-	9	-	-	-	9	8	-
Yarrow, Common	7	9	N	L	9	8+	L	7	-	8	L	L	L	9	7	L
Woody Perennials¹																
Blackberry spp.	6	6+	N	8	6	8	-	N	7+	7	N	7	7+	8	7	8
Dewberry spp.	6	7	N	L	6	7+	-	N	-	8+	-	-	-	7	7	7
Grape, Wild	8	9	N	-	8	9	-	8	-	-	-	L	-	8	N	L
Honeysuckle spp.	7	7+	N	L	N	8+	-	7	8	10	-	L	-	8	N	L
Kudzu	N	6	N	8	6	6	L	8	9	N	8	7	7	-	-	-

Table 5.81 - Relative Effectiveness of Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Species	2,4-D ¹ 2-3 pt	2,4-D + dicamba ¹ 1 qt + 1 pt	Aim 1-2 oz	Chaparral ¹ 2-3 oz (VA, WV)	dicamba ¹ 1 pt	Crossbow ¹ 2-4 qt	DuraCor (12 to 20 fl oz/a) (PA, VA, WV)	GrazonNext HL ¹ 1.5-2.6 pt (PA, VA, WV)	Grazon P+D ¹ 3-4 pt (VA, WV)	Metsulfuron 60DF 0.1-0.3oz	Milestone 5-7 oz	Pasture-Gard HL ¹ 1-1.5 pt	Remedy Ultra 2-4 pt	Roundup/glyphosate 1-2 qt (spot treatment)	Stinger 0.66-1.33 pt	Surmount ¹ 1.5-3 pt (VA, WV)
Locust, Black	7	8+	N	L	8	8	-	L	-	7	L	L	L	8	N	9+
Olive, Autumn	7	8	N	-	7+	8	-	7	-	-	-	-	9	8	N	-
Poison-ivy, Oak	7	8+	N	6	7+	8+	-	7	8+	6	-	L	L	8	N	7
Rose, Multiflora	6	7+	N	8	6	8+	6	7	8+	8+	6	6	8+	8	N	7
Sumac spp.	6	7+	N	-	7	8+	-	L	7	N	-	L	L	8	7	8
Trumpet Creeper	6	7+	N	-	6	8	N	N	7	N	-	-	L	7+	N	7
Virginia Creeper	7	9	N	-	8	8+	-	7	-	-	-	L	L	8	N	-

¹ Herbicide contains multiple active ingredients. See Table 5.80 for prepackaged mixture or co-packs and their constituents.

² Japanese stiltgrass control in grass forages is inconsistent. Prowl H2O or Satellite HydroCap can be applied to established forage grasses in early spring to control germinating Japanese stiltgrass seedlings. Aminopyralid-containing products can provide some residual control when applied in the early spring. Currently there are no labeled, POST herbicides that effectively and selectively control stiltgrass without injuring the desirable forage grasses. Facet L (quinclorac) is labeled in grass forages and has activity on foxtails, crabgrass, barnyardgrass (<2" tall); but it has poor activity on Japanese stiltgrass and kills clover. Acclaim Extra (fenoxaprop) is not labeled in forages. Plateau controls stiltgrass but some cool season forages grasses are sensitive to it (see label for details). Pursuit also controls stiltgrass, but the label is ambiguous about its utility in grass forage settings.

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland

The following comments apply to all herbicides, unless otherwise noted below:

- Apply postemergence to actively growing broadleaf weeds. Treat biennials in the rosette stage of growth.
- Higher rates or repeat treatments may be required for less susceptible species, perennial weeds, and woody plants.
- For maximum efficacy, do not mow, graze, hay, or disturb the treated area for 7 days after application. Make applications at least 7 days before a killing frost.
- These herbicides will severely injure alfalfa, clover, and other legumes. Do not use if loss of desirable legume species cannot be tolerated.
- Follow label recommendations to reduce the potential for spray drift or volatility to sensitive plants.

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier
2,4-D LVE 3.8L or 2,4-D amine 3.8L	2,4-D	Established-POST	1.5–3 qt or 1–2 qt	1.4–2.8 ae or 0.95–1.9 ae	yes

- 2,4-D is marketed by various companies with various trade names. Refer to the label provided with the product for specific recommendations and restrictions.
- Make application when grasses are well established, usually 4–5 inches tall with a good root system and tiller development.
- Make applications by ground in a minimum of 10 gal/A or by air in a minimum of 2 gal/A of water or liquid fertilizer.
- Do not make applications when the temperature is expected to exceed 80 degrees that day as drift is more likely to occur.
- Treat susceptible woody perennials in the spring after leaves are fully expanded.
- Ester formulations are slightly more effective (more leaf-absorbed) than amine formulations, but also slightly more volatile.
- 2,4-D labels vary concerning overseeding or rotational crop restrictions. Unless specified on the label, most crops can be safely planted 3 months after application under normal environmental conditions.
- Freelexx is a new choline salt formulation of 2,4-D that has much lower volatility and low odor compared to other 2,4-D formulations. It can be used in grass forage settings.
- *Water Quality Advisory.*

Aim 2EC	carfentrazone	Seedling-POST Established-POST	1–2 fl oz	0.016–0.032	yes
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- For new seedlings apply to grasses that have at least 3-4 leaves.
- Aim is safe to legumes and clovers, but temporary injury may occur.
- Significant crop response may occur, but is temporary.
- Apply in a minimum of 10 gal/A of water or liquid fertilizer. Applying Aim in liquid fertilizer may increase the level of crop response.
- Applications made within 8 hours of rainfall or irrigation or when heavy dew is present may cause significant crop response.
- Aim has a relatively narrow spectrum of weed control and is primarily used for control of winter or summer annual broadleaf weeds up to 4 inches tall (emerged weeds only).
- Aim has activity on Star-of-Bethlehem, dayflower species, and speedwell species. Star-of-Bethlehem may require additional application at least 10 days after the first.
- Three applications per season are allowed, but do not make applications less than 7 days apart.
- There are no rotational crop or overseeding restrictions for labeled crops; see label.

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
Arsenal 2AS	imazapyr	Grazed fencerows	1–3 pt or 0.4–1.2 fl oz/ gal	0.25–0.75 or 0.3%–0.9% v/v solution	no
<ul style="list-style-type: none"> • Arsenal is labeled for spot treatment in grass pasture. However, due to its length of residual activity on cool-season grass species, bare spots in the pasture could persist for several months. Therefore, it is only recommended for use along permanent or long-term fencerows. • This use falls under the spot treatment part of the label, so grazed fencerows can be treated so long as the total area to be treated is no more than 10% of the total pasture and fencerow areas combined. • DO NOT apply where Arsenal may contact the roots of desirable trees or other plants. • Arsenal provides postemergence and 3 to 6 months of soil residual control of many annual, biennial, and perennial grass and broadleaf weeds as well as several vine and brush species. • Make applications with hand-held equipment. • Refer to weed rate tables of the herbicide label and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff. • Rotational crops can be planted 12 months after application and completion of a successful field bioassay. 					

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
Chaparral 71.6WG VA and WV only	aminopyralid + metsulfuron	Established-POST	2–3.3 oz	0.078–0.128 + 0.012–0.019	
		Seed head suppression	2–2.5 oz	0.078–0.098 + 0.012–0.015	
		Spot treatment	0.025–0.033 oz/gal	0.02%–0.026% w/v solution	yes

- Chaparral provides postemergence control and 2 to 3 months of soil residual control of on many annual, biennial, and perennial weed species and suppression of blackberry and multiflora rose **in permanent grass pasture**.
- Apply by ground in a minimum of 10 gal/A or by air in a minimum of 2 gal/A of water or liquid fertilizer.
- High-volume foliar applications for brush control (volume not specified) are allowed; consult herbicide label for details.
- In general, Chaparral may be applied in the spring or early summer, depending on the target weed species, as a broadcast application over grass that was planted at least 4 months prior to the application and growing under favorable conditions for establishment. Grasses should have well-established root systems and be tillering.
- Smooth brome grass may be more sensitive to applications of Chaparral than other perennial grasses, and temporary growth suppression may occur.
- Special precautions are provided on the label for applications to tall fescue to minimize injury and stunting. Make application later in spring after new growth is 5–6 inches tall or in the fall. Do not use more than 2 oz/A of Chaparral and tank-mix with 2,4-D. Use only a non-ionic surfactant (0.5–1 pt/100 gal) when mixing with water; do not use any adjuvant when mixing with liquid fertilizer. Adhere strictly to these precautions, or severe injury may occur. Even when these precautions are followed, some stunting, yellowing, or seed head suppression of fescue may occur.
- Do not use Chaparral on timothy, annual (Italian) ryegrass, or perennial ryegrass, or severe injury will occur.
- With fall applications, do not plant grasses the following spring; do not overseed ryegrass for 4 months after application.
- Do not rotate to any crop within 1 year following treatment, or to any broadleaf crop until an adequately sensitive field bioassay shows that the aminopyralid level in soil will not adversely affect that broadleaf crop. Cereals and corn can be planted 1 year after treatment; most broadleaf crops require at least a 2-year wait until planting.
- The Chaparral label has restrictions concerning the use and management of plant residues (hay, straw, mulch, compost) and manure that may contain aminopyralid residues. These include important restrictions concerning the movement and sale of hay products treated with aminopyralid. Be certain you understand and are able to follow these label restrictions before using this product.
- For tall fescue seed head suppression and broadleaf weed control: Chaparral may be used to reduce the number of seed heads of tall fescue when applied prior to flower emergence. For best results apply 2–2.5 oz/A after initial green-up when grass height is approximately 6 inches. Later applications may still be effective; however, the seed head suppression will be less effective and the number of seed heads could be noticeably higher. Many weed species can be controlled with this application timing in addition to the suppression of seed head development.
- Make spot applications with hand-held equipment. Refer to weed rate tables of the herbicide label and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff.
- Spot treatments may be applied at equivalent broadcast rates of up to 6.6 oz/A (0.066 oz/gal), but no more than 50% of the acreage may be treated, and the total amount of Chaparral applied from all applications must not exceed 3.3 oz per acre per year.
- A non-ionic surfactant should be added.
- Repeat treatments may be made, but the total amount of Chaparral applied from all applications must not exceed 3.3 oz per acre per year.
- Chaparral may be impregnated on dry bulk fertilizer and spread. This application method relies on herbicide activity in the soil, and thus, difficult to control perennial weeds are not as well controlled compared to spray applications.
- *Water quality advisory.*

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
Clarity 4S	dicamba	Seedling-POST	0.5–1 pt	0.25–0.5 ae	yes
		Established-POST	0.5–2 pt	0.25–1.0 ae	
		Spot treatment	0.2–1.6 fl oz/ gal	0.16%–1.25% v/v solution	
<ul style="list-style-type: none"> • Application to seedling grasses should not exceed 1 pt/A, and grasses should be actively growing, unstressed, and have attained the 3- to 4-leaf stage and 6 inches tall. For higher rates delay application until grasses are well established, usually 4–5 inches tall with a good root system and tiller development. • Apply in a minimum of 10 gal/A of water or liquid fertilizer, or by air in 2 to 40 gal/A of water. • If applied in a liquid nitrogen carrier, foliar burn on the forage can be expected especially if it's sunny and above 80F. It is best to use a 50:50 mixture of water and liquid fertilizer to reduce crop injury. • High-volume foliar applications for brush control (up to 600 gal/A) are allowed; consult herbicide label for details. • Do not make applications when the temperature is expected to exceed 80 degrees that day as drift is more likely to occur. • Forage grasses or small grains can be overseeded after 30 days per pint of dicamba applied. • Legumes and other broadleaf crops may be planted 4 months after application. • Make spot applications with hand-held equipment. Do not treat more than one-tenth of the total area at any one time. • Refer to weed rate tables of the herbicide label and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff. • Clarity is also labeled for wiper applications. Consult the herbicide label for specific recommendations. • <i>Water quality advisory.</i> 					
Crossbow 3E	triclopyr + 2,4-D	Established-POST	1–6 qt	0.25–1.5 ae + 0.5–3.0 ae 1.2%–1.6% v/v	yes
		Spot treatment	1.5–2 fl oz/gal	solution	
<ul style="list-style-type: none"> • Crossbow provides postemergence control and 1 to 2 months of soil residual control of many annual, biennial, and perennial weeds as well as many woody plants. • Apply only to grasses with well-established root systems that are tillering. • Apply to actively growing weeds or brush by ground or air (helicopter only) in 10 to 30 gal/A of water or liquid fertilizer. • For best results, treat biennial or winter annual weeds in the rosette stage. • Some hard-to-control perennial weeds and woody species may require retreatment. Use higher rates for less susceptible species. • High-volume foliar applications for brush control (100–200 gal/A) are allowed; consult herbicide label for details. • Follow all label recommendations to reduce the potential for spray drift or volatility to sensitive plants. • Crossbow will severely injure alfalfa, clover, and other legumes. • Forage grasses may be overseeded 21 days after application. Other crops can be planted the next growing season. • Make spot applications with hand-held equipment. • Refer to weed rate tables of the herbicide label and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. • For best results, do not graze or harvest for 7 days after application, and make applications at least 7 days before a killing frost. • Do not spray to the point of runoff. • <i>Water quality advisory.</i> 					

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
DuraCor 0.73SC (PA, VA, and WV only)	aminopyralid + florpyrauxifen- benzyl	seedling: POST established: POST	12–20 fl oz	0.063–0.104 ae + 0.006–0.0105 ae	
		spot treatment	40 fl oz	1.46 v/v solution	yes
<ul style="list-style-type: none"> • Spot treatments may be applied at an equivalent broadcast rate of up to 40 fl oz of DuraCor (0.208 lbs aminopyralid and 0.0209 lbs florpyrauxifen-benzyl) per acre per annual growing season; however, not more than 50% of an acre may be treated at this rate. • Repeat treatments may be made, but the total amount of DuraCor applied must not exceed 20 fl oz per acre per year. • DuraCor can be applied at 12 fl oz of product per acre in early to mid-spring when weeds are less than 2 inches tall. Applications in this range are most effective when conditions are favorable to plant growth. • For longer residual control of susceptible late spring and early summer weed emergence, apply up to 20 fl oz of product per acre. Increasing application rate to the high end of the rate range specified will extend the period of residual control. • DuraCor may be impregnated on dry bulk fertilizer and spread. This application method relies on herbicide activity in the soil, and thus, difficult to control perennial weeds are not as well controlled compared to spray applications. 					
Facet L 1.5SL	quinclorac	Established-POST	12–64 fl oz	0.14–0.75 ae	
		Spot treatment	0.55–1.6 fl oz/ gal	0.4%–1.25% v/v solution	no
<ul style="list-style-type: none"> • Facet L (formerly Paramount 75WDG) provides postemergence control and 1 to 2 months of soil residual control or suppression of several annual grass weeds, a few annual broadleaf weeds, and field or hedge bindweed. • Facet L is the only herbicide labeled for postemergence control of grass weeds in grass forage crops. Labeled grass weeds are barnyardgrass, large crabgrass, giant, green, and yellow foxtails, junglerice, and broadleaf signalgrass. • Rates greater than 32 fl oz/A and less than 22 fl oz/A are for leafy spurge control and bindweed maintenance, respectively. For broadleaf control apply 22–32 fl oz/A. For grass control apply at 32 fl oz/A with MSO at 1 % v/v. • Use only on labeled established grasses (timothy and reed canarygrass not included) that have developed a good root system and are tillering. • Local experience indicates that Facet may cause more injury to orchardgrass than to the other labeled cool-season grasses. • Apply to actively growing plants by ground in a minimum of 5 gal/A of water. Aerial applications are not allowed in the Northeast region. • For best results apply to labeled grass and broadleaf weeds up to 2 inches tall and prior to grass tiller development. • Do not apply Facet when air temperature is more than 90°F. • Forage grasses can be overseeded 10 months after application. • Legume crops can be planted 24 months after application and completion of a successful field bioassay. • For spot applications, do not exceed the maximum per-area rates for broadcast application. Refer to weed rate tables of the herbicide label and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff. • <i>Water quality advisory.</i> 					

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
			1.2–2.1 pt		
		Established-POST		0.062–0.108 +	
			0.5–0.9 fl oz/	0.5–0.9	
GrazonNext HL 3.74E (PA, VA, WV only)	aminopyralid + 2,4-D	Spot treatment	gal	0.4%–0.7% v/v solution	yes

- GrazonNext provides postemergence control and 2 to 3 months of soil residual control of many annual, biennial, and perennial weed species **in permanent grass pasture**.
- In general, it is best to wait 45–60 days after grass planting before applying GrazonNext.
- Smooth brome grass may be more sensitive to applications of GrazonNext than other perennial grasses, and temporary growth suppression may occur.
- Apply by ground in a minimum of 10 gal/A or by air in a minimum of 2 gal/A of water or liquid fertilizer.
- High-volume foliar applications for brush control (volume not specified) are allowed; consult herbicide label for details.
- Grass can be overseeded in the fall after a spring or early summer application.
- Do not rotate to any crop within 1 year following treatment or to any broadleaf crop until an adequately sensitive field bioassay shows that the aminopyralid level in soil will not adversely affect that broadleaf crop. Cereals and corn can be planted 1 year after treatment; most broadleaf crops require at least a 2-year wait until planting.
- The GrazonNext label has restrictions concerning the use and management of plant residues (hay, straw, mulch, compost) and manure that may contain aminopyralid residues. These include important restrictions concerning the movement and sale of hay products treated with aminopyralid. Be certain you understand and are able to follow these label restrictions before using this product.
- Make spot applications with hand-held equipment. Refer to weed rate tables of the herbicide label and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff.
- Spot treatments may be applied at equivalent broadcast rates of up to 4.2 pt/A (1.7 fl oz/gal), but no more than 50% of the acreage may be treated, and the total amount of GrazonNext applied from all applications must not exceed 2.1 pints per acre per year.
- A non-ionic surfactant should be added.
- Repeat treatments may be made, but the total amount of GrazonNext applied from all applications must not exceed 2.1 pints per acre per year.
- GrazonNext may be impregnated on dry bulk fertilizer and spread. This application method relies on herbicide activity in the soil, and thus, difficult to control perennial weeds are not as well controlled compared to spray applications
- *Water quality advisory.*

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
Grazon P+D 2.54SL (VA, WV only)	picloram + 2,4-D	Established-POST	2–8 pt	0.14–0.54 + 0.5–2.0	yes
<ul style="list-style-type: none"> • Grazon P+D provides postemergence control and 2 to 3 months of soil residual control of many annual, biennial, and perennial weed species in permanent grass pasture. • The distribution of Grazon P+D may be further restricted within Virginia and West Virginia due to the picloram content of the product and sensitivity of certain broadleaf crops. • Apply to grasses that are well established as indicated by tillering, development of secondary root system, and vigorous growth. • Smooth brome grass may be more sensitive to applications of Grazon P+D than other perennial grasses, and temporary growth suppression may occur. • Apply by ground in 10–40 gal/A or by air in a minimum of 2 gal/A of water, an oil-water emulsion, or liquid fertilizer. • High-volume foliar applications for brush control (100 gal/A) are allowed; consult herbicide label for details. • Cool season grasses can be seeded a minimum of 21 days after application (60 days for smooth brome grass). • Do not rotate to food or feed crops on treated land if they are not registered for use with picloram until an adequately sensitive field bioassay or chemical test shows that no detectable picloram is present in soil. • The Grazon P+D label has restrictions concerning the use and management of plant residues (hay, straw, mulch, compost) and manure that may contain picloram residues. Be certain you understand and are able to follow these label restrictions before using this product. • <i>Water quality advisory.</i> • <i>Restricted-use pesticide.</i> 					
GrazonPD3	picloram + 2,4-D	Established-POST	0.67–5 pt	0.07–0.51 + 0.25–1.88	yes
<ul style="list-style-type: none"> • GrazonPD3 provides postemergence control and 2 to 3 months of soil residual control of many annual, biennial, and perennial weed species in permanent grass pasture. • Apply to grasses that are well established as indicated by tillering, development of secondary root system, and vigorous growth. • Smooth brome grass may be more sensitive to applications of GrazonPD3 than other perennial grasses, and temporary growth suppression may occur. • Apply by ground in 10 to 40 gal/A or by air in a minimum of 2 gal/A of water, an oil-water emulsion, or liquid fertilizer. • High-volume foliar applications for brush control (100 gal/A) are allowed; consult herbicide label for details. • Cool-season grasses can be seeded a minimum of 21 days after application (60 days for smooth brome grass). • Do not rotate to food or feed crops on treated land if they are not registered for use with picloram until an adequately sensitive field bioassay or chemical test shows that no detectable picloram is present in soil. • The GrazonPD3 label has restrictions concerning the use and management of plant residues (hay, straw, mulch, compost) and manure that may contain picloram residues. Be certain you understand and are able to follow these label restrictions before using this product. • <i>Water quality advisory.</i> • <i>Restricted-use pesticide.</i> 					

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
		Established-POST	0.1–0.4 oz	0.004–0.015	
		Seed head suppression	0.3–0.4 oz	0.011–0.015	
Metsulfuron 60DF	metsulfuron	Spot treatment	0.01 oz/gal	0.008% w/v solution	yes

- Metsulfuron provides both postemergence control and 2 to 3 months of soil residual control of many annual, biennial, and perennial weed species, and suppression of blackberry and multiflora rose **in permanent grass pasture**.
- Apply by ground in a minimum of 10 gal/A or by air in 2 to 5 gal/A of water or liquid fertilizer.
- Postemergence applications are rainfast in 4 hours, after which rainfall or overhead irrigation is required to activate the herbicide in the soil.
- Applications up to 0.4 oz/A may be made to grasses that have been established for a minimum amount of time as follows: bermudagrass (2 months); bluegrass, bromegrass, and orchardgrass (6 months); timothy (12 months); and fescue (24 months).
- Special precautions are provided on the label for applications to fescue or timothy. Apply to fescue in late spring or fall or to timothy in late summer or fall. Either species should be at least 6 inches tall and actively growing. Use the lowest recommended rate of metsulfuron (up to 0.4 oz/A) for the target weeds and tank-mix with 2,4-D for added safety. Use only a non-ionic surfactant at 0.5 pt/100 gal when mixing with water; do not use any adjuvant when mixing with liquid fertilizer. Adhere strictly to these precautions, or severe injury may occur. Even when these precautions are followed, some stunting or yellowing of timothy or fescue may occur.
- Do not use metsulfuron on annual (Italian) or perennial ryegrass, or severe injury will occur.
- Overseeding intervals for grasses are specific to region, soil pH, metsulfuron rate, and grass species. In our region with soils of pH 7.5 or less, the interval range is from 6 to 34 months (see label).
- Metsulfuron is persistent in soil; rotation to most broadleaf crops is 34 months or completion of a successful field bioassay.
- Cimarron Max is a co-pack that contains the active ingredients of metsulfuron and 2,4-D plus dicamba.
- Cimarron Plus is a premix with the active ingredients metsulfuron and chlorsulfuron (Glean or Telar).
- For tall fescue seed head suppression and broadleaf weed control: Metsulfuron may be used to reduce the number of seed heads of tall fescue when applied prior to flower emergence. For best results apply 0.3–0.4 oz/A after initial green-up when grass height is approximately 6 inches. Later applications may still be effective; however, the seed head suppression will be less effective and the number of seed heads could be noticeably higher.
- Spot treatment with metsulfuron is effective for suppression or control of multiflora rose, blackberry, and Canada thistle. Make applications with hand-held equipment. Apply 1 oz/100 gal (0.28 gr/gal) on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff, but dense stands of brush may need to be treated from both sides to achieve adequate coverage.
- A non-ionic surfactant at 2–4 pt/100 gal should be added.
- Make applications after plants are fully leafed in the spring up through late summer.

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
		Established-POST	3–7 fl oz	0.047–0.109 ae	
Milestone 2E	aminopyralid	Spot treatment	0.13–0.36 fl oz/ gal	0.1%–0.3% v/v solution	yes

- Milestone provides postemergence control and 2 to 3 months of soil residual control of on many annual, biennial, and perennial weed species **in permanent grass pasture**.
- In general, it is best to wait 45–60 days after grass planting before applying Milestone.
- Smooth brome grass may be more sensitive to applications of Milestone than other perennial grasses, and temporary growth suppression may occur.
- Apply by ground in a minimum of 10 gal/A or by air in a minimum of 2 gal/A of water or liquid fertilizer.
- High-volume foliar applications for brush control (volume not specified) are allowed; consult herbicide label for details.
- Grass can be overseeded the fall after a spring treatment.
- Do not rotate to any crop within 1 year following treatment or to any broadleaf crop until an adequately sensitive field bioassay shows that the aminopyralid level in soil will not adversely affect that broadleaf crop. Cereals and corn can be planted 1 year after treatment; most broadleaf crops require at least a 2-year wait until planting.
- The Milestone label has restrictions concerning the use and management of plant residues (hay, straw, mulch, compost) and manure that may contain aminopyralid residues. Follow the label restrictions carefully.
- Make spot applications with hand-held equipment. Refer to weed rate tables of the herbicide label and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff.
- Spot treatments may be applied at equivalent broadcast rates of up to 14 fl oz/A (0.32 fl oz/gal), but no more than 50% of the acreage may be treated, and the total amount of Milestone applied from all applications must not exceed 7 fl oz per acre per year.
- A non-ionic surfactant should be added.
- Repeat treatments may be made, but the total amount of Milestone applied from all applications must not exceed 7 fl oz per acre per year.
- *Water quality advisory.*

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
PastureGard HL 4L	triclopyr + fluroxypyr	Established-POST	0.75–4 pt 0.2–1.5 fl oz/ gal	0.28–1.5 ae + 0.094–0.5 ae 0.16%–1.2% v/v solution	not recommended
		Spot treatment			
<ul style="list-style-type: none"> • PastureGard provides postemergence control and 1 to 2 months of soil residual control of many annual, biennial, and perennial weeds as well as many woody plants. • Apply to actively growing weeds or brush by ground in a minimum of 5 gal/A or by air in a minimum of 3 gal/A (non-woody broadleaf weeds) or 4 gal/A (woody plants) of water. • For brush control, high-volume foliar applications (50–100 gal/A), basal methods, and cut stump methods are allowed; consult herbicide label for details. • For best results treat blackberry either before first flower or after fruit drop. • Some hard-to-control woody species may require retreatment. • Apply only to grasses with well-established root systems that are tillering. • Forage grasses or small grains can be overseeded 21 days after application. • Other crops can be planted 4 months after application. • For spot treatments apply at rates equivalent to broadcast application rates. Refer to weed rate tables of the herbicide label and apply the recommended per gallon concentration above on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff. • <i>Water quality advisory.</i> 					
Permit/Sandea 75WDG	halosulfuron	established: POST	0.67–1.3 oz	0.031–0.063	no
		spot treatment	0.019 oz/gal	0.016% w/v solution	
<ul style="list-style-type: none"> • Sandea provides excellent postemergence control of yellow nutsedge and has both preemergence (3 to 4 weeks soil residual) and/or postemergence activity on several annual broadleaf weeds. • Apply by ground in a minimum of 10 gal/A water or by air in 3–15 gal/A water. • For best results, spray actively growing nutsedge plants at the 3- to 5-leaf stage and susceptible broadleaf plants that are 1 to 3 inches tall. • Heavy nutsedge infestations may require additional applications. • Wait at least 48 hours after application before irrigation. • Yukon is a premix of Sandea and dicamba. • Forage grasses, small grains, sorghum, and corn can be overseeded 2 months after application. • Legume forages can be planted 9 months after application; see label for other broadleaf crops. • Apply Sandea as a postemergence spot treatment only to those areas of emerged nutsedge. Do not exceed a rate of 0.75 oz/A (0.019 oz/gal). Apply on a spray-to-wet basis (1 gal/1,000 sq ft) to provide thorough coverage. Do not spray to the point of runoff. A second postemergence spot application at 0.75 oz/A is allowed where nutsedge has emerged or regrown. Follow the same procedures as first application. The potential for injury to desirable broadleaf and grass plants is increased with a second application. • <i>Water quality advisory.</i> 					

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
Prowl H2O/Satellite Hydrocap 3.8AS	pendimethalin	established POST (fall, winter, spring) between cuttings	1.1–4.2 qt	1-4	yes
<ul style="list-style-type: none"> • Prowl H2O will not control any weeds that have already emerged at the time of application. • Provides 1 to 2 months of residual control of most annual grass weeds and a few broadleaf weeds as they germinate (refer to label for weeds controlled). • An early April application may be required to control annual grasses such as foxtails (annual species only), jointhead arthraxon, crabgrass, and others as well as suppression of Japanese stiltgrass • Applications may be made in fall after last cutting/grazing, in winter, spring, or between cuttings (but before weed emergence). • Apply to solid (established) stands of perennial forage grasses with a minimum of 6 tillers. • Apply by ground in a minimum of 10 gal/A or by air in a minimum of 5 gal/A of water or liquid fertilizer. • Adequate rainfall or overhead irrigation is required to activate Prowl H2O. • Multiple applications are allowed, however maximum use rate of Prowl H2O is 4.2 qt/A/year with 30 days between sequential applications. • Adverse environmental conditions or weak stands of grass may cause temporarily injury. • Do not apply to mixed stands with forage legumes other than alfalfa. • Rotational restrictions are based on Prowl rate used, precipitation, and application timing; see label. • Prowl may be impregnated on dry bulk fertilizer and spread. This application method relies on herbicide activity in the soil, and thus, difficult to control perennial weeds are not as well controlled compared to spray applications. 					
Remedy Ultra 4L	triclopyr	Established-POST	0.5-4 pt	0.25–2.0 ae	yes
<ul style="list-style-type: none"> • Remedy Ultra provides postemergence control and 1 to 2 months of soil residual control of many annual, biennial, and perennial weeds as well as many woody plants. • Apply to actively growing weeds or brush by ground in a minimum of 10 gal/A or by air in a minimum of 2 gal/A (non-woody broadleaf weeds) or 4 gal/A (woody plants) of water or liquid fertilizer. • Do not use liquid fertilizer as the carrier when treating woody plants (brush). • For brush control, high-volume foliar applications (100–200 gal/A), basal methods, and cut stump methods are allowed; consult herbicide label for details. • Biennial or winter annual weeds are most susceptible while in the rosette stage. • For best results treat blackberry during or after bloom. • Some hard-to-control woody species may require retreatment. • Apply only to grasses with well-established root systems that are tillering. • Forage grasses can be overseeded 21 days after application. • Other crops can be planted the next season after application. • Vastlan is a new choline salt formulation of triclopyr that has much lower volatility and odor compared to other triclopyr formulations. It can be used in grass forage settings. • <i>Water Quality Advisory.</i> 					

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
Roundup 3S or Roundup WeatherMax 4.5S	glyphosate	Spot treatment	2.5 fl oz/gal	2% v/v solution	no
<ul style="list-style-type: none"> • Glyphosate controls emerged weeds only (no residual activity). • Make applications with hand-held equipment or wiper applicators. Avoid contact with desirable vegetation. Consult the herbicide label for specific wiper applicator recommendations. • At rates up to 2 qt/A, any portion up to the entire field may be treated. For rates above 2 qt/A, apply only to weed-infested areas of the field, and do not treat more than one-tenth of the total area at any one time. • Subsequent applications to the same areas can be made at 30-day intervals. • Refer to weed rate tables of the herbicide label for the recommended herbicide concentration. • For spot treatment, apply on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff. • There are no overseeding restrictions for spot treatment with glyphosate. 					
Sharpen 2.85SC	saflufenacil	Established-dormant Established-POST	1–2 fl oz	0.022–0.044	yes
<ul style="list-style-type: none"> • Sharpen has a relatively narrow spectrum of weed control and is primarily used for control of winter or summer annual broadleaf weeds up to 6 inches tall. It primarily controls emerged weeds but has some very short (1-2 weeks at the labeled rates) residual activity. • Apply by ground in a minimum of 5 gal/A water or 20 gal/A liquid fertilizer, or by air in a minimum of 3 gal/A water. • Make dormant applications in the fall, during the winter, or in early spring before green-up. • Make in-season applications before weeds reach the maximum size (usually 3-6 inches) listed on the weed table of the label. • Sharpen may cause transitory injury to forage grasses. • There are no replant restrictions for forage grasses, small grains, or sorghum at the 2 fl oz/A rate. • For other crops, rotation restrictions are up to 5 months at the 2 fl oz/A rate; see label. • <i>Water Quality Advisory</i> 					

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
		Established-POST	10–20 lb 0.4–0.7 oz/100	2–4	
Spike 20P	tebuthiuron	Individual plant	sq ft	2–4	n/a

- Spike 20P is a pelleted formulation for control of woody plants (trees, shrubs, etc) and vines.
- Apply by hand evenly over the area occupied by individual plants, multistem clumps, or small stands of woody vegetation.
- For multiflora rose control, apply Spike in early spring after ground thaw and before multiflora rose growth.
- Requires rainfall to move herbicide to root zone.
- Make only one application per year.
- Desirable grasses or legumes in the treated area may be injured or killed. Dormant season application is recommended to minimize herbicidal activity on forage grasses.
- For best results, do not disturb treated plants by wood cutting or removal for 2 years after application.
- Poor or erratic results are likely to occur in soils containing more than 5% organic matter or more than 30% clay, and in areas where woody plants are rooted directly in a shallow water table.
- Spike can persist in the soil for several years, and should therefore only be used on land dedicated to long-term grass forage production unless severe herbicide injury to legumes, row crops, shrubs, or trees can be tolerated in treated areas for several years. A field bioassay is required before planting sensitive crops.
- Do not apply Spike 20P in the vicinity of desirable plants. Exposure of even a small part of a plant root system to Spike may cause severe plant injury or death. Treatment setback distance from desirable plants should be one to two times the height or width of adjacent non-target vegetation, whichever is greater. Avoid applications on slopes where surface or ground water flow toward desirable vegetation.
- Do not apply more than 10 lb/A on “vulnerable sites” as described on the herbicide label under “Use Restrictions for Groundwater Protection.” Do not apply in areas where the water table is predominately shallow (5 feet or less), to interior ditch banks, or to ditches used to transport irrigation water or potable water. Do not apply within areas identified by state or local authorities as protected groundwater recharge zones.
- *Water quality advisory.*

		Established-POST	0.66–1.3 pt	0.25–0.50 ae	
		Spot treatment	0.13–0.5 fl oz/ gal	0.1%–0.4% v/v solution	no
Stinger 3S	clopyralid				

- Stinger provides postemergence control and 1 to 3 months of soil residual control of some annual, biennial, and perennial broadleaf weeds, but is primarily used for Canada thistle control.
- Apply to actively growing weeds by ground in a minimum of 10 gal/A of water. Do not apply by aircraft.
- For Canada thistle, apply in rosette stage or after thistle is at least 4 inches tall, but before the bud stage.
- Multiple treatments are allowed as long as all treatments do not exceed 1.33 pt/A during a growing season.
- Apply only to actively growing well-established grasses that are tillering and have developed secondary roots.
- The Stinger label has restrictions concerning the use and management of plant residues (hay, straw, mulch, compost) and manure that may contain herbicide residues. Follow the label recommendations carefully.
- There are no overseeding restrictions for forage grasses, small grains, or field corn.
- Most broadleaf crops can be planted 10.5–18 months after application; see label.
- Spot treatment with Stinger is primarily for Canada thistle control. Refer to weed rate table of the herbicide label and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff.
- *Water quality advisory.*

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
Surmount 1.33L (VA, WV only)	picloram + fluroxypyr		3–6 pt		
		Established-POST		0.25–0.5 +	
		Spot treatment	0.6–1.1 fl oz/ gal	0.25–0.5 0.5%–0.85% v/v solution	yes

- Surmount provides postemergence control and 2 to 3 months of soil residual control of many annual, biennial, and perennial weed species **in permanent grass pasture**. It may provide improved control of hemp dogbane, milkweed, dewberry, or sumac species over Grazon P+D.
- The distribution of Surmount may be further restricted within Virginia and West Virginia due to the picloram content of the product and sensitivity of certain broadleaf crops.
- Apply to grasses that are well established as indicated by tillering, development of secondary root system, and vigorous growth.
- Apply by ground in a minimum of 10 gal/A or by air in a minimum of 5 gal/A of water, an oil-water emulsion, or liquid fertilizer.
- High-volume foliar applications for brush control (100 gal/A) are allowed; consult herbicide label for details.
- Cool-season grasses can be seeded a minimum of 21 days after application.
- Do not rotate to any crop within 1 year following treatment other than range or pasture grasses, grasses for hay or silage, barley, oats, rye, or grain sorghum. Thereafter, other crops may be planted after an adequately sensitive field bioassay shows that the risk of crop injury is within acceptable limits.
- The Surmount label has restrictions concerning the use and management of plant residues (hay, straw, mulch, compost) and manure that may contain picloram residues. Be certain you understand and are able to follow these label restrictions before using this product.
- Spot treatment with hand-held sprayers should be applied at a rate equivalent to a broadcast application. Refer to weed rate table of the herbicide label and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff.
- Make applications at least 7 days before a killing frost.
- *Water quality advisory.*
- *Restricted-use pesticide.*

Table 5.82 - Comments on Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Common Name	Application Timing	Product/A	lb ai/A	Apply in Liquid Fertilizer as a Carrier (yes/no)
Weedmaster 3.87L	dicamba + 2,4-D	Seedling-POST	0.5–2 pt	0.06–0.25 +	yes
			1–4 pt	0.18–0.72	
		Established-POST	0.4–1.6 fl oz/ gal	0.125–0.5 +	
			Spot treatment	0.36–1.4 0.3%–1.25% v/v solution	

- For broadcast applications, apply by ground in 5–40 gal/A of water or liquid fertilizer or by air in 3–10 gal/A of water.
- For brush control, foliar and basal applications in oil and water emulsions and cut surface applications are allowed; consult herbicide label for details.
- Applications to newly seeded areas should not exceed 2 pt/A and should only be applied to actively growing unstressed grasses that have attained the 3- to 4-leaf stage and have reached a minimum height of 6 inches.
- Multiple applications are allowed on established grasses as long as all treatments do not exceed 8 pt/A during a growing season.
- Do not make applications when the temperature is expected to exceed 80°F that day, as drift is more likely to occur.
- Forage grasses and small grains can be overseeded after 10 days per pint of Weedmaster applied.
- Legumes and other broadleaf crops may be planted 4 months after application.
- Make spot applications with hand-held equipment. Refer to weed rate tables of the herbicide label and apply the recommended concentration on a spray-to-wet basis (1 gal/1,000 ft²) to provide thorough coverage. Do not spray to the point of runoff. Do not make spot treatments in addition to broadcast treatments.
- Weedmaster is effective on many woody species as a spot spray at the higher rates.
- Add a surfactant at 0.5% v/v for improved control.
- *Water quality advisory.*

Table 5.83 - Adjuvants and Rainfastness for Postemergence Herbicides Used in Grass Pasture, Hay, and CRP Grassland

Adjuvants are products included in the spray tank to improve the performance of herbicides. These include non-ionic surfactant (NIS), crop oil concentrate (COC), methylated seed oil (MSO), or nitrogen solutions. In general, NIS should contain at least 80% active ingredient, and COC should contain at least 15% emulsifier. Nitrogen solutions can be 28, 30, or 32% ammonium-based fertilizer solutions; ammonium sulfate should be spray-grade dry ammonium sulfate (21-0-0). Crop injury can occur with the use of adjuvants. Adding additional adjuvants than what is labeled can increase the chance or severity of crop injury. Following are recommended adjuvants for broadcast postemergence applications; refer to herbicide labels for adjuvant recommendations with other application types.

Rainfastness is number of hours needed between time of application and rainfall or irrigation to ensure sufficient absorption in the plant.

Trade Name	Adjuvant(s)	Rate	Apply in Liquid Fertilizer as a Carrier	Rainfastness (hours)
2,4-D amine 3.8L	none recommended ² or	1 qt/100 gal	yes	1
	nonionic surfactant ³ or	1–2 qt/A		
	crop oil concentrate ³			

Table 5.83 - Adjuvants and Rainfastness for Postemergence Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Adjuvant(s)	Rate	Apply in Liquid Fertilizer as a Carrier	Rainfastness (hours)
2,4-D ester 3.8L	none recommended ² or	1 qt/100 gal	yes	1
	nonionic surfactant ³ or crop oil concentrate ³	1–2 qt/A		
Aim 2EC	nonionic surfactant or	1 qt/100 gal	yes	not specified
	crop oil concentrate or	1 gal/100 gal		
	methylated seed oil	1 gal/100 gal		
	plus nitrogen solution or ammonium sulfate (optional)	2–4 gal/100 gal 2–4 lb/A		
Arsenal 2AS	nonionic surfactant or	1 qt/100 gal	N/A	1
	methylated seed oil	1.5–2 pt/A		
Chaparral 71.6WG ¹	crop oil concentrate or	1 gal/100 gal	yes	not specified
	methylated seed oil or	0.5-1 gal/100 gal		
	nonionic surfactant	1 qt/100 gal		
	plus nitrogen solution or ammonium sulfate (optional)	2 qt/A 2 lb/A		
Clarity 4S	nonionic surfactant or	1–2 pt/100 gal	yes	4
	crop oil concentrate	1 qt/A		
	plus nitrogen solution or	2–4 qt/A		
	ammonium sulfate (optional)	2.5 lb/A		
Crossbow 3L	none recommended		yes	not specified
DuraCor 0.73SC	methylated seed oil	1 % v/v	yes	2
	non-ionic surfactant	0.25–0.5 v/v		
Facet 1.5L	crop oil concentrate or	2 pt/A	no	6
	methylated seed oil	1–2 pt/A		
	plus nitrogen solution or	2–4 qt/A		
	ammonium sulfate (optional)	8.5 lb/100 gal		
Glyphosate preplant or spot treatment	varies by product, check label	see label	no	1-6
	ammonium sulfate (optional)	8.5–17 lb/100gal		
Gramoxone SL 2.0	nonionic surfactant or	1 qt/100 gal	yes	0.5
Gramoxone SL 3.0	crop oil concentrate	1 gal/100 gal		
GrazonNext HL 3.74E	nonionic surfactant	1–2 qt/100 gal	yes	not specified
Grazon P+D 2.54SL	nonionic surfactant ²	1 qt/100 gal	yes	not specified
GrazonPD3 3.81SL	nonionic surfactant	1 qt/100 gal	yes	not specified

Table 5.83 - Adjuvants and Rainfastness for Postemergence Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

Trade Name	Adjuvant(s)	Rate	Apply in Liquid Fertilizer as a Carrier	Rainfastness (hours)
MCPA 3.7L	none recommended		yes	not specified
Metsulfuron 60DF	nonionic surfactant or	1–2 qt/100 gal	yes	4
	nonionic surfactant (on fescue)	0.5-1 pt/100 gal		
Milestone 2L	nonionic surfactant	1–2 qt/100 gal	yes	not specified
	nonionic surfactant (on timothy)	0.5 pt/100 gal		
PastureGard HL 4L	nonionic surfactant ⁴ or	1–2 qt/100 gal	not recommended	not specified
	nitrogen solution ⁴	1–2 qt/100 gal		
Permit/Sandea 75DF	non-ionic surfactant	1–2 qt/100 gal	no	4
Prowl H2O 3.8AS	none recommended		yes	not applicable
Remedy Ultra 4L	nonionic surfactant ²	1 qt/100 gal	yes	not specified
Sharpen 2.85SC	methylated seed oil	1 gal/100 gal	yes	1
	plus ammonium sulfate (dormant only)	8.5–17 lb/100 gal		
Stinger 3S	not recommended ⁵		no	6
Surmount 1.33L	nonionic surfactant ³ or	1–2 qt/100 gal	yes	not specified
	nitrogen solution ³	1–2 qt/100 gal		
Weedmaster 3.87L	nonionic surfactant	2–4 pt/100 gal	yes	4
	plus nitrogen solution (optional)	2–4 qt/A		

¹ See fescue precautions on herbicide label for specific adjuvant recommendations.

² An adjuvant is allowed in water dilutions to provide improved wetting of the foliage, but not required.

³ An adjuvant is recommended for control of woody plants only.

⁴ An adjuvant is allowed for improved weed or woody plant control, especially when plants are drought-stressed.

⁵ The label states that the addition of adjuvants is not usually necessary and that “adding a surfactant to the spray mixture may increase effectiveness on weeds but may reduce selectivity to the crop, particularly under situations of plant stress.”

Table 5.84 - Grazing, Harvest, Haying (PHI), and Slaughter Restrictions for Herbicides Used in Grass Pasture, Hay, and CRP Grassland

A – (dash) means interval not specified on the label.

Trade Name	Type of Animal	Interval between Application and Grazing	Interval between Application and Green Harvest ¹	Interval between Application and Haying	Comments
2,4-D amine or	Lactating dairy	7 days	– ²	7 days	Remove meat animals from treated area 3 days before slaughter. 2,4-D labels vary. See specific label of product used.
2,4-D LVE	Other livestock	0	–	7 days	
Aim (carfentrazone)	All	0	0	0	Slaughter restrictions are not mentioned on label.

Table 5.84 - Grazing, Harvest, Haying (PHI), and Slaughter Restrictions for Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

A – (dash) means interval not specified on the label.

Trade Name	Type of Animal	Interval between Application and Grazing	Interval between Application and Green Harvest ¹	Interval between Application and Haying	Comments
Chaparral (aminopyralid + metsulfuron)	All	0	–	0	No slaughter restrictions.
Cimarron Plus (metsulfuron + chlorsulfuron)	All	0	0	0	Be cautious of crop rotation restrictions. See label for details.
Clarity	Lactating dairy	7 days if < 1 pt 21 days if 1-2 pt 40 days if 2-4 pt	–	37 days if < 1 pt 51 days if 1-2 pt 70 days if 2-4 pt	Remove meat animals from treated areas 30 days prior to slaughter.
	Other livestock	0	–	7	
Crossbow (2,4-D + triclopyr)	Lactating dairy	14 days (< 2 gal)	14 days	Next season (dried hay)	Remove meat animals from treated areas or dried hay 3 days prior to slaughter.
	Other livestock	0	0	7 days	
DuraCor SC (aminopyralid + floryprauxifenbenzyl)	All	0 days (allow 14 days for optimal herbicide efficacy)	18 months	14 days	Do not move hay or silage made from grass treated with DuraCor within the preceding 18 months off farm unless allowed by supplemental labeling.
Facet L (quinclorac)	All	0	–	7 days	No slaughter restrictions on the label
GrazonNext HL (aminopyralid + 2,4-D)	All	0	–	7	Do not transfer grazing animals for 3 days from treated areas to areas with Milestone sensitive-species. Do not spread manure to areas where sensitive-species are or will be grown.
Grazon P+D (picloram + 2,4-D)	Lactating dairy	7 days	–	30 days	Remove meat animals from treated area 3 days before slaughter.
	Other livestock	0	–	30 days	
GrazonPD3	Lactating dairy	7 days	–	30 days	Remove meat animals from treated area 3 days before slaughter.
	Other livestock	0	–	30 days	
Metsulfuron	All	0	0	0	Do not seed to other crops for 1 or more years. See label for restrictions.

Table 5.84 - Grazing, Harvest, Haying (PHI), and Slaughter Restrictions for Herbicides Used in Grass Pasture, Hay, and CRP Grassland (cont.)

A – (dash) means interval not specified on the label.

Trade Name	Type of Animal	Interval between Application and Grazing	Interval between Application and Green Harvest ¹	Interval between Application and Haying	Comments
Milestone (aminopyralid)	All	0	0	0	Do not transfer grazing animals for 3 days from treated areas to areas with Milestone-sensitive species. Do not spread manure to areas where sensitive-species are or will be grown.
PastureGard HL (triclopyr + fluroxypyr)	All	0	0	14 days	Remove meat animals from treated areas at least 3 days before slaughter.
Permit/Sandea (halosulfuron)	All	0	37	37	0-day preslaughter interval
Prowl H2O (pendimethalin)	All	0	0	0	Mixed stand alfalfa/cool-season forage grasses may be grazed or harvested for forage or hay 14 or more days after applying Prowl H2O.
Remedy Ultra (triclopyr)	Lactating dairy Other livestock	next season 0	next season 0	14 days	Remove meat animals from treated areas at least 3 days before slaughter.
Roundup/ glyphosate	All	Spot-7 days Renovate- 56 days	Spot-7 days Renovate- 56 days	Spot-7 days Renovate- 56 days	Use as spot treatment. Do not treat more than one-tenth of any acre. Leaves no soil residue.
Sharpen (saflufenacil)	All	0	0	28	No slaughter restrictions on the label.
Spike (tebuthiuron)	All	< 20 lb/A	–	One year	Leaves soil residue up to 2 years.
Stinger (clopyralid)	All	0	0	0	Do not use hay or straw from treated areas for compost or mulch on susceptible broadleaved crops.
Surmount (picloram + fluroxypyr)	Lactating dairy Other livestock	14 0	14 0	14 0	Remove meat animals from treated areas at least 3 days before slaughter.
Weedmaster (dicamba + 2,4-D)	Lactating Dairy Other livestock	7 0	7 7	7 7	Remove meat animals from treated areas 30 days prior to slaughter.

¹ Green harvest includes harvest for silage, green-chop, or haylage.² — = interval not specified on the label.

Table 5.85 - Herbicides labeled for preplant and postemergence uses in native warm-season grasses (NWSGs)¹

	2,4-D + dicamba	atrazine	Chapparall	Cimarron Plus	Crossbow	DuraCor	Facet L	Grazon P+D	GrazonNext HL	Outrider	Plateau	Remedu Ultra	Sharpen	Surmount
preplant														
big bluestem	X		X	X	X	X		X	X	X	X	X	X	X
eastern gamagrass	X	X	X	X	X	X		X	X			X	X	X
Indiangrass	X		X	X	X	X		X	X	X	X	X	X	X
little bluestem	X		X	X	X	X		X	X	X	X	X	X	X
switchgrass	X		X	X	X	X		X	X	X		X	X	X
plant-back restriction for labeled NWSGs	30 days	0 days	6 mo.	6 mo.	30 days	15 days	N/A	21 days ²	3 mo.	14 days	0 days	21 days	0 days	21 days
postemergence														
big bluestem	X	X	X	X	X	X	X	X	X	X	X	X	X	X
eastern gamagrass	X		X	X	X	X	X	X	X		X ³	X	X	X
Indiangrass	X	X	X	X	X	X	X	X	X	X	X	X	X	X
little bluestem	X	X	X	X	X	X	X	X	X	X	X	X	X	X
switchgrass	X	X	X	X	X	X	X	X	X	X		X	X	X
safe growth stage for NWSGs	≥ 5-leaf	≥ 1 year	≥ 5-leaf	≥ 5-leaf	≥ 5-leaf	≥ 5-leaf	≥ 1 year	≥ 5-leaf	≥ 5-leaf	≥ 5-leaf	any time	≥ 5-leaf	≥ 5-leaf	≥ 5-leaf

¹ This table is modified from a publication by Matt Booher, Integrated Conservation Agronomist at Virginia Tech.

² Label states, "after vigorous growth resumes in spring."

³ May cause suppression or thinning of the stand.

Table 5.86 - Herbicides Labeled for Summer Annual Grass Crops

Weed management in summer annual grasses begins with a clean seedbed obtained by either tillage close to planting or preplant herbicides such as glyphosate. Use fields with fewer perennial and annual grass weeds. Successful establishment begins with properly amended soils (pH and fertility) and appropriate seeding rate, depth, and equipment. When moisture is adequate, annual forage grasses emerge and grow quickly and compete well with weeds. There is often no need for additional weed control. Chemical weed control may be warranted when establishment is slow, weed populations are high, potentially toxic weeds are present, or high-quality (weed-free) hay or forage is desired. Herbicide options are limited. 2,4-D and dicamba herbicides are labeled for use in annual grass forages. However, **2,4-D and dicamba herbicides are not recommended in many areas during the hot summer months** due to potential injury to sensitive plants with physical or vapor drift. Pay particular attention to rotational crop restrictions; consult labels for crops not listed. Check labels for weeds controlled. The listed postemergence herbicides typically control only small annual broadleaf weeds, so check labels for maximum weed size or growth stage.

Herbicide	Labeled Annual Grasses	Timing ^{1/} Weed Type	Use Rate per Acre	Crop Stage	Season Maximum Rate	Grazing/ Harvest Interval	Rotation to Grasses (months)	Rotation to Small Grains (months)	Rotation to Alfalfa/ Clover (months)
2,4-D	forage sorghum, sorghum-sudan hybrid	POST/ broadleaf	0.5–2.1 pt	At least 6 leaves and 5 to 10 inches tall	2.1 pt (1 appl.)	30 days	1	After harvest	After harvest
Aim ²	teff, crabgrass	POST / broadleaf	0.5–2.0 fl oz	any	5.9 fl oz (3 appls.)	0	0	0	12/12
Aim ²	millets	POST / broadleaf	0.5–2.0 fl oz	up to jointing	2.0 fl oz	7 days	0	0	12/12
Aim ²	forage sorghum	POST / broadleaf	0.5–1.0 fl oz	up to 6 leaf	1 fl oz	after 6 leaf	0	0	12/12
Atrazine ² 4L	forage sorghum, sor-sudan hybrid	PPI, Pre, POST / broadleaf	3.2–4.0 pt (see label for details)	up to 12 inches	5 pt	PPI/Pre =60 day POST = 45 days	second year	next year to second year ²	second year
Basagran ²	forage sorghum	POST / broadleaf	1.0–2.0 pt	before heading	2 pt	12 days	0	0	0
Callisto ²	pearl millet	Pre / broadleaf	up to 6.0 fl oz	n/a	6.0 fl oz (1 appl.)	n/a	18	4	10/18
dicamba	forage sorghum, sudan-grass	POST/ broadleaf	8–32 fl oz	At least 3 leaves	64 fl oz	7 days	1	0.5-1.5 (see label)	4
Dual II Magnum ^{4,5}	forage sorghum	Pre / grass	1.0 to 1.67 pt ⁵	n/a	1 applic.	n/a	next spring	4.5	4/9
Huskie ²	forage sorghum	POST / broadleaf	12.8–16 fl oz	3-lf but prior to flag leaf or 30 inches.	32 fl oz	7/ 7	1 (9 for timothy)	1 week	4/bioassay

Table 5.86 - Herbicides Labeled for Summer Annual Grass Crops (cont.)

Herbicide	Labeled Annual Grasses	Timing ^{1/} Weed Type	Use Rate per Acre	Crop Stage	Season Maximum Rate	Grazing/ Harvest Interval	Rotation to Grasses (months)	Rotation to Small Grains (months)	Rotation to Alfalfa/ Clover (months)
Maestro 2EC (Buctril) (for 4EC formulation reduce rates by half) ⁴	forage sorghum, sudan-grass, sor-sudan hybrid	POST / broadleaf	1 pt/ 1.5 pt	3-lf but prior to pre-boot/ 4-lf but prior to pre-boot	2 pt	45 days	1	1	1
Permit/Sandea ²	pearl millet	POST / broadleaf & nutsedge	0.5–0.67 oz	2 lf but prior to head	0.67 oz	0/ 37 forage hay	2	2	9
Permit/Sandea ²	sorghum	POST / broadleaf & nutsedge	0.67–1.0 oz	2 lf but prior to head	1.0 oz	30/30	2	2	9
Yukon	sorghum, proso millet	POST/ broadleaf and nutsedge	3–6 oz	3- to 5-leaf	6 oz (1 appl.)	0/0; 30/30	2	2	9

¹ Abbreviations: appl, application; POST, postemergence; PPI, preplant incorporated, PRE, preemergence.

² Check label for adjuvant recommendations.

³ Next year if applied before June 10; second year if applied after June 10.

⁴ No adjuvant recommended.

⁵ Requires the use of Concep-treated seed.

⁶ Coarse soils 1.0 to 1.33 pt; medium soils 1.33 to 1.5 pt; fine soils 1.33 to 1.67 pt.

Table 5.87 - Optimum Time of Year for Foliar Application of Systemic Herbicides to Selected Weeds

These timings are based on adequate soil moisture and climate of the Eastern Shore area. Across the Mid-Atlantic region (north to south or east to west) these timings could vary by 1 to 3 weeks either way. Consult this table for general guidelines but herbicide labels for specific application information.

Winter annual weeds should be treated in late fall to spring. Summer annual weeds should be treated in early to late summer soon after emergence. Biennial weeds should be treated in the fall or early-spring while in the seedling or rosette stages or in the early spring prior to bolting. Herbaceous and woody perennial weeds can vary significantly by species for when best to apply herbicides. In general, apply systemic herbicides to perennials is when the source/sink movement of sugars is towards the underground structures, typically optimized when the perennial is in early bloom stage or in the fall when temperature begin to cool. Applications of these herbicides made in earlier growth stages, when movement is upward from underground structures to shoots and foliage, provides only control of top growth, with essentially no effect on the perennial structures. The addition of mechanical weed control techniques can substantially improve herbicide efficacy on perennials. Mowing or clipping the weed one or more times causes significant reductions in underground food reserves because the plant is forced to produce new top growth. When the weed reaches the early bloom stage following clipping, relatively less of the systemic herbicide is required to produce a lethal concentration in the depleted perennial structure.

	Do not apply								
	Less than optimal but potentially effective depending on your specific geography and weather								
	Optimal timing of application								
Weeds	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Winter annual weeds (chickweed, henbit, horseweed, etc.)	■	■							■
Summer annual weeds (fleabane, pigweed, ragweed, perilla mint, etc.)				■	■	■			
Spiny pigweed			■	■	■	■			
Biennial weeds (burdock, wild carrot, poison hemlock, bull thistle, spotted knapweed, etc.)	■	■							■
Musk thistle	■	■	■						■
Herbaceous Perennials									
Buttercup, ssp., plantains								■	■
Dandelion	■	■						■	■
Dock spp.	■	■							
Dogfennel			■	■	■	■			
Garlic, Wild	■	■							■
Horsenettle, Carolina					■	■	■		
Dogbane, Hemp					■	■	■	■	
Milkweed, common					■	■	■	■	
Pokeweed	■	■				■	■		
Star-of-Bethlehem	■	■							
Thistle, Canada			■	■	■	■			■
Woody Perennials									
Barberry, Japanese			■	■	■	■		■	■
Brambles (<i>Rubus</i> spp.)			■	■	■	■		■	■
Olive, Autumn			■	■	■	■		■	■
Rose, Multiflora			■	■	■	■	■		
Sumac			■	■	■	■	■		

Table 5.88 - Accurate Herbicide Volume and Weight Measurements for Small Volume Applications

Common conversion factors							
Liquid Products	Quart (qt)	Pint (pt)	Cup	Fluid Ounces (fl oz)	Tablespoon (Tbspn)	Teaspoon (tsp)	Milliliter (ml)
1 gallon	4	8	16	128	256	768	3785
1 quart	–	2	4	32	64	192	946
1 pint	–	–	2	16	32	96	473
1 cup	–	–	–	8	16	48	237
1 fl oz	–	–	–	–	2	6	29.57
1 tbsp	–	–	–	–	–	3	14.8
1 tsp	–	–	–	–	–	–	4.9
Dry Products:							
1 pound (lb) = 16 oz-wt = 453.6 grams (gr)							
1 oz wt = 28.35 grams (gr)							

Spot-spray, wiper bar, or other small-area applications often require preparation of a small volume of spray solution. Backpack sprayers usually have a 1- to 3-gallon capacity. Spray concentrations for liquid herbicide formulations can be as low as 0.05 fl oz (1.5 ml) per gallon, and concentrations for dry herbicide formulations as low as 0.01 oz wt (0.28 gr) per gallon. Inaccurate measurement of these very small concentrations can cause large deviations above or below the intended application rate, resulting in possible crop damage, carryover, or poor weed control. For example, when measuring a pint of liquid herbicide, a deviation of 0.5 ml, which is equivalent to 6 drops from a dropper, would result in a negligible increase or decrease of 0.1% from the intended rate. However, the same 6 drop deviation when measuring 1.5 ml of a liquid herbicide would result in an unacceptable rate increase or decrease of 33%.

Most liquid measuring devices intended for use with agricultural products are good for measuring large volumes (pints, quarts, gallons), but they are usually not accurate below a volume of 10 fl oz (296 ml). Two types of measuring devices are available for low volumes that are accurate and easy to use. Graduated cylinders are tall, narrow cylinders with milliliter graduations along the outside of the tube. They are available in durable polypropylene material that can be washed and reused. They are available in sizes ranging from 10 ml (0.34 fl oz) with 0.2-ml increments to 4,000 ml (1.06 gal) with 50-ml increments. Pouring liquid herbicides into small graduated cylinders from large containers can be difficult. Disposable syringes are probably the cleanest and most accurate way to measure small volumes of liquid herbicide. Although they are termed disposable, they can be easily dismantled, washed, and reused several times. Buy syringes without the needles if possible, or remove and dispose of needles before use to avoid possible injury or exposure to the herbicide through a skin puncture. A syringe is essential for measuring volumes of less than 0.17 fl oz (5 ml) and can be purchased in sizes ranging from 3 ml with 0.1-ml increments up to 60 ml with 1-ml increments. A good arrangement of measuring devices to have for medium- to small-volume measurements includes a 250-ml graduated cylinder with 2-ml graduations, and 3-ml, 10-ml, and 60-ml syringes.

For dry products, postal scales measuring to 0.1 oz wt are adequate for weights above 1 oz wt (28.4 gr). A gram scale accurate to 1/100 of a gram (0.01 gr) should be used for measuring weights of less than 1 oz wt. Converting products measured by mass (oz wt or grams) into volume (teaspoons, tablespoons, or milliliters) is not practical because of the variability in the density (weight per given volume) of individual products. If sufficiently accurate weighing devices are not available, dry products requiring low concentrations should not be used for small-volume applications.

Table 5.89 - Herbicides Labeled for Farmstead Use

This table lists several herbicides available for use in farmstead areas. Farmstead areas may include areas around buildings (storage buildings, poultry houses, greenhouses, etc.), non-grazed fencerows, non-irrigation ditch banks, unpaved lanes, or other non-cropped agricultural areas where selective weed control or bare ground is desired. Some herbicide labels allow grazing or haying of treated areas within or around these sites, others do not. Many of these herbicides are toxic to desirable plants when spray particles contact either above-ground plant parts, bare roots, and/or the soil where plant roots have penetrated. Most of these products should not be used on impervious surfaces such as paved or highly compacted areas. Runoff from treated impervious surfaces or transport of treated soils by erosion can severely injure or kill susceptible non-target plants. Do not apply these products directly to water, and exercise caution when using these products near irrigation or domestic water supplies. Many of these products are not recommended for use on highly permeable soils and/or soils with groundwater near the soil surface. Read herbicide labels carefully to determine allowed uses, environmental risks, human risks, desirable plant species tolerance, weed species susceptibility, application types, use rates, adjuvant requirements, and specific grazing or haying restrictions.

Trade Name	Components (ai or ae/gal or lb)	Soil Residual ¹ (yes/no)	Grass Control	Broadleaf Control	Woody Plant and Vine Control	Grazing Restriction (days)	Haying Restriction (days)
2,4-D (various formulations)	(varies) 2,4-D	no	no	yes	few	0–7	7
Arsenal 2AS	2 lb imazapyr	yes	yes	yes	yes	0	7
Cimarron Max CoPack	Part A (dry) 0.6 lb metsulfuron Part B (liquid) 1 lb dicamba 2.87 lb 2,4-D	yes	no	yes	several	0–7	37
Cimarron Plus 63WG	0.48 lb metsulfuron 0.15 lb chlorsulfuron	yes	no	yes	several	0	0
Crossbow 3L	2 lb 2,4-D 1 lb triclopyr	limited	no	yes	several	0–NS ²	14
dicamba	4 lb dicamba	no	no	yes	several	0–40	0–70
Escort / Metsulfuron ³ 60WG	0.6 lb metsulfuron	yes	no	yes	few	0	0
EsplAnade 200SC	1.67 lb indaziflam	yes	yes	yes	no	do not	do not
Glyphosate (various formulations)	(varies) glyphosate	no	yes	yes	several	0–56	0–56
Karmex80DF / Direx 4L	0.8 lb diuron	yes	yes	yes	no	not specified	not specified
PastureGard HL 4L	3 lb triclopyr 1 lb fluroxypyr	limited	no	yes	several	0–NS ²	14
Payload 51WG	0.51 lb flumioxazin	yes	yes	yes	no	do not	do not
Pramitol 25E	2 lb prometon	yes	yes	yes	no	not specified	not specified
Prowl3.3EC	3.3 lb pendimethalin	yes	yes	yes	no	do not	do not
Prowl H2O	3.87 lb pendimethalin	yes	yes	yes	no	see label	see label

Table 5.89 - Herbicides Labeled for Farmstead Use (cont.)

Trade Name	Components (ai or ae/gal or lb)	Soil Residual ¹ (yes/no)	Grass Control	Broadleaf Control	Woody Plant and Vine Control	Grazing Restriction (days)	Haying Restriction (days)
Sahara 70DG	0.078 lb imazapyr 0.62 lb diuron	yes	yes	yes	many	not specified	not specified
Solicam 78.6DF	0.79 lb norflurazon	yes	yes	yes	no	do not	do not
Spike 20P	0.2 lb tebuthiuron	yes	no	yes	many	0	365
Starane Ultra / Vista 2.8L	2.8 lb fluroxypyr	limited	no	yes	no	7	14
Stinger 3L	3 lb clopyralid	limited	no	yes	no	0	0
Velpar 2L or 75DF	2 lb hexazinone	yes	yes	yes	several	60–365	60–365
Weedmaster 3.87L	2.87 lb 2,4-D 1 lb dicamba	no	no	yes	several	0–7	37

¹ Herbicides listed as having limited soil residual activity may, for a short time, provide residual control or suppression of some species, and can injure or kill susceptible desirable plants through soil activity.

² NS=next season after application

³ Not on all metsulfuron labels.

Tobacco

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Soil Texture

Herbicide performance and safety are highly influenced by soil texture and organic matter content. Herbicide rates are usually higher for fine versus coarse soil textures and with increasing percentages of organic matter content. In general, high herbicide rates may be necessary for fine-textured soils with at least 1% to 2% organic matter. Use the low recommended herbicide rate when soil organic matter is less than 1%, regardless of soil texture. Soil textures are described in herbicide recommendations as:

Coarse - Sands; loamy sands; sandy loams

Medium - Sandy clay loams; loams; silt loams; silts

Fine - Clay loam; silty clay loams; clays

Soil Preparation

All weed growth and crop stubble must be thoroughly worked into the soil prior to application of most herbicides used in tobacco fields. The soil should be moist and loose with all clods broken down.

Spray Equipment

ALWAYS clean, check, and calibrate sprayers before use to ensure correct herbicide spray volume and uniform spray pattern. Apply liquid, wettable powder, and dry flowable herbicide formulations in 20 to 40 gallons of water per acre using a standard low-pressure (25 to 50 psi) boom sprayer. Poast must be applied in 5 to 20 gallons of water per acre at 40 to 60 psi using hollow-cone or flat-fan nozzles. Maintain continuous agitation, and never leave a spray mixture in the tank overnight.

Preplant Incorporated (PPI)

Apply herbicides in an even broadcast application before planting. **Avoid spray overlap.** Use boom sprayer equipped with fan-type (8004, etc.), flood-jet (TK4, etc.), or raindrop nozzles. Incorporate herbicide immediately after application (see label) with the following:

1. **Disc** (Combination, tandem, double-disc, disk harrow, or similar equipment) - Set to cut 4 to 6 inches deep and operate in two different directions (at right angles to each other) at 4 to 6 mph. A disc set to cut 4 to 6 inches will incorporate herbicide in the top 1 to 2 inches of soil.

Precautions - Avoid use of a large field disc. Discs should be set no more than 8 inches apart and be no wider than 24 inches in diameter. **A single cultivation does not adequately incorporate herbicides, and may increase crop injury and decrease weed control.** Incorporation with implements set to cut less than 2 inches deep may result in erratic weed control. Using incorporation equipment and tractor speeds not listed on the label may result in poor or erratic weed control and/or crop injury.

2. **PTO-driven equipment** (tillers, cultivators, hoes) - Set to cut 3 to 4 inches deep and operate one time at 4 mph. This type of equipment performs best on coarse soil types. PTO-driven equipment should not be operated at a speed greater than 4 mph.
3. Other equipment can be used, but proper procedures should be followed. Read labels or manufacturer's directions.

Overtop after Transplanting

Herbicides labeled for this use can be sprayed, either in a band or broadcast, onto freshly prepared soil within 7 days of transplanting. Cultivation is required, immediately before or at time of application, if the application is made more than 2 days after transplanting or if significant rain has fallen since transplanting.

1. **Band application** - Apply herbicide in a 14- to 24-inch band over the row using fan-type, even-spray nozzles (8004E, etc.). Refer to label and product information on this type of application. The amount of herbicide required per crop acre is

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reduced with band application and can be determined by the following formula: **Banded product rate/acre = Band width (inches)/Row spacing (inches) x Broadcast product rate.**

- Broadcast** - Apply herbicide in an even broadcast application with a sprayer equipped with fan-type nozzles (8004, etc.).

Layby

Labeled herbicides can be applied as a directed spray to weed-free row middles immediately after the last normal cultivation. Application should be made using commercially available drop nozzles equipped with flood-jet flat (TK2, TK4, etc.) or even flat-fan (8004E, etc.) nozzles in order to spray a 16- to 30-inch band between rows. In fields where the spray boom passes over the same row-middle twice, use nozzles which apply one-half the normal number of gallons per acre to prevent over-application. Use the following formula to determine the amount of product to use with band application: **Product/acre for band treatment = Band width (inches)/Row spacing (inches) x Broadcast rate of product/A.** One-half inch of water is usually necessary within 7 to 10 days after application for herbicide activation.

No-till

Aim (carfentrazone) or Spartan Charge (sulfentrazone + carfentrazone) may be used as a pretransplant burndown treatment. Command 3ME and Devrinol DF may be applied at transplanting. Irrigation or rainfall may be needed to wash Devrinol off mulch and onto the soil surface.

Weeds

A herbicide should be selected based on the most important weeds in each field. The majority of the herbicides used in tobacco will control grasses and a limited number of broadleaf weeds. Herbicide applications to heavier soils may be somewhat less effective than in sandier or "lighter" soils. These differences are indicated in Tables 5.90 and 5.91 below.

Relative Effectiveness of Herbicides for Tobacco

Table 5.90 - Grasses and Nutsedge¹

	Barnyardgrass	Bermudagrass	Broadleaf Signalgrass	Crabgrass	Crowfoot grass	Fall Panicum	Foxtails	Goosegrass	Johnsongrass (seedling)	Johnsongrass (rhizome)	Nutsedge	Texas Panicum
Aim	N	N	N	N	N	N	N	N	N	-	N	N
Command & generics	E	P-F	G-E	G-E	E	G-E	G-E	E	F-G	P	P	G
Devrinol	G	P	G	G-E	E	G	G-E	E	F	P	N-P	-
Poast	G-E	G	E	G	F	G-E	G-E	G	G-E	F	N	E
Prowl & generics	G	P	G	G-E	E	G	G-E	E	G	P	N-P	G
Spartan & generics	F	P	F	F	F	F	F	F	P	P	G-E	F

¹E = 90 to 100% control; G = 75 to 90%; F = 50 to 75%; P = Less than 50%; N = no control. This table gives general ratings of relative herbicidal activity. Activity varies with weather conditions, soil type, and application method. Under non-optimal conditions, activity may be less than indicated.

Table 5.91 - Broadleaf Weeds¹

	Black Nightshade	Carpetweed	Cocklebur	Galinsoga	Jimsonweed	Lambsquarters	Morningglory	Pigweed	Purslane	Prickly sida	Ragweed, Common	Ragweed, Giant	Sicklepod	Smartweed	Velvetleaf
Aim	–	–	G	P	G	G	E	E	G	P	N	N	P	G	–
Command & generics	P	P	F	F-G	F-G	G	P	P	F-G	G-E	F-G	P-F	P	G	G
Devrinol	P	G	N-P	P-F	N-P	F-G	N-P	F-G	G-E	P	F	N-F	P	P	P
Poast	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Prowl & generics	N	G	N-P	P	N-P	G	P	G	G	P	P	N-P	P	P	F
Spartan & generics	G	G	F-G	F-G	G	G-E	G-E	G-E	G	G	P	P	P	G	F

¹E = 90 to 100% control; G = 75 to 90%; F = 50 to 75%; P = Less than 50%; N = no control. This table gives general ratings of relative herbicidal activity. Activity varies with weather conditions, soil type, and application method. Under non-optimal conditions, activity may be less than indicated.

Effect of PPI Applications on Early-season Growth of Tobacco

Preplant herbicides may delay plant growth during the first month after transplanting, but under favorable growing conditions any delay should be minimal and should not effect yield. Herbicide application factors that can enhance root injury include: 1) improper incorporation; 2) incorrect rates for soil texture; 3) poor spray technique or equipment. Applying tobacco herbicides at transplanting and/or after the last cultivation will eliminate possible delays in plant growth from herbicide residues already present in soil prior to transplanting.

Effect of Herbicide on Small Grain Crops

Residues of some tobacco herbicides (Command and Devrinol applied PPI) may affect the growth of small grain crops following tobacco (as indicated on product labels). If the small grain is grown only as a cover crop, the problem may not be serious. The potential for carry-over can be reduced by: 1) using minimum labeled rates of the chemicals; 2) band applications of labeled products at transplanting and/or at layby; 3) early stalk and root destruction; 4) deep plowing before seeding of small grain.

Table 5.92 - Field-grown Tobacco

Weed problem	Soil ¹ Texture	Chemical; lbs Active Ingredient/A	Product; Rate/A	Application ² Method	Remarks
Pigweed, lambsquarters, nightshade, purslane, smartweed, velvetleaf, spurred anoda, carpetweed, cocklebur, cotton, groundcherry, morningglory, common ragweed		carfentrazone	Aim	Burndown, shielded, directed	<u>HRAC Group E</u> . Use a Crop Oil Concentrate (1% v/v). <i>Spray solution will cause extensive burn to broadleaf plants (and tobacco leaves) on contact</i> . Pre-transplant interval = 1 day; pre- harvest interval = 6 days. For directed sprays to flue-cured tobacco (only), direct nozzles toward the base of tobacco plants, at least 3 to 4 inches above the soil, to spray <i>beneath</i> the plant canopy. Read precautionary statements.
		0.012-0.024	0.5-1.0 oz		
			Aim EC or Aim EW		
		0.013-0.023	0.8-1.5 fl oz.		
Barnyardgrass, broadleaf signalgrass, crabgrass, field sandbur (suppression), foxtails, seedling johnsongrass, lambsquarters, fall panicum, velvetleaf, jimsonweed, prickly sida, purslane, spurred anoda, venice mallow, common ragweed, smartweed, cocklebur (suppression), shattercane	Coarse Fine	clomazone	Command 3ME	PPI, OT	<u>HRAC Group F4</u> . Use the higher rate for heavy weed pressure or heavy soils. Best results are obtained when the product is incorporated no more than 1 inch deep. Transplants should be planted so that roots are below the treated area. OT applications must be made within 7 days of transplanting. Read precautionary statements.
		0.75	2.0 pt		
		1.0	2.7 pt		
			Willowood Clomazone 3ME Caravel		
Barnyardgrass, carpetweed, crabgrass, fall panicum, foxtails, goosegrass, johnsongrass from seed, lambsquarters, pigweed, common purslane, ragweed (suppression), rye- grass. Check label for uncommon weeds.	Coarse Medium Fine	napropamide	Devrinol 2EC or Devrinol 2-XT	PPI only	<u>HRAC Group K3</u> . Incorporate the same day as applied. Small grain injury may result from PPI application. Use high rate for burley in southwest Virginia. Read precautionary statements.
		1.0	2.0 qt		
		1.0-1.5	2.0-3.0 qt		
		2.0	4.0 qt		
				Devrinol 50DF or Devrinol DF-XT	PPI, OT, Layby
	Coarse Medium Fine	1.0 1.0-1.5 2.0	2.0 lb 2.0-3.0 lb 4.0 lb		

Table 5.92 - Field-grown Tobacco (cont.)

Weed problem	Soil ¹ Texture	Chemical; lbs Active Ingredient/A	Product; Rate/A	Application ² Method	Remarks	
Grass weeds and Volunteer small grain	All types	sethoxydim	Poast	post-emergence	HRAC Group A. Apply to actively growing grasses at 40-60 psi in 5-20 gal/A through hollow cone or flat-fan nozzles. May be banded or applied broadcast. Do not apply more than 4 pt/A/season. Read precautionary statements.	
	Single use:	0.28	1.5 pt + 2.0 pt oil concentrate			
	Sequential use:	0.19	1.0 pt + 2.0 pt oil concentrate			
Annual spurge, barnyardgrass, carpetweed, crabgrass, crowfootgrass, Florida pusley, foxtails, goosegrass, johnsongrass from seed, lambsquarters, panicums, pigweed, purslane, signalgrass. Check label for uncommon weeds.		pendimethalin	Prowl 3.3EC		HRAC Group K1. Use on transplanted tobacco. Apply up to 60 days prior to transplanting; incorporate within 7 days after application. Use highest rate of Acumen specified for each soil type. May also be applied in a band in row middles at layby. Read precautionary statements.	
	Coarse	0.74-0.99	1.8-2.4 pt	PPI only		
	Medium	0.74-1.24	1.8-3.0 pt			
	Fine	0.99-1.24	2.4-3.0 pt			
	Coarse	0.50-0.74	1.2-1.8 pt	Layby only		
	Medium	0.74-0.99	1.8-2.4 pt			
	Fine	0.74-0.99	1.8-2.4 pt			
			Acumen Satellite 3.3			
	Coarse		2.4 pt	PPI only		
	Medium		2.4 pt			
	Fine		3.0 pt			
	Coarse		1.8 pt	Layby only		
	Medium		2.4 pt			
	Fine		2.4 pt			
			Prowl H ₂ O Satellite HydroCap			
Coarse	0.95	2.0 pt	PPI only			
Medium	0.95-1.19	2.0-2.5 pt				
Fine	1.19	2.5 pt				
Coarse	0.71	1.5 pt	Layby			
Medium	0.95	2.0 pt				
Fine	0.95	2.0 pt				

Table 5.92 - Field-grown Tobacco (cont.)

Weed problem	Soil ¹ Texture	Chemical; lbs Active Ingredient/A	Product; Rate/A	Application ² Method	Remarks			
Hairy galinsoga, goosegrass, groundcherry, jimsonweed, lambsquarters, morning-glory (except pitted), wild mustard, nightshade, nutsedge, orchardgrass, fall panicum, pigweed, prickly sida, broadleaf signalgrass, Pennsylvania smartweed. Suppresses: most grasses, foxtail, cocklebur, sparges. Check label for uncommon weeds.	<u>Coarse</u> <1.5%OM 1.5-3%OM >3%OM	0.14-0.19	4.5-6.0 fl.oz.	After bedding, before transplanting	HRAC Group 14. Apply to soil surface after field has been prepared for planting. Apply within 14 days of transplanting. Where raised beds are used, apply after beds are knocked down for planting. If soil must be worked after application, do not disturb soil below a 2 inch depth. Do not apply at or after transplanting. Maximum rates for Shutdown are 11.8 fl.oz./A for all soil textures. Read precautionary statements.			
		0.19-0.25	6.0-8.0 fl.oz.					
		0.25-0.32	8.0-10.1 fl.oz.					
	<u>Medium</u> <1.5%OM 1.5-3%OM >3%OM	0.19-0.25	6.0-8.0 fl.oz.					
		0.25-0.32	8.0-10.1 fl.oz.					
		0.32-0.38	10.1-12.0 fl.oz.					
	<u>Fine</u> <1.5%OM 1.5-3%OM >3%OM	0.25	8.0 fl.oz.					
		0.32	10.1 fl.oz.					
		0.38	12.0 fl.oz.					
	Pre-Emergent: Same as Spartan 4F. Check label for uncommon weeds, as well as weed control spectrum for Post-Emergent, Pre- Plant Burndown applications.	<u>Coarse</u> <1.5%OM 1.5-3%OM >3%OM	0.14-0.19 + 0.016-0.021			5.6-7.6 fl.oz.	Burndown, preplant surface application, PPI	HRAC Group 14. May be surface applied or preplant incorporated (less than 2 inches) from 14 days to 12 hours before transplanting. Beds must be knocked down before applying the product. If not incorporated, timely cultivation after transplanting is required for acceptable weed control. Tobacco may be re-planted in treated soil, but do not retreat or re-bed field. Read precautionary statements.
			0.19-0.25 + 0.021-0.028			7.6-10.2 fl.oz.		
			0.25-0.32 + 0.028-0.035			10.2-12.8 fl.oz.		
<u>Medium</u> <1.5%OM 1.5-3%OM >3%OM		0.19-0.25 + 0.021-0.028	7.6-10.2 fl.oz.					
		0.25-0.32 + 0.028-0.035	10.2-12.8 fl.oz.					
		0.32-0.38 + 0.035-0.042	12.8-15.2 fl.oz.					
<u>Fine</u> <1.5%OM 1.5-3%OM >3%OM		0.25 + 0.028	10.2 fl.oz.					
		0.32 + 0.035	12.8 fl.oz.					
		0.38 + 0.042	15.2 fl.oz.					

¹ When the soil type has less than 1% organic matter, use the rate for the coarse soil texture recommendations. **Coarse** - Sands; loamy sands; sandy loams. **Medium** - Sandy clay loams; loams; silt loams. **Fine** - Clay loam, silty clay loam; clays.

² PPI - Preplant incorporated. Delay in growth may result under adverse weather conditions and/or when poor application practices have been used. OT - Overtop after transplanting as a band or broadcast applications. Layby - Application of herbicide to row-middle after last cultivation. Burndown, shielded, directed – broadcast spray before transplanting (burndown), or shielded/hooded spray to row-middles only (shielded), or spray directed toward row-middles and surface of row beds after sequential harvesting of flue-cured tobacco has removed sufficient leaves that the spray will not contact remaining crop leaves (directed).

Precautionary and Restriction Statements

Read all directions, cautions, precautions, and special precautions on each product label.

Aim EC, EW (carfentrazone)

As a contact burndown herbicide for broadleaf weeds, Aim may be applied (1) to kill cover crops prior to no-till transplanting, (2) as a shielded or hooded spray to row middles before layby, or (3) as a directed spray following first harvest of flue-cured tobacco. Spray solution will cause extensive burn to broadleaf plants (and tobacco leaves) on contact. Don't spray when conditions favor drift, such as wind above 10 mph. Don't apply more than 2 oz of Aim or 3 fl oz. of Aim EC or EW per acre per season.

Command 3ME and Caravel (clomazone)

Apply only as specified on the label. Command and Caravel may be tank-mixed with other EPA-registered tobacco herbicides and can be impregnated on dry bulk fertilizer. Bottom leaves of tobacco plants in treated soil may whiten or yellow temporarily, but the crop should grow out of this with no adverse effect on yield or quality. Avoid spraying Command or Caravel within 300 feet of susceptible and desirable plant species, as spray drift can cause foliar whitening or yellowing of some plants. Do not apply Command or Caravel within 1,200 feet of residences, towns, subdivisions, or commercial vegetable or fruit nurseries or greenhouses. Small grains should not be planted in the fall or following spring after product use.

Devrinol 50DF, DF-XT, 2EC, 2-XT (napropamide)

Do not apply more than a total of 2 lb of active ingredient per acre in any one season. After harvest or prior to planting succeeding crops, a deep moldboard or disk plowing operation must be carried out. Do not seed to alfalfa, small grain, sorghum, or corn for 12 months after applying a napropamide herbicide. Injury to rotational crops is lessened by band versus broadcast application. When Devrinol is applied after transplanting or at layby, rainfall or overhead irrigation following application improves weed control.

Poast (sethoxydim)

When mixing Poast, fill sprayer 1/2-2/3 full of water. Add oil concentrate (preferably highly refined vegetable oil) first, with agitation. Add Poast last with remaining volume of water, also with agitation. Agitation must be maintained during application. Do not apply Poast (1) at rates above 1.5 pt/A in the field; (2) to exceed 4 pt/A/season; (3) when grasses are under stress; (4) if rainfall is expected within 1 hour; (5) with any other pesticide, additive, or fertilizer except as specified on the Poast label; (6) through any type of irrigation system; (7) within 42 days of harvest.

Prowl 3.3EC, Satellite 3.3, Prowl H₂O, Satellite HydroCap and Acumen (pendimethalin)

Applied according to directions and under normal growing conditions, pendimethalin should not harm transplanted tobacco, but can temporarily retard growth under stressful conditions (cold/wet or hot/dry weather). *Layby applications should be made as a directed spray in a 16- to 24-inch band centered between rows. Broadcast rates for layby applications must be adjusted based on the width of the intended spray band and soil texture.* Any spray contacting tobacco leaves may cause deformations. Crop injury may result if winter wheat and winter barley are planted in the fall (after a spring application) when no-till planting procedures are used. Do not feed forage or graze livestock for 75 days after planting wheat or barley in treated land.

Spartan 4F, Blanket 4F, Shutdown, and Sulfentrazone 4SC (sulfentrazone)

Do not use in tobacco greenhouses, impregnate on fertilizer, or apply after transplanting. Do not apply to soils classified as sands that contain less than 1 percent organic matter or shallow groundwater. Don't incorporate more than 2 inches deep or perform tillage operations that may concentrate the product in the bed. *Most tobacco fields in Virginia contain coarse to medium-textured soils. The 8 to 10 fl.oz. rates are appropriate for these conditions. Crop injury can occur when incorporation is poor, transplants are set too shallow, or heavy rain falls near transplanting.* Splashing of treated soil onto young tobacco can cause localized burning. Don't apply sulfentrazone herbicides more than once per site per season. See label for rotational crop restrictions.

Spartan Charge (sulfentrazone + carfentrazone)

Do not use in tobacco greenhouses. May be tank-mixed with liquid fertilizer, but perform a jar test before mixing to ensure compatibility. See label for instructions. Do not apply to soils classified as sands that possess less than 1 percent organic matter. Broadcast applications require at least 10 gallons of water per acre. Don't incorporate more than 2 inches deep or perform tillage operations that may concentrate the product in the bed. *Most tobacco fields in Virginia contain coarse to medium-textured soils. The 5.7 to 12.8 fl.oz. rates are appropriate for these conditions. Crop injury can occur when incorporation is poor, transplants are set too shallow, or heavy rain falls near transplanting.* Splashing of treated soil onto young tobacco can cause localized burning. Don't apply Spartan Charge more than once per site per season. See label for rotational crop restrictions. The following table presents rates of Spartan Charge with rates equivalent to those in Spartan 4F:

SPARTAN CHARGE CONVERSION TABLE	
Rate of Spartan Charge	Rate of Spartan 4F
5.7 fl oz/acre	4.5 fl oz/acre
7.6 fl oz/acre	6.0 fl oz/acre
10.2 fl oz/acre	8.0 fl oz/acre
12.8 fl oz/acre	10.1 fl oz/acre
15.2 fl oz/acre	12.0 fl oz/acre

Do not seed small grains within 4 months of application, or plant cotton within 18 months or canola within 24 months. See label for other crop rotational restrictions.

Weed Control in Peanuts

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Effective weed management is essential for profitable peanut production. Peanuts are not very competitive with weeds and thus require higher levels of weed control than most other agronomic crops to avoid yield losses. Weeds may also decrease digging efficiency, so effective late-season weed control can minimize losses during harvest. A weed management program in peanuts consists of good weed control in rotational crops; cultivation, if needed; establishment of a satisfactory stand and growing a competitive crop; and proper selection and use of herbicides. Finally, weeds interfere with fungicide movement into the peanut canopy, often referred to as deposition, and this can negatively affect disease control.

1. *Crop rotation.* Rotate peanuts with corn, cotton, or grain sorghum to help manage various pests, including weeds. Crop rotation allows the use of different herbicides on the same field in different years. Crop and herbicide rotation, along with good weed control in the rotational crops, helps prevent the buildup of problem weeds and helps keep the overall weed population at lower levels. Crop rotation will also help reduce the chance of developing populations of weeds that are resistant to herbicides.
2. *Cultivation.* Cultivation can supplement chemical weed control. However, cultivation can damage the crop and reduce yield if not done properly. Moving soil onto the lower branches and around the base of the plants causes physical damage and enhances development of stem and pod diseases. Deep cultivation also destroys residual herbicide barriers and brings up additional weed seeds. Cultivate when peanuts are small. Set sweeps to run flat and shallow to avoid throwing soil onto the peanut plants. Generally, in-season cultivation of peanuts is not recommended.
3. *Weed identification and scouting.* All fields, regardless of the crop being grown, should be surveyed for weeds between mid-August and the first killing frost. Record the weed species present and note the general level of infestation of each species (light, moderate, or heavy). Weeds present in the fall will be the ones most likely to be problems the following year. Knowing what problems to expect allows you to better plan a weed management program for the following crop. Scout peanut fields weekly from planting through mid-July to determine if or when postemergence herbicide treatment is needed. Proper weed identification is necessary because species respond differently to various herbicides. Contact your county Extension center for aid in weed identification. Timely application of postemergence herbicides is critical for effective control. Cultivation may be more appropriate if herbicide-resistant biotypes increase in prevalence.

Comments of Peanut Herbicides

Preplant Burndown Herbicides

Glyphosate (various formulations) and Gramoxone SL (other formulations are available) are relatively nonselective herbicides that control many of the winter weeds present in reduced tillage fields (Table 5.93). Harmony Extra and 2,4-D (various formulations) can also be applied. Harmony Extra can be applied no closer to planting than 45 days before planting. 2,4-D should be applied at least 30 days before planting.

Preplant Incorporated, Preemergence, and Postemergence Herbicides

Numerous herbicides are labeled for use in peanuts (Tables 5.93, 5.94, 5.95). Timely application of the appropriate herbicide at the correct rate is essential for successful weed control in peanuts. Additional information on feeding restrictions of peanut hay (Table 5.96), suggested rain-free period to maintain control (Table 5.97), and rotation restrictions on herbicide use (Table 5.98) are provided.

Reduced Rates of Herbicides

When crop prices are low, producers are looking for ways to reduce production costs. One possibility is to reduce the application rate of herbicides. Under certain environmental conditions and with certain weed species or weed complexes, specific herbicides can be applied below the manufacturer's suggested use rate without sacrificing weed control. However, growers are cautioned that herbicides applied at reduced rates often do not control weeds adequately when environmental conditions (soil moisture in particular) do not favor herbicide activity. Applying herbicides at reduced rates to large weeds or weeds that are "hardened" often results in poor control as well. Weeds can also be more difficult to control if they were injured by herbicide

with previous treatment. Using reduced rates will require that growers apply herbicides in a timelier manner and when weeds are not stressed. Regardless of the previously mentioned factors relative to reduced rates, manufacturers of herbicides will not back up their products when they are applied below the suggested use rate. Liability falls exclusively to the grower.

Compatibility of Agrochemicals

Compatibility is an important consideration when applying two or more products in the same tank. See chapter 9 for more information on agrochemical compatibility. Consult product labels, chapter 8, and your county Extension agent for more information on agricultural chemical compatibility.

Table 5.93 - Chemical Weed Control in Peanuts

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preplant Incorporated, Annual grasses and small-seeded broadleaf weeds		
alachlor, MOA 15 (Intro 4 EC)	2 to 3 (2 to 3 qt)	Incorporate no deeper than 2 inches; see label for specific instructions. Unless shallowly incorporated, Intro is more consistently effective when applied preemergence. Weak on Texas panicum. Do not apply more than 3 qt of Intro per acre per season. Before using Intro, check with buyers to determine if there are marketing restrictions on Intro-treated peanuts.
acetochlor, MOA 15 (Warrant 3 ME)	0.94 to 1.5 (1.25 to 2 qt)	Apply and incorporate in top 2 inches of soil. Do not apply more than 4 qt of Warrant per acre per year.
ethalfuralin, MOA 3 (Sonalan 3 EC)	0.56 to 0.75 (1.5 to 2 pt)	Controls common annual grasses including Texas panicum. Use 3 pt Prowl or 2 pt ethalfuralin for control of broadleaf signalgrass, Texas panicum, and fall panicum. Incorporate 3 inches deep for Texas panicum; otherwise, incorporate 2 to 3 inches deep. See labels for maximum waiting period between application and incorporation. Immediate incorporation is best. Dual Magnum, Outlook, or Warrant may be tank mixed with Prowl or Sonalanto suppress yellow nutsedge.
pendimethalin, MOA 3 (Prowl H2O 3.8 EC) (Prowl 3.3 EC)	0.71 to 1.43 (1.5 to 3 pt) (1.7 to 3.5 pt)	
Preplant Incorporated, Annual grasses, small-seeded broadleaf weeds, and nutsedge		
dimethenamid, MOA 15 (Outlook 6.0 L)	0.75 to 1 (16 to 21 fl oz)	Apply and incorporate in top 2 inches of soil within 14 days of planting. Use high rate of Dual Magnum, Dual, or Outlook for yellow nutsedge and broadleaf signalgrass. Not effective on purple nutsedge. Weak on Texas panicum. May be tank mixed with Prowl or Sonalan.
metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC)	0.95 to 1.27 (1 to 1.33 pt) (1.5 to 2 pt)	

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preplant Incorporated, Broadleaf weeds and suppression of nutsedge		
diclosulam, MOA 2 (Strongarm 84 WDG)	0.024 (0.45 oz)	Effective on common cocklebur, morningglory, common ragweed, eclipta, and common lambsquarters. Suppresses yellow and purple nutsedge. Does not control sicklepod. More effective when applied in combination with Dual, Outlook, Warrant, Prowl, or Sonalan. See label for rotation restrictions, especially corn and grain sorghum. Growers are cautioned that Strongarm can occasionally injure cotton the following year on soils with a shallow hardpan (less than 10 inches) and/or loam soils. Cotton grown under early season stress resulting from conditions such as excessively cool, wet, dry, or crusted soils may be particularly susceptible to carryover of Strongarm. The rotation interval between applying Strongarm to peanut and then planting cotton is 18 months in Camden, Currituck, Pasquotank, and Perquimans counties. Some weed species have developed resistance to Strongarm including common ragweed and Palmer amaranth.
Preplant Incorporated, Annual grasses, broadleaf weeds, and suppression of nutsedge		
diclosulam, MOA 2 Strongarm	0.024 (0.45 oz)	Effective on annual grasses, common cocklebur, common ragweed, eclipta, morningglory, and common lambsquarters. Suppresses purple and yellow nutsedge. Does not control sicklepod. See Strongarm label for rotation restrictions.
+	+	
pendimethalin, MOA 3 (Prowl H2O 3.8 EC) (Prowl 3.3 EC)	0.71 to 1.43 (1.5 to 3 pt) (1.7 to 3.5 pt)	
or	or	
ethalfluralin, MOA 3 (Sonalan 3 EC)	0.56 to 0.75 (1.5 to 2 pt)	
or	or	
metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC)	0.95 to 1.27 (1 to 1.33 pt) (1.5 to 2 pt)	
or	or	
dimethenamid (Outlook 6.0 L)	0.75 to 1 (16 to 21 fl oz)	
or	or	
acetochlor (Warrant 3 ME)	0.95 to 1.5 (1.24 to 2 qt)	

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
PPI followed by PRE, Annual grasses, broadleaf weeds, and suppression of nutsedge		
pendimethalin, MOA 3 (Prowl H2O 3.8 EC) (Prowl 3.3 EC)	0.71 to 1.43 (1.5 to 3 pt) (1.7 to 3.5 pt)	Controls most broadleaf weeds. Will not control sicklepod and is marginal on certain large-seeded broadleaf weeds. Do not incorporate Valor SX. Valor SX should be applied to the soil surface immediately after planting. Significant injury can occur if flumioxazin is incorporated or applied 3 or more days after planting. Significant injury from Valor SX has been noted in some years even when applied according to label recommendations. However, injury is generally transient and does not affect yield. See previous comments about cotton response to Strongarm applied the previous year on some soils. Up to 3 oz per acre of Valor SX can be applied to peanut but injury potential increases. See product label for sprayer cleanup before other uses.
or	or	
ethalfluralin, MOA 3 (Sonalan 3 EC)	0.56 to 0.75 (1.5 to 2 pt)	
or	or	
metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC)	0.95 to 1.27 (1 to 1.33 pt) (1.5 to 2 pt)	
or	or	
dimethenamid, MOA 15 (Outlook 6.0L)	0.75 to 1 (16 to 21 oz)	
or	or	
acetochlor, MOA 15 (Warrant 3 ME)	0.95 to 1.5 (1.24 to 2 qt)	
followed by		
diclosulam, MOA 2 (Strongarm 84 WDG)	0.024 0.45 oz	
or	or	
flumioxazin, MOA 14 (Valor SX 51 WDG)	0.063 (2 oz)	
Split application (PPI + POST), Most broadleaf weeds and nutsedge		
imazethapyr, MOA 2 (Pursuit 2 AS)	0.031 + 0.031 (2 + 2 oz)	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control eclipta, lambsquarters, ragweed, or croton. Pursuit will usually control seedling johnsongrass and foxtails. For control of other annual grasses, Pursuit may be tank mixed with Dual Magnum, Dual, Outlook, Prowl H2O, Prowl, or Sonalan and incorporated. See label for incorporation directions and rotational restrictions. Some weed species have developed resistance to Pursuit. Research in N.C. has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preemergence, Annual grasses and small-seeded broadleaf weeds		
alachlor, MOA 15 (Intro 4 EC)	2 to 3 (2 to 3 qt)	Apply as soon after planting as possible. All herbicides are weak on Texas panicum. Before using Intro, check with buyers to determine if there are marketing restrictions on Intro-treated peanuts.
dimethenamid, MOA 15 (Outlook 6.0 L)	0.75 to 1 (16 to 21 fl oz)	
metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC)	0.95 to 1.27 (1 to 1.33 pt) (1.5 to 2 pt)	
acetochlor (Warrant 3 ME)	0.95 to 1.5 (1.25 to 2 qt)	An alternative MOA for the control of Palmer amaranth and other small seeded broadleaf and grass weeds. Brake will cause temporary peanut injury in the form of bleaching. Plant peanut at least 1.5" deep. Apply prior to planting (up to 14 days) or preemergence within 36 hours after planting. Brake needs at least 0.5" of moisture for activation as soon as possible.
fluridone, MOA 12 (Brake 1.2 SL)	0.1125-0.15 (12-16 oz)	
Preemergence, Broadleaf weeds		
flumioxazin, MOA 14 (Valor SX 51 WDG)	0.063 (2 oz)	Apply within 2 days after planting. Significant injury can occur if Valor SX is incorporated or applied 3 or more days after seeding. Controls carpetweed, common lambsquarters, Florida pusley, nightshade, pigweeds, prickly sida, and spotted spurge. Does not control sicklepod, yellow and purple nutsedge, or annual grasses. Morningglory control is marginal where Valor SX is applied at 2 oz per acre. Significant injury from Valor SX has been noted in some years even when applied according to label recommendations. However, injury is generally transient and does not affect yield. Injury may occur if excessive and forceful rainfall occurs when peanut is emerging. Peanut recovers from injury by midseason in most instances. Up to 3 oz per acre of Valor SX can be applied to peanut, but injury potential increases. See product label for comments on sprayer cleanup before other uses.

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preemergence, Annual grasses, broadleaf weeds, and suppression of nutsedge		
flumioxazin, MOA 14 (Valor SX 51 WDG)	0.063 (2 oz)	Apply within 2 days after planting. Significant injury can occur if applied 3 or more days after planting. The combination of Valor SX and Dual, Dual Magnum, Warrant, or Outlook does not control sicklepod but will control annual grasses (except Texas panicum) and will suppress yellow nutsedge. Valor SX and Warrant will not suppress yellow nutsedge. Significant injury from Valor SX has been noted in some years even when applied according to label recommendations. However, injury is generally transient and does not affect yield. Injury may occur if excessive and forceful rainfall occurs when peanut is emerging. Peanut recovers from injury by midseason in most instances. Up to 3 oz per acre of Valor SX can be applied to peanut but injury potential increases. See product label for comments on sprayer cleanup before other uses.
+	+	
metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC)	0.95 to 1.27 (1 to 1.33 pt) 1.5 to 2 pt)	
or	or	
dimethenamid, MOA 15 (Outlook 6.0L)	0.75 to 1 (16 to 21 fl oz)	
or	or	
acetochlor, MOA 15 (Warrant 3 ME)	0.94 to 1.5 (1.25 to 2 qt)	
diclosulam, MOA 2 (Strongarm 84 WDG)	0.024 (0.45 oz)	Effective on common cocklebur, morningglory, common ragweed, eclipta, and common lambsquarters. Suppresses yellow and purple nutsedge. Does not control sicklepod. More effective when applied in combination with Dual, Dual Magnum, Outlook, Prowl, Sonalan, or Warrant. See label for rotation restrictions, especially corn and grain sorghum. See previous comments on possible cotton injury from Strongarm applied the previous year on some soils.
sulfentrazone, MOA 14	0.07 to 0.12	Do not apply Spartan Charge after peanuts crack soil. Application immediately after planting is advised. See label for specific rates based on soil texture and organic matter content. See product label for comments on application with other herbicides. Rotation restriction for planting cotton following Spartan Charge at recommended rates for peanut is 12 months.
+		
carfentrazone, MOA 14 (Spartan Charge (0.35 + 3.15 F))	(3 to 5 fl oz)	
diclosulam, MOA 2 (Strongarm 84 WDG)	0.024 (0.45 oz)	Effective on annual grasses, common cocklebur, common ragweed, eclipta, morningglory, and common lambsquarters. Suppresses purple and yellow nutsedge. Does not control sicklepod. See label for rotation restrictions. Some weed species have developed resistance to Strongarm. See previous comments on carryover potential to cotton on some soils and restrictions on planting corn or grain sorghum after use in peanut.
+	+	
metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC)	0.95 to 1.27 (1 to 1.33 pt) 1.5 to 2 pt)	
or	or	
dimethenamid, MOA 15 (Outlook 6.0 L)	0.75 to 1 (16 to 21 oz)	
or	or	
acetolchlor, MOA 15 (Warrant 3 ME)	0.94 to 1.5 (1.25 to 2 qt)	

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preemergence, Most annual broadleaf weeds and nutsedge		
imazethapyr, MOA 2 (Pursuit 2 AS)	0.063 (4 fl oz)	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control ragweed, eclipta, lambsquarters, or croton. Pursuit may be tank mixed with Dual, Dual Magnum, Warrant, or Outlook for annual grass control. See label for rotational restrictions. Some weed species have developed resistance to Pursuit. Research in N.C. has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.
Cracking stage, Emerged annual grasses and broadleaf weeds		
paraquat, MOA 22 (Gramoxone 2.5 SL) (Parazone 3 SL)	0.13 (11 oz) (8 oz)	Apply at ground cracking for control of small emerged annual grasses and broadleaf weeds. May be tank mixed with Dual, Dual Magnum, Outlook, or Warrant for residual control. Tank mix may increase injury to emerged peanuts. Add 1 pint nonionic surfactant per 100 gallons spray solution. Follow all safety precautions on label. Applying Basagran at 0.5 pt per acre will reduce injury.
Cracking stage and Postemergence, Additional residual control of annual grasses and certain small-seeded broadleaf weeds		
alachlor, MOA 15 (Intro 4 EC)	2 to 3 (2 to 3 qt)	Use as a supplement to preplant or preemergence herbicides to provide additional residual control of annual grasses and certain small-seeded broadleaf weeds such as pigweed and eclipta. This treatment will not control emerged grasses or broadleaf weeds. See product labels for recommended tank mixtures with contact and systemic herbicides with foliar activity on weeds. With the exception of Anthem Flex, these herbicides do not provide appreciable control of weeds that have emerged. Total amount of Warrant that can be applied PRE + early POST = 8 pt/A/year. Do not apply Zidua preemergence to peanuts. For Zidua, total of 2 applications (5 oz/A of 4.17SC/year) can be applied.
dimethenamid, MOA 15 (Outlook 6.0L)	0.75 to 1 (16 to 21 oz)	
metolachlor, MOA 15 (Dual Magnum 7.62 EC) (Dual 8 EC)	0.95 (1 pt) (1.5 pt)	
acetochlor, MOA 15 (Warrant 3 ME)	0.95 to 1.5 (1.25 to 2 qt)	
pyroxasulfone, MOA 15 (Zidua 4.17SC)	0.08 to 0.11 (2.4 to 3.3 oz)	
Pyroxasulfone, MOA 15 +	0.073 +	
Carfentrazone, MOA 15 (Anthem Flex)	0.005 (2.5 oz)	

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Cracking stage, Most annual broadleaf weeds and nutsedge		
imazethapyr, MOA 2 (Pursuit 2 AS)	0.063 (4 oz)	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control ragweed, eclipta, lambsquarters, or croton. If weeds are emerged, add surfactant or crop oil according to label directions. See label for rotational restrictions. Pursuit may be tank mixed with paraquat. Some weed species have developed resistance to Pursuit.
Cracking stage, Some emerged broadleaf weeds and suppression of eclipta and yellow nutsedge		
diclosulam, MOA 2 (Strongarm 84 WDG)	0.024 (0.45 oz)	Strongarm can be applied through the cracking stage. Add 1 quart nonionic surfactant per 100 gallons. The spectrum of weeds controlled is much narrower when applied to emerged weeds. Strongarm will not control emerged common lambsquarters or pigweeds but will control common ragweed and morningglories and will suppress yellow nutsedge and eclipta. See product labels for information on mixing Strongarm with other herbicides. Some weed species have developed resistance to Strongarm. See product label for carryover potential to cotton, corn, and grain sorghum. Strongarm suppresses emerged marestail and dogfennel more effectively than other postemergence broadleaf herbicides when applied to small weeds.
Postemergence, Annual broadleaf weeds		
acifluorfen, MOA 14 (Ultra Blazer 2 L)	0.25 to 0.38 (1 to 1.5 pt)	Apply when weeds are small and actively growing. Use minimum of 20 GPA and high pressure (40 to 60 psi). See label for species controlled, maximum weed size to treat, and addition of surfactant. Do not apply more than 2 pints per acre per season. May make sequential applications of 0.25 pound followed by 0.25 pound per acre. Allow at least 15 days between sequential applications. Can be applied with residual herbicides for improved control.
acifluorfen, MOA 14 (Ultra Blazer 2 L)	0.25 to 0.38 (1 to 1.5 pt)	Addition of 2,4-DB to Ultra Blazer improves control of certain weeds when weed size exceeds that specified on the Ultra Blazer label. See label suggestions on use of surfactant or crop oil. Apply when peanuts are at least 2 weeks old and before pod filling begins. Can be applied with residual herbicides for improved control.
+	+	
2,4-DB, MOA 4 (Butyrac 200 2 L)	0.25 (16 fl oz)	

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Annual broadleaf weeds (cont.)		
bentazon, MOA 6 (Basagran 4 L) (Basagran 5 L)	0.75 to 1 (1.5 to 2 pt) (1 to 1.5 pt)	Apply when weeds are small and actively growing. Use minimum of 20 GPA and high pressure (40 to 60 psi). See label for addition of oil concentrate, species controlled, and maximum weed size to treat. Basagran (4L) may also be applied at 1 pint per acre for control of cocklebur, jimsonweed, and smartweed 4 inches or less. Two applications (7-10 days apart) will be required for the control of yellow nutsedge. Do not apply more than 4 pints (4L formulation) of bentazon per acre per season. Can be applied with residual herbicides for improved control.
bentazon, MOA 6 (Basagran 4 L) + acifluorfen, MOA 14 (Ultra Blazer 2 L)	0.5 to 1 (1 to 2 pt) + 0.25 to 0.38 (1 to 1.5 pt)	See above comments for Ultra Blazer and Basagran. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Can be applied as a tank mixture or as Storm 4L. Can be applied with residual herbicides for improved control.
bentazon, MOA 6 + acifluorfen, MOA 14 (Storm 4L)	0.5 + 0.25 (1.5 pt)	These rates of bentazon and acifluorfen (Ultra Blazer and Basagran) may not provide consistent control of lambsquarters, prickly sida, spurred anoda, and morningglory. Can be applied with residual herbicides for improved control.
bentazon, MOA 6 (Basagran 4 L) + acifluorfen, MOA 14 (Ultra Blazer 2 L) + 2,4-DB, MOA 4 (Butyrac 200 2 L)	0.5 (1 pt) + 0.25 (1 pt) + 0.125 to 0.25 (8 to 16 fl oz)	Adding 2,4-DB will improve control of larger morningglory, cocklebur, common ragweed, pigweed, jimsonweed, and citron. Add surfactant or crop oil according to label directions. Apply when peanuts are at least 2 weeks old. Do not apply after pod filling begins. See comments for Ultra Blazer and Basagran alone. Can be applied with residual herbicides for improved control.
bentazon, MOA 6 (Basagran 4 L) + 2,4-DB, MOA 4 (Butyrac 200 2 L)	0.75 to 1 (1.5 to 2 pt) + 0.125 (8 fl oz)	Addition of 2,4-DB to Basagran improves control of morningglories. See above comments for Basagran. Add surfactant or crop oil according to label directions. Do not make more than two applications per year. Apply when peanuts are at least 2 weeks old and not within 45 days of harvest. Can be applied with residual herbicides for improved control.

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Annual broadleaf weeds (cont.)		
imazapic, MOA 2 (Cadre 2 AS) (Impose 2 AS)	0.063 (4 fl oz)	Controls most broadleaf weeds except ragweed, croton, lambsquarters, and eclipta. Apply before weeds exceed 2 to 4 inches; see label for specific weed sizes to treat. Add nonionic surfactant at 1 quart per 100 gallons or crop oil concentrate at 1 quart per acre. A soil-applied grass control herbicide should be used. However, Cadre will usually control escaped broadleaf signalgrass, large crabgrass, fall panicum, and Texas panicum but not goosegrass. Cadre can be mixed with Cobra, Ultra Blazer, and 2,4-DB. See label for rotational restrictions. Some weed species have developed resistance to Cadre. Can be applied with residual herbicides for improved control.
imazethapyr, MOA 2 (Pursuit 2 L)	0.063 (4 fl oz)	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control eclipta, lambsquarters, ragweed, or croton. Apply when weeds are 3 inches tall or less. Add surfactant or crop oil according to label directions. See label for rotational restrictions. Pursuit may be tank mixed with Basagran, Ultra Blazer, Gramoxone, and 2,4-DB. Some weed species have developed resistance to Pursuit.
2,4-DB, MOA 4 (Buryrac 200 2 L)	0.2 to 0.25 (12 to 16 fl oz)	Effective on cocklebur and morningglory; pitted morningglory may be only partially controlled. Best results achieved when applied to small weeds. May use two applications per year. Do not apply within 45 days before harvest.
lactofen, MOA 14 (Cobra 2 EC)	0.2 (12.5 fl oz)	Apply after peanuts have at least six true leaves. Apply to actively growing peanut. Controls most annual broadleaf weeds. See label for species controlled and maximum weed size to treat. Add nonionic surfactant at 1 quart per 100 gallons or crop oil concentrate or methylated seed oil at 1 to 2 pints per acre. See label on when to use various adjuvants. Allow at least 14 days between applications. Can be tank mixed with Basagran, Pursuit, Cadre, 2,4-DB, and/or Select. Can be applied with residual herbicides for improved control. Other formulations of lactofen are available.
lactofen, MOA 14 (Cobra 2 EC)	0.2 (12.5 fl oz)	See above comments for Basagran and Lactofen alone. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Can be applied with residual herbicides for improved control.
+	+	
bentazon, MOA 6 (Basagran 4 L)	0.75 to 1 (1.5 to 2 pt)	

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Annual broadleaf weeds (cont.)		
lactofen, MOA 14 (Cobra 2 EC)	0.2 (12.5 fl oz)	Adding 2,4-DB will improve control of larger morningglory, cocklebur, common ragweed, jimsonweed, and citron. See above comments for bentazon, lactofen, and 2,4-DB. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Can be applied with residual herbicides for improved control.
+	+	
bentazon, MOA 6 (Basagran 4 L)	0.75 to 1 (1.5 to 2 pt)	
+	+	
2,4-DB, MOA 4 (Butyrac 200 2 L)	0.125 to 0.25 (8-16 fl oz)	
lactofen, MOA 14 (Cobra 2 EC)	0.2 (12.5 fl oz)	See above comments for imazapic and lactofen. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Some weed species have developed resistance to Cadre. Can be applied with residual herbicides for improved control.
+	+	
imazapic, MOA 2 (Cadre 2 AS) (Impose 2 AS)	0.063 (4 fl oz)	
lactofen, MOA 14 (Cobra 2 EC)	0.2 (12.5 fl oz)	See above comments for imazethapyr and lactofen. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Some weed species have developed resistance to Pursuit.
+	+	
imazethapyr, MOA 2 (Pursuit 2 AS)	0.063 (4 fl oz)	
paraquat, MOA 22 (Gramoxone 2 SL) (Parazone 3 SL)	0.13 (11 fl oz) (8 fl oz)	See label for weeds controlled and maximum weed size to treat; best results if weeds 1 inches or less. A postemergence application may be made following an at-crack application. Do not make more than two applications per season, do not apply later than 28 days after ground cracking, and do not apply if peanuts are under stress or have significant injury from thrips feeding. Gramoxone is more effective when applied within 2 weeks after peanut emergence. Add 1 pint of nonionic surfactant per 100 gallons of spray solution. Will cause foliar burn on peanuts, but peanuts recover, and yield is not affected. Follow all safety precautions on label. Can be applied with residual herbicides for improved control.
paraquat, MOA 22 (Gramoxone 2 SL) (Parazone 3 SL)	0.13 (11 oz) (8 oz)	See previous comments for paraquat alone. Adding Basagran improves control of common ragweed, prickly sida, smartweed, lambsquarters, and cocklebur and reduces injury to peanuts from paraquat. May be applied any time from ground cracking up to 28 days after ground cracking. Add 1 pint of nonionic surfactant per 100 gallons of spray solution. Can be applied with residual herbicides for improved control.
+	+	
bentazon, MOA 6 (Basagran 4 L)	0.25 to 0.75 (0.5 to 1.5 pt)	

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Annual broadleaf weeds (cont.)		
paraquat, MOA 22 (Gramoxone 2 SL) (Parazone 3 SL)	0.13 (11 fl oz) (8 fl oz)	See previous comments for paraquat alone. Storm improves control of common ragweed, smartweed, lambsquarters, common cocklebur, tropic croton, and spurred anoda. May be applied anytime from ground cracking up to 28 days after ground cracking. Add 0.5 pint of nonionic surfactant per 100 gallons of spray solution. The mixture of Gramoxone SL and Storm is more injurious than these herbicides applied alone. Can be applied with residual herbicides for improved control.
+	+	
bentazon, MOA 6	0.5	
+	+	
acifluorfen, MOA 14 (Storm 4 L)	0.25 (1 pt)	
Postemergence, Florida beggarweed		
chlorimuron, MOA 2 (Classic 0.25 DF)	0.008 (0.5 oz)	Use only for control of Florida beggarweed. Apply from 60 days after crop emergence to within 45 days of harvest. Application to peanuts less than 60 days old will result in crop injury and yield reduction. Some peanut varieties are more sensitive to classic compared with others, not all varieties have been tested for Classic use. Apply before Florida beggarweed has begun to bloom and before it has reached 10 inches tall. Larger beggarweed may only be suppressed. Add 1 quart of nonionic surfactant per 100 gallons spray solution; do not add crop oil. May be tank mixed with 2,4-DB; see label for rates and precautions. Recommended as a salvage treatment only.
Postemergence, Yellow nutsedge		
bentazon, MOA 6 (Basagran 4 L)	0.75 to 1 (1.5 to 2 pt)	Apply when nutsedge is 6 to 8 inches tall. A repeat application 7 to 10 days later may be needed. Adding crop oil concentrate at 1 quart per acre will increase control. Do not apply more than 2 pints of Basagran per season. Not effective on purple nutsedge.
Postemergence, Yellow and purple nutsedge		
imazapic, MOA 2 (Cadre 2 AS) (Impose 2 AS)	0.063 (4 fl oz)	Apply postemergence when nutsedge is 4 inches or less. Add nonionic surfactant at 1 quart per 100 gallons or crop oil concentrate at 1 quart per acre. See label for rotational restrictions.
imazethapyr, MOA 2 (Pursuit 2 AS)	0.063 (4 fl oz)	Apply before nutsedge is larger than 3 inches tall. Add surfactant at 1 quart per 100 gallons or crop oil concentrate at 1 quart per acre. Do not mix with Basagran for nutsedge control. See label for rotational restrictions. A split application with half of the Pursuit applied preplant incorporated and half applied early postemergence may be more effective than applying all of the Pursuit at one time.

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Annual grasses		
clethodim, MOA 1 (Select Max 0.97 EC) (Various "2 EC" formulations)	0.094 to 0.125 (9 to 16 fl oz) (6 to 8 fl oz)	Apply Select and Poast to actively growing grass not under drought stress. Consult labels for maximum grass size to treat. Apply in 5 to 20 GPA at 40 to 60 psi. Do not cultivate within 7 days before or after application. Add 2 pints crop oil to Poast. See label for adjuvant use with Select or Select Max. Some broadleaf/sedge herbicides and fungicides can reduce the efficacy of Select and Poast when applied in tank mixtures. See product labels for specific instructions concerning compatibility with other chemicals. Apply the highest rate of a clethodim product when tank mixing with broadleaf/sedge herbicides or fungicides.
sethoxydim, MOA 1 (Poast 1 EC) (Poast Plus 1.5 EC)	0.19 (1.5 pt) (1 pt)	
Postemergence, Bermudagrass		
clethodim, MOA 1 (Select Max 0.97 EC) (Various "2 EC" formulations)	0.125 to 0.25 (12 to 32 fl oz) (8 to 16 fl oz)	Apply to actively growing bermudagrass before runners exceed 6 inches. In most cases, a second application will be needed. Make second application if regrowth occurs. See comments under annual grasses for adjuvant selection and tank mixing for these herbicides.
sethoxydim, MOA 1 (Poast 1 EC) (Poast Plus 1.5 EC)	0.28 (2.25 pt) (1.5 pt)	
Postemergence, Rhizome johnsongrass		
clethodim, MOA 1 (Select Max 0.97 EC) (Various "2 EC" formulations)	0.125 to 0.25 (12 to 32 fl oz) (8 to 16 fl oz)	Apply to actively growing johnsongrass before it exceeds 25 inches tall. Add 2 pints per acre of crop oil concentrate. A second application of the same rates can be made if needed before new plants or regrowth exceeds 12 inches.
sethoxydim, MOA 1 (Poast 1 EC) (Poast Plus 1.5 EC)	0.28 (2.25 pt) (1.5 pt)	

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Suppression of large Palmer amaranth and other pigweed species that are resistant to the ALS inhibiting herbicides imazapic, chlorimuron, imazethapyr, and diclosulam		
2,4-DB, MOA 4 (Buryrc 200 2 SL)	0.25 (16 fl oz)	Suppresses and does not completely control Palmer amaranth and other pigweed species that exceed 8 inches. Suppression of weeds exceeding 12 inches will be less than suppression of smaller weeds. Do not expect suppression to exceed 60%. Applying 2,4-DB 3 to 4 days prior to Ultra Blazer or Cobra may be more effective than tank mixtures of 2,4-DB with Ultra Blazer or Cobra. Cobra is generally more effective on larger Palmer amaranth and other pigweed species than Ultra Blazer. Apply crop oil concentrate at 1 gallon per 100 gallons water with acifluorfen or lactofen. See product labels for comments on spray volume and effects on peanut especially during pod set and pod fill. Higher spray volumes are more effective by increasing spray coverage of the contact herbicides Ultra Blazer and Cobra. Two applications of 2,4-DB spaced 10 to 14 days apart will suppress Palmer amaranth and other pigweed species. Although suppression by 2,4-DB is lower than sequential or tank mix application of 2,4-DB and acifluorfen or lactofen within two weeks after application, suppression by sequential applications of 2,4-DB 4 to 5 weeks after initial application is only slightly lower than suppression by sequential or tank mix application of 2,4-DB and Ultra Blazer or Cobra.
+	+	
lactofen, MOA 14 (Cobra 2 EC)	0.20 (12.5 fl oz)	
or	or	
acifluorfen, MOA 14 (Ultra Blazer 2 L)	0.38 (1.5 pt)	
2,4-DB, MOA 4 (Butyrac 200 2 SL)	0.25 (16 fl oz)	
then	then	
lactofen, MOA 14 (Cobra 2 EC)	0.20 (12.5 fl oz)	
or	or	
acifluorfen, MOA 14 (Ultra Blazer 2 L)	0.38 (1.5 pt)	
2,4-DB, MOA 4 (Butyrac 200 2 L)	0.25 (16 oz)	
then	then	
2,4-DB, MOA 4 (Butyrac 200 2 L)	0.25 (16 oz)	
paraquat, MOA 22 (Gramoxone SL)	See comments	Apply in a roller/wiper implement. Best control achieved when at least 60% coverage of weed foliage occurs. Do not allow paraquat to contact peanut foliage. Mix 1 part Gramoxone SL (other formulations may not be labeled) with 1 to 1.5 parts water to prepare 40 to 50% solution. Add nonionic surfactant at 1 quart per 100 gallons. Adjust equipment to apply up to 2 pints per acre of the herbicide-water mixture.

Table 5.93 - Chemical Weed Control in Peanuts (cont.)

Herbicide and Formulation	Pounds Active Ingredient Per Acre	Precautions and Remarks
Postemergence, Late-season residual control of annual grasses and certain small-seeded weeds		
dimethenamid, MOA 15 (Outlook 6.0 L)	0.75 to 1 (16 to 21 fl oz)	Will not control emerged grasses or weeds; apply following a cultivation or appropriate postemergence herbicide if emerged grasses or broadleaf weeds are present. Benefit likely only on very sandy fields heavily infested with annual grasses that receive above normal rainfall during the first 4 to 5 weeks of the growing season. Lay-by of Dual Magnum, Outlook, Warrant, or Anthem Flex may also be of value in fields with a history of eclipta problems; the application must be made before eclipta emerges. Rates are on a broadcast basis; apply in an 18-inch band to row middles. Anthem Flex also provides post-emergence control of broadleaf weeds. Anthem Flex improves the control of emerged morningglory. This product may cause leaf burn and stunting but does not lead to yield reduction. See labels for preharvest intervals.
metolachlor, MOA 15 (Dual Magnum 7.62 EC)	0.64 to 0.84 (0.67 to 0.88 pt)	
acetochlor, MOA 15 (Warrant 3 ME)	0.95 to 1.5 (1.25 to 2 qt)	
Pyroxasulfone, MOA 15	0.073	
+	+	
Carfentrazone, MOA 15 (Anthem Flex)	0.005 (2.5 oz)	
Postemergence, Harvest Aide for morningglory control		
Carfentrazone, MOA 14 (Aim 2 EC)	0.016 to 0.031 (1.0 to 2.0 oz)	Aim desiccates annual morningglory. Apply with nonionic surfactant at 1 quart per 100 gal or crop oil concentrate at 1 gal per 100 gal within 7 days of optimum pod maturity and digging and vine inversion. Do not apply earlier in the season. Yield reductions occur when applied prior to 7 days before optimum pod maturity.

Table 5.94 - Weed Response to Preplant Incorporated, Preemergence, At-Cracking, and Postemergence Herbicides in Peanuts

Herbicides Key: PPI = Preplant Incorporated; PRE = Preemergence; AC= At-Cracking; POST = Postemergence

	Prowl or Sonalan PPI	Dual Magnum or Dual PPI	Outlook PPI	Strongarm PPI or PRE	Prowl or Sonalan + Strongarm PPI	Pursuit PPI + POST	Dual Magnum or Dual PRE	Intro PRE	Brake PRE	Outlook PRE	Valor SX PRE	Prowl or Sonalan PPI + Valor SX PRE	Dual Magnum, Dual, Outlook or Warrant + Valor SX PRE	Dual Magnum or Dual AC ¹	Intro AC ¹	Outlook AC ¹	Gramoxone SL AC or POST	Strongarm AC ²	Gramoxone + Strongarm AC ²	Zidua, AC ² , or POST ¹	Anthem Flex, AC ² , or POST ¹
Bermudagrass	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N	N	P	N	P	N	N
Black nightshade	N	F	F	F	N	N	F	FG	-	F	E	E	E	F	FG	F	PF	N	G	F	F
Broadleaf signalgrass	G	E	G	FG	P	G	G	FG	FG	FG	P	G	FG	G	FG	FG	E	N	GE	FG	FG
Carpetweed	G	G	FG	FG	G	G	FG	FG	-	G	-	G	G	FG	FG	G	FG	-	G	G	G
Cocklebur	N	N	N	N	G	G	GE	N	G	N	PF	PF	PF	N	N	N	E	E	E	N	N
Common ragweed	N	P	PF	PF	G	G	P	PF	FG	F	FG	G	GE	PF	PF	F	F	E	E	F	F
Crabgrass	E	E	E	E	P	E	F	E	FG	E	PF	E	E	E	E	E	G	N	G	E	E
Crowfootgrass	E	E	E	E	-	-	E	E	-	E	PF	G	G	E	E	E	E	N	GE	E	E
Dayflower	P	GE	-	GE	-	G	-	GE	-	P	-	F	GE	GE	-	-	-	-	G	-	-
Eclipta	N	G	G	FG	G	GE	P	FG	-	FG	G	G	GE	FG	FG	FG	FG	NP	FG	FG	FG
Fall panicum	G	E	E	E	P	E	PF	E	-	E	PF	FG	GE	E	E	E	E	N	GE	E	E
Florida beggarweed	N	PF	PF	F	F	F	P	F	P	F	G	GE	E	F	F	F	E	FG	G	F	F
Foxtails	E	E	E	E	P	E	G	E	FG	E	PF	E	E	E	E	E	E	N	GE	E	E
Goosegrass	E	E	E	E	P	E	PF	E	FG	E	PF	GE	E	E	E	E	E	N	GE	E	E
Jimsonweed	N	N	N	N	GE	G	N	-	N	G	G	GE	N	N	N	N	E	-	E	N	N
Johnsongrass, Seedling	G	G	G	PF	PF	N	G	GE	PF	P	PF	N	FG	PF	PF	PF	E	N	GE	PF	PF
Johnsongrass, Rhizome	P	PF	PF	N	N	N	P	FG	N	N	N	N	N	N	N	N	P	N	P	N	N
Lambsquarters	G	NG	G	F	FG	FG	GE	FG	F	-	FG	GE	GE	F	F	FG	F	N	G	FG	FG
Morningglory	P	P	P	N	N	G	G	N	F	N	FG	G	G	N	N	N	F	GE	E	N	GE

Table 5.94 - Weed Response to Preplant Incorporated, Preemergence, At-Cracking, and Postemergence Herbicides in Peanuts (cont.)

	Prowl or Sonalan PPI	Dual Magnum or Dual PPI	Outlook PPI	Strongarm PPI or PRE	Prowl or Sonalan + Strongarm PPI	Pursuit PPI + POST	Dual Magnum or Dual PRE	Intro PRE	Brake PRE	Outlook PRE	Valor SX PRE	Prowl or Sonalan PPI + Valor SX PRE	Dual Magnum, Dual, Outlook or Warrant + Valor SX PRE	Dual Magnum or Dual AC ¹	Intro AC ¹	Outlook AC ¹	Gramoxone SL AC or POST	Strongarm AC ²	Gramoxone + Strongarm AC ²	Zidua, AC ² , or POST ¹	Anthem Flex, AC ² , or POST ¹
Nutsedge, Yellow	N	G	FG	FG	FG	FG	FG	P	P	F	P	PF	FG	FG	P	F	PF	PF	G	F	F
Nutsedge, Purple	N	N	N	FG	FG	FG	N	N	P	N	P	P	P	N	N	N	PF	NP	PF	N	N
Palmer amaranth and other pigweed	G	E	E	G	E	E	G	GE	GE	GE	E	E	E	G	GE	GE	E	NP	E	GE	GE
Prickly sida	N	P	P	P	FG	G	P	P	-	P	FG	G	G	P	P	P	F	-	G	P	P
Purslane	G	GE	GE	G	-	G	G	FG	G	G	GE	GE	GE	GE	P	P	-	-	-	G	P
Sicklepod	N	NP	NP	NP	P	P	NP	PF	P	NP	P	PF	PF	NP	PF	NP	G	N	G	NP	NP
Smartweed	N	N	N	N	G	G	N	N	-	N	-	-	-	N	N	N	G	-	E	N	N
Spurge spp.	P	F	F	PF	P	PF	F	P	-	F	G	G	G	N	N	N	FG	-	FG	N	N
Spurred anoda	N	N	N	N	FG	G	N	N	G	N	F	FG	FG	N	N	N	P	-	G	N	F
Texas panicum	G	G	G	PF	P	G	PF	PF	PF	PF	PF	G	F	PF	PF	PF	E	N	GE	F	F
Tropic croton	N	N	N	N	PF	P	N	N	G	N	-	-	-	N	N	N	F	-	F	N	N
Velvetleaf	N	N	N	N	GE	FG	N	N	-	N	F	FG	FG	N	N	N	F	-	FG	N	N

¹Residual control only (except morningglory control by Anthem Flex).
²Assumes weeds are 1- to 2-inches tall or smaller.
 Key:
 E = Excellent control, 90% or better G = Good control, 80%-90% F = Fair control, 50%-80%
 P = Poor control, 25%-50% N = Essentially no control, less than 25%
 Stage: PPI = Preplant soil incorporated POE = Postemergence PRE = Preemergence AC = At cracking

Table 5.95 - Weed Response to Postemergence Herbicides in Peanuts

Herbicides Key: PPI = Preplant Incorporated; PRE = Preemergence; AC= At-Cracking; POST = Postemergence

	Butyrac 200	Gramoxone ¹	Gramoxone + Basagran	Gramoxone + Storm	Basagran	Basagran + Butyrac 200	Ultra Blazer	Ultra Blazer + Butyrac 200	Ultra Blazer + Basagran ²	Storm	Storm + Butyrac 200	Pursuit + Butyrac 200	Cadre or Impose	Cobra	Cobra + Basagran	Cobra + Basagran + Butyrac 200	Cobra + Cadre or Impose	Cobra + Pursuit	Poast or Poast Plus	Clethodim products
Bermudagrass	N	P	P	P	N	N	N	N	P	N	N	N	N	N	N	N	N	N	FG	G
Black nightshade	N	PF	PF	G	P	P	G ¹	G ¹	G ¹	G ¹	G ¹	G	G	G ¹	G ¹	G ¹	G	G	N	N
Broadleaf signalgrass	N	GE	E	GE	N	N	NP	NP	P	NP	NP	G	G	N	N	N	G	G	E	E
Carpetweed	P	FG	FG	G	P	P	GE	E	E	G	G	FG	FG	G	G	G	G	G	N	N
Cocklebur	E	G	E	E	E	E	G	E	E	E	E	E	E	G	G	E	E	E	N	N
Common ragweed	PF	F	G	E	G ⁴	G ⁴	E ¹	E ¹	E ¹	E ¹	E ¹	P	PF	E	E	E	E	E	N	N
Crabgrass	N	G	G	G	N	N	N	N	N	N	N	FG	FG	N	N	N	FG	FG	GE	GE
Crowfootgrass	N	GE	G	GE	N	N	P	P	P	P	P	P	G	N	N	N	G	P	F	G
Dayflower	-	G	G	FG	G	G	-	-	G	FG	FG	-	G	-	G	G	G	-	N	N
Eclipta	P	F	F	FG	FG	FG	G	G	G	FG	FG	P	F	G	G	G	G	G	N	N
Fall panicum	N	GE	G	GE	N	N	PF	PF	P	PF	PF	PF	G	N	N	N	G	PF	E	E
Florida beggarweed	P	G	GE	G	N	P	PF	F	F	P	P	P	F	F	F	F	F	F	N	N
Foxtails	N	GE	G	GE	N	N	PF	PF	P	PF	PF	G	G	N	N	N	G	G	E	E
Goosegrass	N	GE	G	GE	N	N	N	N	N	N	N	N	F	N	N	N	F	N	GE	GE
Jimsonweed	P	G	E	E	E	E	E	E	E	E	E	G	E	E	E	E	E	E	N	N
Johnsongrass, Seedling	N	GE	GE	GE	N	N	P	P	P	P	P	GE	E	N	N	N	E	GE	E	E
Johnsongrass, Rhizome	N	P	P	P	N	N	N	N	N	N	N	F	FG	N	N	N	FG	F	G	GE
Lambsquarters	PF	F	G	G	FG	G ⁴	G	G	GE	G	G	P	PF	P	FG	G	PF	P	N	N
Morningglory, Pitted	FG	F	FG	E	P	G	E	E	E	E	E	G	GE	G	G	G	GE	G	N	N
Morningglory, Others	E	F	FG	E	P	E	GE	E	E	GE	E	E	G	G	G	E	G	E	N	N
Nutsedge, Yellow	N	PF	FG	G	G ³	G	N	N	G	F	F	F	G	N	G ³	G ³	G	F	N	N
Nutsedge, Purple	N	PF	PF	PF	NP	P	N	N	P	N	N	FG	G	N	P	P	G	FG	N	N
Palmer amaranth and other pigweed	PF	G	G	E	N	P	E	E	E	E	E	E	E	E	E	E	E	E	N	N
Prickly sida	F	F	G	G	G	G	N	F	G	FG	G	P	G	G	G	G	G	G	N	N
Purslane	FG	-	G	G	G	G	E	E	E	GE	GE	FG	-	E	E	E	E	E	N	N
Sicklepod	G ³	G	G	G	N	G ⁶	NP	G ⁶	NP	NP	G ⁶	G ⁶	E	P	P	G ⁶	E	F	N	N
Smartweed	PF	G	E	E	E	E	GE	E	E	E	E	G	F	F	E	E	F	G	N	N
Spurge spp.	P	F ¹	F ¹	F ¹	P	P	F ¹	F ¹	F ¹	PF ¹	PF ¹	PF ¹	-	F ¹	F ¹	F ¹	F ¹	-	N	N
Spurred anoda	P	P	FG	G	G	GE	P	P	G	F	F	F	G	F	G	GE	G	F	N	N
Texas panicum	N	GE	G	GE	N	N	NP	NP	NP	NP	NP	NP	G	N	N	N	G	NP	E	E
Tropic croton	PF	F	F	G	F	F	G	G	G	G	G	P	P	G	G	G	G	G	N	N
Velvetleaf	P	F	G	FG	G	G	PF	PF	FG	FG	FG	FG	G	G	G	G	G	G	N	N

Table 5.95 - Weed Response to Postemergence Herbicides in Peanuts (cont.)

Herbicides Key: PPI = Preplant Incorporated; PRE = Preemergence; AC= At-Cracking; POST = Postemergence

¹Assumes weeds are 1 to 2 inches tall or smaller.

²Assumes optimum rates and ratios of Basagran and Blazer; see labels.

³Two applications, 10 to 14 days apart.

⁴Assumes optimum conditions and addition of crop oil concentrate.

⁵Ratings assume weeds in one- to two-leaf stage.

⁶Assumes follow-up treatment with 2,4-DB.

Key:

E = Excellent control, 90% or better G = Good control, 80%-90% F = Fair control, 50%-80%

P = Poor control, 25%-50% N = Essentially no control, less than 25%

Table 5.96 - Restriction on Feeding Peanut Hay to Livestock Following Treatment with Herbicides

Feeding Restricted (Do not feed treated hay to livestock.)	No Feeding Restrictions or Defined Feeding Restrictions*
2,4-DB, Aim, Cadre, clethodim-containing products, Cobra, Impose, Poast, Poast Plus, Pursuit, Sonalan, Storm, Ultra Blazer	Basagran, Dual Magnum, Gramoxone SL, Outlook, Prowl, Zidua

*See product labels for specific information.

Table 5.97 - Suggested Rain-free Periods After Application of Postemergence Herbicides

Herbicide	Rain-free Period (hours)	Herbicide	Rain-free Period (hours)
2,4-DB	NR**	Paraquat	0.5
Arrow	1	Poast	1
Basagran	NR*	Poast Plus	1
Ultra Blazer	NR*	Pursuit	1
Cadre, Impose	3	Select, Select MAX	1
Classic	1	Storm	NR*
Cobra	1		

* No restriction listed on label. Suggest 4 to 6 hours for best results.

** No restriction listed on label. Suggest at least 1 hour for best results.

Table 5.98 - Restrictions on Crop Rotation of Herbicides with Significant Residual Activity Applied to Peanuts

Herbicide	Corn	Cotton	Soybeans	Tobacco	Wheat	Grain Sorghum
Anthem Flex	NR	2 months	NR	9 months	4 – 6 months ***	6 – 12 months ***
Cadre, Impose	9 months	18 months	9 months	9 months	4 months	18 months
Pursuit	NR/8.5 months*	9.5 months/ 18 months*	NR	9.5 months	4 months	18 months
Strongarm	18 months**	9 months	NR	> 18 months	4 months	18 months
Valor SX	NR	NR	NR	NR	4 months	NR
Prowl	Following year	NR	NR	NR	4 months	NR
Outlook	NR	Following year	NR	NR	4 months	NR
Dual Magnum	NR	NR	NR	NR	4.5 months	NR
Warrant	NR	NR	NR	NR	4 months	NR
Zidua	NR	NR	NR	18 months	4 – 6 months ***	6 – 12 months ***

NR = no restriction.

*No restriction and 9.5 months if applied postemergence; 8.5 and 18 months if applied preplant incorporated.

See label on rainfall and temperature requirements.

**No restriction if appropriate IMI-tolerant corn hybrid is planted. See label for specific instructions.

***See label for Anthem Flex and Zidua rates.

Preventing and Managing Herbicide-Resistant Weeds

Populations of weeds that were once controlled by specific herbicides have developed resistance to these herbicides. Historically, the resistance of individual weeds within a population of a species has rarely occurred. However, increased selection pressure and the occurrence of cross and multiple resistance have resulted in increased frequency of herbicide resistance in some peanut fields. Two steps are critical to prevent yield loss from weed interference and preserve herbicide effectiveness: (1) determine whether weed escapes are herbicide resistant, and (2) develop an appropriate management strategy for herbicide-resistant weeds. While most weed escapes are the result of an application error or weather conditions, herbicide resistance is a real threat. Indicators of herbicide resistance, approaches to managing herbicide-resistant weed populations, and classification of resistance potential by mode of action are listed in Tables 5.99 and 5.100. Note that herbicides that are generally not prone to having resistance populations develop can become ineffective if they are used repeatedly without implementation of other weed management practices. The intensity of selection pressure (frequency of application) and likelihood of resistance to develop for a particular herbicide are the two essential elements in determining occurrence of herbicide resistant biotypes. Contact your local Cooperative Extension agent if herbicide resistance is suspected.

In North Carolina and Virginia, populations of Palmer amaranth and common ragweed resistant to acetolactate synthase (ALS) inhibiting herbicides have been confirmed. The effectiveness of the herbicides Cadre, Pursuit, and Strongarm will be less in fields where resistant populations exist. To manage weeds in these fields, growers must use herbicides with a different mode of action from the ALS-inhibiting herbicides. This goal can be accomplished in a variety of ways, including application of herbicide mixtures to broaden the spectrum of control.

While not confirmed, it is speculated that populations of Palmer amaranth resistant to PPO-inhibiting herbicides (Valor SX, Cobra, Ultra Blazer, and Storm) are present in North Carolina. Although PPO-herbicide-resistant weeds have not been documented in Virginia, it has been suggested to prevent weeds escaping PPO-inhibiting herbicides from reproducing when these weed escapes are first observed. Experiences with development of Palmer amaranth resistance to glyphosate and ALS-inhibiting herbicides reminds us that recognizing and addressing resistant populations when they first develop is critical.

Table 5.99 - Identification and Management of Herbicide-Resistant Weeds**Possible reasons why herbicides do not control weeds that are NOT associated with herbicide resistance:**

- Improper herbicide choice or rate.
- Poor or improper application of herbicide.
- Poor timing of herbicide application.
- Weather conditions were not favorable when herbicide was applied.
- Weeds emerged after the postemergence herbicide was applied.
- Other chemicals antagonized the herbicide.

Indicators suggesting that weeds are resistant to herbicides:

- Herbicide normally controls the weed in question.
- Performance poor on one species while other species are controlled well. Poor control is confined to spots in the field.
- Some plants of the weed in question are controlled well while other plants of that species are controlled poorly.
- Field history of heavy use of herbicides with the same mechanism of action.

Steps to take to prevent or manage herbicide resistance:

- Rotate herbicides having different mechanisms of action.
- Use tank mixes or sequential applications of herbicides having different mechanisms of action.
- Be especially vigilant when using herbicides with higher risk of resistance development.
- Integrate nonchemical controls when possible.
- Avoid allowing weeds to produce seeds when herbicide resistance is suspected.

Additional key points:

Although some herbicides inherently are at low risk for resistance development, selection pressure (the frequency of herbicide applications with the same mode of action) can overcome the low or moderate theoretical possibility of resistance developing. Spraying weeds that are large and beyond the recommendation on the herbicide label is equivalent to applying herbicides at rates lower than the recommended labeled rates applied to small weeds. This approach increases the decreases the length of time (number of generations) required for weed populations to become resistant.

Table 5.100 - Herbicide Categories Prone to Have Weeds Develop Resistance

Trade Name	Common Name	Family	MOA
ALS* Inhibitors—Weeds highly susceptible to developing resistance			
Cadre, Impose, Pursuit	imazapic, imazethapyr	Imidazolinone	2
Strongarm	diclosulam	Triazolopyrimidine	2
Classic	chlorimuron	Sulfonyl urea	2

Table 5.100 - Herbicide Categories Prone to Have Weeds Develop Resistance (cont.)

Trade Name	Common Name	Family	MOA
ACCase* Inhibitor—Weeds moderately to highly susceptible to developing resistance			
Arrow, Clethodim, Cleanse, Select, Select MAX, Tapout, Volunteer	clethodim	cyclohexanedione	1
Poast, Poast Plus	sethoxydim	cyclohexanedione	1
Microtubule Assembly Inhibition—Weeds moderately susceptible to developing resistance			
Prowl	pendimethalin	dinitroaniline	3
Sonalan	ethafluralin	dinitroaniline	3
Herbicides at low to moderate risk for resistance development			
Aim	carfentrazone ethyl	aryltriazinone	14
Anthem Flex	pyroxasulfone + carfentrazone ethyl	pyrazole + aryltriazinone	15
Basagran	bentazon	benzothiadiazole	6
Cobra	lactofen	diphenylether	14
Gramoxone SL	paraquat	bipyridilium	22
Dual Magnum	metolachlor	chloroacetamide	15
Intrro	alachlor	chloroacetamide	15
Outlook	dimethenamid	chloroacetamide	15
Spartan Charge	carfentrazone + sulfentrazone	triazolinone + triazolinone	14
Storm	acifluorfen + bentazon	diphenylether + benzothiadiazole	14 + 6
Ultra Blazer	acifluorfen	diphenylether	14
Valor SX (various formulations)	flumioxazin	N-phenylphthalimide derivative	14
Warrant	acetochlor	chloroacetamide	15
Zidua	pyroxasulfone	pyrazole	15
2,4-DB (various formulations)	2,4-DB	phenoxy	4

*ALS = acetolactate synthase; ACCase = acetyl CoA carboxylase; MOA, mode of action.

Table 5.101 - General Recommendations on Herbicides to Use in a Comprehensive Weed Management Program for Peanuts

Herbicide	Timing	Should these herbicides be used?
Prowl or Sonalan	Preplant incorporated	Yes. These herbicides are relatively inexpensive and provide early season control of grasses and small-seeded broadleaf weeds. Although Prowl can be applied preemergence, it is generally more effective incorporated. Sonalan always needs to be incorporated. These herbicides are an important part of a comprehensive weed management strategy and should always be applied.
Dual Magnum (various formulations), Outlook, or Warrant	Preplant incorporated or preemergence	Yes. These herbicides are important in suppressing yellow nutsedge, especially Dual Magnum, and provide control of small-seeded broadleaf weeds including pigweeds. While these herbicides do not control weeds for the entire season, they provide good early-season control and are an important foundation of a comprehensive weed management strategy for peanuts.

Table 5.101 - General Recommendations on Herbicides to Use in a Comprehensive Weed Management Program for Peanuts (cont.)

Herbicide	Timing	Should these herbicides be used?
Valor SX (various formulations) or Strongarm	Preemergence	Yes. Under current situations with increased prevalence of Palmer amaranth and traditional broadleaf weeds such as eclipta, common ragweed, and common lambsquarters, one of these two herbicides is needed in a comprehensive weed management strategy for peanuts. Valor SX provides excellent rotation options for crops grown the following season, while Strongarm will carry over to corn and grain sorghum, and there is some concern about carryover to cotton on some soils. Weeds present, especially Palmer amaranth, that express resistance to Strongarm keep this herbicide from being a complete answer in some fields. Although Valor SX is effective early in the season, the rate used in peanut (2 oz/acre) generally does not control morningglories and will not control other weeds season-long every year.
Brake	Preemergence	Yes. Brake is an alternative MOA for the control of Palmer amaranth and other small seeded broadleaf and grass weeds. Brake will cause temporary peanut injury in the form of bleaching. Plant peanut at least 1.5" deep. Apply prior to planting (up to 14 days) or preemergence within 36 hours after planting. Brake needs at least 0.5" of moisture for activation as soon as possible. Some cultivars may exhibit more foliar injury (bleaching) than other cultivars (cosmetic/no yield loss). Brake should be used in combination with other at-plant residual herbicides such as Dual Magnum, Outlook, Prowl, Sonalan, Strongarm, Valor, Warrant. Crop rotation restrictions: cotton/peanut = 0 months; soybean/sweet potato = 2 months; wheat/barley/rye = 8 months (grain) or 5 months (cover crop only); corn/sorghum = 10 months; sunflower = 18 months; tobacco = 18 months. Do not apply Brake to the same field more than 2 years in a row.
Paraquat plus Basagran plus Anthem Flex, Dual Magnum (various formulations), Outlook, Warrant, or Zidua	At cracking or early postemergence	Yes. Given that Palmer amaranth is present in many fields and that preplant incorporated and preemergence herbicides often are incomplete in control due to weather conditions or poor incorporation, this treatment (paraquat, with Gramoxone SL being the most prevalent commercial product) can often clean up fields when applied on time, taking pressure off of other postemergence options. Basagran reduces injury from paraquat. In fields with known histories of Palmer amaranth and other problematic weeds, applying Anthem Flex, Dual Magnum, Outlook, Warrant, or Zidua with paraquat plus Basagran will improve early-season weed control. Apply paraquat early in the season, no later than 28 days after peanuts emerge, but preferably within the first three weeks. Anthem Flex causes more injury than other residual herbicides, but injury is transient and research data indicate that it does not adversely affect peanut yield.

Table 5.101 - General Recommendations on Herbicides to Use in a Comprehensive Weed Management Program for Peanuts (cont.)

Herbicide	Timing	Should these herbicides be used?
Cobra, Ultra Blazer, Storm, Basagran	Postemergence	Most likely. These herbicides should be applied as needed. In fact, many if not most peanut fields will need at least one application of these herbicides. Weed size has a major impact on the degree of control obtained with these herbicides. If weeds exceed 3 inches, control is often incomplete. When preplant incorporated or preemergence herbicides are not applied or are marginally effective, growers often have to apply repeat applications of these herbicides (Cobra, Storm, Ultra Blazer). Multiple applications in some cases can negatively affect peanut yield. For this reason growers are encouraged to have a comprehensive program of preplant incorporated and preemergence herbicides and apply paraquat plus Basagran to take the pressure off of Cobra, Storm, and Ultra Blazer. Note that Storm does not contain sufficient Ultra Blazer to control Palmer amaranth and other weeds in most cases, so adding additional Ultra Blazer to Storm is recommended in some circumstances. Residual herbicides can be added to improve control (see comments under Paraquat plus Basagran).
Postemergence grass herbicides (clethodim and sethoxydim are active ingredients in these herbicides)	Postemergence	Most likely. Preplant incorporated and preemergence herbicides often control annual grasses through midseason and sometimes late into the season. However, many fields need a postemergence application of sethoxydim (several formulations) or clethodim (several formulations). These herbicides should be applied as needed because grasses often cause peanut pod loss during the digging process.
Cadre, Pursuit	Postemergence	In many cases. Pursuit is used much less often now than in previous years. Cadre (also formulated as Impose) is a very good herbicide that controls yellow and purple nutsedge, annual grasses in many cases, and a range of broadleaf weeds. The challenge with Cadre is presence of resistant Palmer amaranth and carryover potential to cotton and grain sorghum. Cadre continues to be a good option for peanut growers as long as they realize carryover potential and know whether or not resistance to this herbicide is present in certain fields. Residual herbicides can be added to improve control.
2,4-DB	Postemergence	Yes. The broadleaf herbicides mentioned above, with the exception of paraquat, benefit from the addition of 2,4-DB. For example, when Palmer amaranth is slightly larger than the size recommended for complete control by Cobra, Ultra Blazer, or Storm, the inclusion of 2,4-DB can help obtain complete control. 2,4-DB is often effective when applied alone, but this is very species dependent. For example, common cocklebur can be controlled completely by 2,4-DB. 2,4-DB is also a viable option for suppression of escapes of sicklepod and Palmer amaranth when applied sequentially.

Cotton

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Table 5.102 - Early Preplant Burndown and Preplant Incorporated

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Barnyardgrass, broadleaf signalgrass, carpetweed, crabgrass, fall panicum, Florida pusley, foxtails, goosegrass, johnsongrass seedlings, lambsquarters, pigweed, purslane, sandbur, Texas panicum, wild cane, shattercane	Pendimethalin 0.5-0.75 lb ai	Prowl 3.3EC 1.2-1.8 pt or Prowl H ₂ O 3.8ACS 1.1-1.6 pt	Apply and incorporate 1-2 inches deep within 7 days after application. Follow label for proper soil incorporation procedures. Lower rate is safest to cotton.
Barnyardgrass, broadleaf signalgrass, carpetweed, crabgrass, fall panicum, Florida pusley, foxtails, goosegrass, johnsongrass seedlings, lambsquarters, pigweed, purslane, sandbur, Texas panicum, wild cane, shattercane	Trifluralin 0.5-0.75 lb ai	Treflan 4EC 1.0-1.5 pt	Incorporate within 24 hours after application. Follow label for proper soil incorporation procedures. Lower rate is safest to cotton.
Controls most annual grasses and broadleaf weeds	Glyphosate 0.56-1.13 lb ae	Numerous brands and formulations	Apply any time prior to planting. Control of cutleaf eveningprimrose, field pansy, Carolina geranium, and wild radish may not be adequate. Rates suggested for terminating cover crops: Wheat < 12 in.: 0.56 lb ae Wheat > 12 in.: 0.75 lb ae Rye < 12 in.: 0.56 lb ae Rye > 12 in.: 0.75 lb ae
Controls most annual grasses and broadleaf weeds. Better activity on broadleaf weeds compared to glyphosate alone.	Fomesafen 0.25-0.37 lb ai + Glyphosate 0.99-1.5 lb ae	Flexstar GT 3.5EC 3.5-5.3 pt	Apply Flexstar GT 7-14 days before planting. Very effective on glyphosate resistant and ALS-resistant biotypes that has not emerged yet. Apply only to coarse textured soils (sandy loam, loamy sand, sandy clay loam). Rainfall or irrigation (around 0.25") within 7 days of application is required to activate the residual herbicide. Some crinkling or spotting on cotton foliage may occur if heavy rainfall occurs during or soon after emergence.

Table 5.102 - Early Preplant Burndown and Preplant Incorporated (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Many grass and broadleaf weeds	Paraquat 0.65-1 lb ai	Numerous brands and formulations	Apply any time prior to planting to control emerged weeds. Add nonionic surfactant at 1 pt per 100 gal or crop oil concentrate at 1 gal per 100 gal. Follow directions and precautions on label. Not effective on cutleaf eveningprimrose, horseweed, or larger wild mustard and wild radish. Apply 0.63 lb ai for wheat and 0.5 lb ai for rye cover crops.
Many grass and broadleaf weeds	Glufosinate 0.53-0.79 lb ai	Liberty 280 SL 2.34L 29-43 fl oz	Can be applied prior to emergence of any transgenic or conventional cotton variety to control emerged weeds. If applied at rates greater than 29 oz, the seasonal total applied cannot exceed 72 fl oz. Control greatly affected by temperature; apply on a sunny day with temperature above 75 degrees. Two hours of sunshine before a morning application is suggested. Less effective than glyphosate on grasses.
Many broadleaf weeds	2,4-D 0.24-0.95 lb ae	Numerous brands and formulations	Most, but not all, brands of 2,4-D may be applied at least 30 days ahead of cotton planting. Excellent control of cutleaf eveningprimrose. Not effective on Carolina geranium. To control glyphosate-resistant horseweed, 0.95 lb ae is needed. Cotton containing the Enlist trait can be planted anytime following Enlist One application.
Many broadleaf weeds	Glyphosate 0.74-1.0 lb ae + 2,4-D 0.7-0.95 lb ae	Enlist Duo 3.3S 3.5-4.75 pt	Apply at least 30 days ahead of planting any cultivar not containing the Enlist trait. Enlist Duo may be applied through planting for Enlist cultivars. See website listed on Enlist Duo label for details on tank mixing and use of drift reduction agents. Excellent control of cutleaf eveningprimrose. To control glyphosate-resistant horseweed 4.75 pt/A is needed. Current label does not allow tank mixing with other herbicides.

Table 5.102 - Early Preplant Burndown and Preplant Incorporated (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Many broadleaf weeds	Dicamba 0.25 lb ai	Clarity 4S	Following application of dicamba and a minimum of 1 in. of rainfall, a waiting period of at least 21 days is required before planting and cultivar not containing the XtendFlex trait. Engenia and XtendiMax can be applied through planting of XtendFlex cultivars. See websites listed on Engenia and XtendiMax labels for details on tank mixing and use of drift reduction agents. Suppresses Carolina geranium and curly dock. Less effective on cutleaf eveningprimrose than 2,4-D. Clarity will control horseweed. Applicators must hold a VA pesticide license and receive annual training to use Engenia and Xtendimax.
		8 fl oz	
		or	
		Engenia 5S	
		6.4 fl oz	
		or	
		XtendiMax 2.9S	
		11 fl oz	
Lambsquarters, morningglory species, nightshade species, pigweed species, velvetleaf, spurred anoda, purslane, hemp sesbania, prostrate spurge, and Pennsylvania smartweed	Carfentrazone 0.008-0.016 lb ai	Aim 2EC 0.5-1 fl oz	There is no waiting period between application and cotton planting. Added to glyphosate, Aim will increase speed of control and may improve control of some species. Will not control cutleaf eveningprimrose or horseweed.
Common ragweed, smooth pigweed, morningglory species, and velvetleaf	Flumiclorac pentyl ester 0.013-0.027 lb ai	Resource 0.86EC 2-4 fl oz	There is no waiting period between application and cotton planting. Added to glyphosate, Resource will increase speed of control and may improve control of some species. Will not control cutleaf eveningprimrose or horseweed.
Common ragweed, pigweed species, morningglory species, and velvetleaf	Pyraflufen ethyl 0.0008-0.0032 lb ai	ET 0.208EC 0.5-2 fl oz	There is no waiting period between application and cotton planting. Added to glyphosate, ET will increase speed of control and may improve control of some species. Will not control cutleaf eveningprimrose or horseweed.

Table 5.102 - Early Preplant Burndown and Preplant Incorporated (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Lambsquarters, morningglory species, nightshade species, pigweed species, velvetleaf, spurred anoda, purslane, hemp sesbania, prostrate spurge, and Pennsylvania smartweed.	Flumioxazin 0.031 to 0.063 lb ai	Valor SX 1-2 oz or Valor EZ (4SC) 1 to 2 fl oz	In no-till or stale seedbed system, a minimum of 14 days must pass and a 1 in. rainfall must occur between Valor SX application and cotton planting when Valor SX is applied at 1 oz/A; 21 days must pass when applied at 1.5 to 2 oz/A. If a strip-till operation occurs between Valor SX application and cotton planting, the waiting interval can be reduced to 14 days for the 2 oz/A rate. However, strip-tillage after Valor SX will reduce or eliminate weed control in the tilled strip. Adding Valor SX to glyphosate will improve control of cutleaf eveningprimrose and wild radish. Applied at 1 oz/A, Valor SX will give 2 to 4 weeks residual control of lambsquarters, pigweed, prickly sida, spurge, and Florida pusley. At 2 oz/A, Valor SX will give 6 to 8 weeks residual control of these species. Application to cover crops or dense winter vegetation may reduce residual control. Will not control emerged horseweed. Carefully follow label direction for cleaning out the sprayer after each day's use. Generic brands of flumioxazin include Outflank and Panther.
Carolina geranium, common chickweed, curly dock, henbit, swinecress, Virginia pepperweed, wild mustard, and wild radish	Thifensulfuron 0.0156 lb ai + Tribenuron 0.0078 lb ai	Harmony Extra SG with TotalSol 50WDG 0.75 oz	Harmony Extra should be applied at least 14 days prior to planting. Add nonionic surfactant according to Harmony Extra label. Not effective on cutleaf eveningprimrose or horseweed.
Common chickweed, curly dock, dandelion, Carolina geranium, henbit, lambsquarters, pigweed species, smartweed species, velvetleaf, wild mustard, and wild radish	Rimsulfuron 0.0156 lb ai + Thifensulfuron 0.0156 lb ai	Leadoff 33.4 WDG 1.5 oz	Can be applied from late fall to 30 days prior to planting. Controls emerged winter annual weeds plus provides residual control of later emerging winter weeds. See Leadoff label for adjuvant recommendations. Can be tank mixed with glyphosate and 2,4-D. Does not substitute for Valor SX. The best fit for Leadoff is a late fall or winter application (December to early March) followed by another burndown application containing Valor SX 2 to 4 weeks prior to planting. Crusher 50 WDG is a generic containing a 1:1 ratio of rimsulfuron:thifensulfuron.

Table 5.102 - Early Preplant Burndown and Preplant Incorporated (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Carolina geranium, common chickweed, curly dock, henbit, swinecress, Virginia pepperweed, wild mustard, and wild radish	Thifensulfuron 0.008-0.013 lb ai + Tribenuron 0.008-0.013 lb ai	FirstShot SG 50WDG 0.5-0.8 oz	FirstShot should be applied at least 14 days prior to planting. Add nonionic surfactant according to FirstShot label. Weed control similar to Harmony Extra. Not effective on cutleaf eveningprimrose or horseweed. Generic brands containing a 1:1 ratio of thifensulfuron:tribenuron include Edition BroadSpec and Rapport BroadSpec.
Fair control of cocklebur, morningglory species, jimsonweed, sicklepod, prickly sida, and sesbania; good control of lambsquarters, pigweed species, purslane, and ragweed	Diuron 0.5-1 lb ai	Direx 4L 1-2 pt	Apply 15 to 45 days ahead of planting. Can improve control of certain weeds, including cutleaf eveningprimrose, when tank mixed with Gramoxone. If Cotoran is applied preemergence, reduce Cotoran rate to account for residual activity of Direx. Do not apply Di-Syston or Thimet in-furrow.
Horseweed, pigweeds, and henbit etc.	Oxyfluorfen 0.25-0.5 lb	Goal 2XL 1.0-2.0 pt	Apply Goal 2XL at least 7 days before planting cotton. Can be tankmixed with glyphosate or paraquat for control of larger winter annual broadleaf weed or annual grasses in fallow beds.

Table 5.103 - Preemergence

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Fair control of cocklebur, morningglories, jimsonweed, sicklepod, and tropic croton; good control of lambsquarters, pigweed species, prickly sida, and ragweed	Fluometuron 1.0-2.0 lb ai	Cotoran 4L 1.0-2.0 qt	Apply to soil surface after planting, before crop and weeds emerge. On light, sandy soils, low in organic matter, use no more than 1.0 lb ai/A. Not labeled for use on sand or loamy sand soils.
Fair control of cocklebur, morningglories, jimsonweed, sicklepod, prickly sida, and sesbania; good control of lambsquarters, pigweed species, purslane, and ragweed	Diuron 0.5-1 lb ai	Direx 4L 1-2 pt or Diruon 4L	Apply to soil surface after planting, before crop and weeds emerge. On light, sandy soils, low in organic matter, use no more than 0.5 lb ai/A. Not labeled for use on sand or loamy sand soils. Do not apply Di-Syston or Thimet in-furrow. May be mixed with Prowl, Reflex, Staple, or Warrant.
Annual grasses and pigweed species	Acetochlor 1.125 lb ai	Warrant 3ME 3 pt	Research to date indicates good crop tolerance. May be mixed with Cotoran, Direx, Prowl, or Reflex. Any conditions that delay emergence of cotton may cause growth reduction and uneven growth. If soil is left undisturbed, a waiting interval of 3 weeks is suggested before replanting cotton. Following a deep tillage operation (heavy enough to bring nontreated soil into the planting zone), cotton may be replanted after waiting 2 weeks.

Table 5.103 - Preemergence (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Annual grasses and many broadleaf weeds	Acetochlor 1.06 lb ai + Fomesafen 0.24 lb ai	Warrant Ultra 3.45CS 3 pt	Warrant Ultra is a premix formulation containing 2.82 lb/gal acetochlor plus 0.63 lb/gal fomesafen. Use preemergence only on coarse-textured soils. Warrant Ultra at 3 pt/A has the equivalent of 15.4 fl oz/A of Reflex. See comments for Reflex below.
Barnyardgrass, broadleaf signalgrass, carpetweed, crabgrass, fall panicum, Florida pusley, foxtails, goosegrass, johnsongrass seedlings, lambsquarters, pigweed, purslane, sandbur, Texas panicum, wild cane, shattercane	Pendimethalin 0.5-0.75 lb ai	Prowl 3.3EC 1.2-2.4 pt or Prowl H ₂ O 3.8ACS 1.1-1.6 pt	Apply at planting or up to 2 days following planting to a firm seedbed. Prowl must be activated by rainfall or irrigation, preferably within 2 days of application.
Pigweed species, eclipta, lambsquarters, eastern black nightshade, purslane, ragweed, prickly sida; partially controls spurred anoda, cocklebur, morningglories, and yellow nutsedge	Fomesafen 0.25 lb ai	Reflex 2L 1 pt	Suggested primarily for control of Palmer amaranth. Also effective on yellow nutsedge. Label restricts application to coarse-textured soils. May be mixed with Cotoran, Direx, Prowl, Staple, or Warrant. See label for specific comments on tank mixing. In a tank mix, one may consider reducing the Reflex rate to 12 fl oz/A to reduce the potential for crop injury.
Redroot pigweed, smooth pigweed, prickly sida, spotted spurge, spurred anoda, velvetleaf, and suppresses jimsonweed, ladythumb smartweed, Pennsylvania smart and several morningglory species	Pyriithiobac 0.033-0.053 lb ai	Staple LX 3.2SL 1.3-2.1 oz	Use the higher rate for harder to control weeds but do not exceed 2.1 fl oz/A and do not use on soils with less than 0.5% organic matter. Staple Herbicide may be mixed with several other preemergence herbicides (Cotoran, Direx, Karmex, or Cotton Pro) taking care not to exceed recommended rates of these herbicides for soil types. Do not apply more than 5.1 fl oz/A Staple Herbicide per acre per year.
Herbicide-resistant Palmer amaranth	Fluridone 0.15-0.3 lb ai	Brake 1.2F 16-32 fl oz	Label specifies to tank mix with another residual herbicide when Brake is applied at less than 21 fl oz/A. Suggested tank mixes include Cotoran, Direx, Reflex, or Warrant. If applied alone, Brake will be most effective at 32 fl oz/A. See label for rotational restrictions. Suggested primarily for fields infested with herbicide-resistant Palmer amaranth. Preliminary data also suggest Brake has some common ragweed activity.

Table 5.104 - Postemergence Over-the-top: Annual Grasses

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Barnyardgrass, broadleaf signalgrass, fall panicum, foxtails, johnsongrass seedlings, crabgrass, shattercane, Texas panicum, volunteer corn	Clethodim 0.094-0.25 lb ai + (see remarks)	Select 2EC 6.0-16.0 oz or Select Max 0.97EC 9.0-16.0 oz + (see remarks)	Apply to actively growing grasses at the rate and size range indicated on the label for the individual grass species. Apply with 5.0-40.0 gal of water/A and 30-60 psi. Under certain conditions use a minimum of 10.0 gal - see label. Do not use flood-type nozzles. Always add 2.0 pt/A crop oil concentrate to Select. For Select Max, add 0.25% nonionic surfactant, 1% crop oil concentrate, or 1% methylated seed oil. May be weak on goosegrass.
Barnyardgrass, broadleaf signalgrass, fall panicum, foxtails, johnsongrass, crabgrass, shattercane, Texas panicum, and volunteer corn	Sethoxydim 0.19-0.28 lb ai + crop oil concentrate	Poast 1.5EC 1.0-1.5 pt or Poast Plus 1EC 1.5-2.25 + crop oil concentrate 2.0pt	Apply to actively growing grasses at the rate and size range indicated on the label for the individual grass species with 5.0 gal of water/A and 40-60 psi. Do not use flood type nozzles. Always add 2.0 pt/A crop oil concentrate.
Barnyardgrass, broadleaf signalgrass, fall panicum, foxtails, johnsongrass seedlings, Texas panicum, goosegrass, shattercane and volunteer corn	Fluazifop-P 0.19 lb ai + crop oil concentrate or nonionic surfactant	Fusilade DX 2EC 12.0 oz + crop oil concentrate 0.5-1.0% v/v or nonionic surfactant 0.25% v/v	Apply to actively growing grasses at the rate and growth stage indicated on the label. Apply with a minimum of 10 gal of water/A and 30-60 psi. Do not use flood nozzles. Add 0.5-1.0% v/v crop oil concentrate or 0.25% v/v nonionic surfactant to the spray mixture.
Barnyardgrass, broadleaf, signalgrass, crabgrass, fall panicum, field sandbur, seedling johnsongrass, shattercane, Texas panicum, volunteer small grains	Fluazifop-P plus fenoxaprop-P 0.12-0.16 lb ai + crop oil concentrate or nonionic surfactant	Fusion 2EC 8.0-10.0 oz + crop oil concentrate 0.5-1.0% v/v or nonionic surfactant 0.25-0.5% v/v	Apply to actively growing grasses at the rate and growth stage listed on the label in 5.0-40.0 gal of water/A at 30-60 psi. Do not apply Fusion with recirculating sprayers, rope-wick applicators, controlled droplet applicators, or any similar devices. Add 0.5-1.0% v/v crop oil concentrate or 0.25-0.5% v/v nonionic surfactant to the spray mixture.
Barnyardgrass, broadleaf signalgrass, fall panicum, field sandbur, seedling johnsongrass, shattercane, Texas panicum	Quizalofop 0.034-0.069 lb ai + crop oil concentrate or nonionic surfactant	Assure II 0.88EC 5.0-12.0 oz + crop oil concentrate 1% v/v or nonionic surfactant 0.25% v/v	Apply to actively growing grasses at the rate and growth stage listed on the label. Apply with a minimum of 10.0-15.0 gal water/A and 25-60 psi. May be weak on crabgrass. See label for rate to control specific grasses.

Table 5.105 - Postemergence Over-the-top: Perennial Grasses

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Bermudagrass (wiregrass)	Clethodim 0.125-0.25 lb ai + crop oil concentrate + (sequential treatment on regrowth) Clethodim 0.125-0.25 lb ai + crop oil concentrate	Select 2EC 8.0-16.0 oz or Select Max 0.97EC 12.0-32.0 oz + (see remarks) + (sequential treatment on regrowth) Select 2EC 8.0-16.0 oz or Select Max 0.97EC 12.0-32.0 oz + (see remarks)	Apply to actively growing bermudagrass at the rate and stage indicated on the label. Apply the first application to bermudagrass with 3- to 6-inch runners. Apply regrowth treatments to bermudagrass with 3- to 6-inch runners. Always add 2.0 pt/A crop oil concentrate to Select. For Select Max, add 0.25% nonionic surfactant, 1% crop oil concentrate, or 1% methylated seed oil.
	Fluazifop-P + fenoxaprop-ethyl 0.19 lb ai + crop oil concentrate or nonionic surfactant + (sequential treatment on regrowth) Fluazifop P + fenoxaprop-ethyl 0.12 lb ai + crop oil concentrate or nonionic surfactant	Fusion 2EC 12.0 oz + crop oil concentrate 0.5-1.0% v/v or nonionic surfactant 0.25-0.5% v/v + (sequential treatment on regrowth) Fusion 2EC 8.0 oz + crop oil concentrate 0.5-1.0% v/v or nonionic surfactant 0.25-0.5% v/v	Make first application to 4- to 8-inch runners. Apply a second treatment to 4- to 8-inch runners if regrowth occurs. Use a minimum of 15.0 gal/A spray solution. Add 0.5-1.0% v/v crop oil concentrate or 0.25-0.5% v/v nonionic surfactant to the spray mixture.
	Sethoxydim 0.28 lb ai + crop oil concentrate + (sequential treatment on regrowth) Sethoxydim 0.19 lb ai + crop oil concentrate	Poast 1.5EC or Poast Plus 1EC 2.25 pt + crop oil concentrate 2.0 pt + (sequential treatment on regrowth) Poast 1.5EC 1.0 pt or Poast Plus 1EC 1.5 pt + crop oil concentrate 2.0 pt	Apply to actively growing grass. Apply first treatment to bermudagrass plants with stolons (runners) less than 6 inches in length. Apply regrowth treatments to bermudagrass plants with runners less than 4 inches in length. Add 2.0 pt/A crop oil concentrate.

Table 5.105 - Postemergence Over-the-top: Perennial Grasses (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Bermudagrass (wiregrass), Rhizome johnsongrass	Fluazifop-P 0.19 lb ai +	Fusilade DX 2EC 12.0 oz +	Apply to actively growing johnsongrass 8-18 inches high.
	crop oil concentrate or nonionic surfactant +	crop oil concentrate 0.5-1.0% v/v or nonionic surfactant 0.25-0.5% v/v +	Apply regrowth treatments when 6-12 inches high. Add 0.5-1.0% v/v crop oil concentrate or 0.25-0.5% v/v nonionic surfactant to the spray mixture. OR Apply to actively growing bermudagrass with 4- to 8-inch runners. Apply regrowth treatments to bermudagrass with a runner length of 4-8 inches. Add 0.5-1.0% v/v crop oil concentrate or 0.25-0.5% v/v to the spray mixture.
	(sequential treatment on regrowth) Fluazifop-P 0.125 lb ai +	(sequential treatment on regrowth) Fusilade DX 2EC 8.0 oz +	
	crop oil concentrate or nonionic surfactant	crop oil concentrate 0.5-1.0% v/v or nonionic surfactant 0.25-0.5% v/v	
	Quizalofop 0.07-0.08 lb ai +	Assure II 0.88EC 10.0-12.0 oz +	Apply to actively growing johnsongrass when 10 to 24 inches tall or bermudagrass up to 6-inch runners. Apply regrowth treatments to 6- to 10-inch johnsongrass, or bermudagrass with 3- to 6-inch runners. Add 0.5-1.0% v/v crop oil concentrate or 0.25-0.5% v/v nonionic sufactant to the spray mixture.
	crop oil concentrate or nonionic surfactant +	crop oil concentrate 1.0% v/v or nonionic surfactant 0.25% v/v +	
	(sequential treatment on regrowth) Quizalofop 0.05 lb ai +	(sequential treatment on regrowth) Assure II 0.88EC 10.0 oz +	
	crop oil concentrate or nonionic surfactant	crop oil concentrate 1.0 % v/v or nonionic surfactant 0.25% v/v	

Table 5.105 - Postemergence Over-the-top: Perennial Grasses (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Rhizome johnsongrass	Clethodim 0.125-0.25 lb ai + crop oil concentrate + (sequential treatment on regrowth)	Select 2EC 8.0-16.0 oz or Select Max 0.97EC 12.0-32.0 oz + (see remarks)	Apply to actively growing johnsongrass at the rate and stage indicated on the label. Apply the first application to johnsongrass 12-24 inches high. Apply regrowth treatments to 6- to 18-inch johnsongrass. Always add 2.0 pt crop oil concentrate to Select. For Select Max, add 0.25% nonionic surfactant, 1% crop oil concentrate, or 1% methylated seed oil.
	Clethodim 0.094-0.16 lb ai + crop oil concentrate	(sequential treatment on regrowth) Select 2EC 6.0-8.0 oz or Select Max 0.97EC 12.0-32.0 oz + (see remarks)	
	Fluazifop-P + fenoxaprop-ethyl 0.16-0.19 lb ai + crop oil concentrate or nonionic surfactant + (sequential treatment on regrowth)	Fusion 2EC 10.0-12.0 oz + crop oil concentrate 0.5-1.0% v/v or nonionic surfactant 0.25-0.5% v/v + (sequential treatment on regrowth)	Make first application to actively growing johnsongrass before the boot stage and a second application when regrowth is 4 to 6 inches tall. Add 0.5-1.0% v/v crop oil concentrate or 0.25-0.5% v/v nonionic surfactant to the spray mixture.
	Fluazifop-P + fenoxaprop-ethyl 0.12 lb ai + crop oil concentrate or nonionic surfactant	Fusion 2EC 8.0 oz + crop oil concentrate 0.5-1.0% v/v or nonionic surfactant 0.25-0.5% v/v	
	Sethoxydim 0.28 lb ai + crop oil concentrate + (sequential treatment on regrowth)	Poast 1.5 pt or Poast Plus 2.25 pt + crop oil concentrate 2.0 pt + (sequential treatment on regrowth)	Apply to actively growing johnsongrass. Apply first treatment to johnsongrass 15 to 20 inches high. Apply regrowth treatments to 6- to 10-inch johnsongrass.
	Sethoxydim 0.19 lb ai + crop oil concentrate	Poast 1.0 pt or Poast Plus 1.5 pt + crop oil concentrate 2.0 pt	

Table 5.106 - Postemergence: Over-the-top

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Controls most annual grasses and broadleaf weeds in conventional and reduced tillage production systems. Control or temporary suppression of many perennial weeds including bermudagrass, hemp dogbane, horsenettle, nutsedges, rhizome johnsongrass, and trumpet creeper	Glyphosate 0.75-1.0 lb ai	Numerous brands and formulations	For use only on cotton varieties designated as Roundup Ready Flex, GlyTol, Enlist, or XtendFlex. Some brands of glyphosate are not registered for use on these varieties (see labels). Glyphosate will be most effective as a component of a program that includes the use of standard preplant incorporated, preemergence, and postemergence herbicides. Adjuvant recommendations vary by glyphosate products. See labels for specification. Observe all labels regarding seasonal maximums and take extreme caution to avoid drift to adjacent vegetation.
Controls many annual broadleaf weeds and suppresses annual grasses in conventional and reduced tillage production systems. Suppression may be expected of pigweed spp. and most grasses after just a single glufosinate application.	Glufosinate 0.53-0.79 lb ai	Liberty 280 2.34L 29-43 fl oz	For use only on cotton varieties designated as LibertyLink, Enlist, or XtendFlex. Apply postemergence over-the-top to cotton at emergence until the early-bloom stage of cotton development. Flat-fan nozzles and a minimum of 15 gpa are recommended. Application time of day is important. Two hours of sunshine before a morning application is suggested. Do not apply later than 1 hour before sunset. Multiple applications are allowed. Liberty at 22 to 29 fl oz can be applied three times, with a seasonal maximum of 87 fl oz. If applied at rates greater than 29 oz, only two applications are allowed and the season total should not exceed 72 fl oz. For best results, broadleaf weeds should be 2 to 3 in. tall and grasses 1 to 2 in. tall. Liberty should not be mixed with postemergence grass herbicides, such as Assure, Fusilade, Poast, or Select. If applying Liberty and grass herbicide separately then maintain a gap of 5 days between applications. Postemergence grass control reduces when tankmix application of Liberty with either of grass herbicide, such as, clethodim, fluzifop, quizalofop, and sethoxydim is applied.

Table 5.106 - Postemergence: Over-the-top (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Controls many annual broadleaf weeds and suppresses annual grasses in conventional and reduced tillage production systems. Suppression may be expected of pigweed spp. and most grasses after just a single glufosinate application.	Glufosinate 0.55 lb ai	Liberty 280 2.34L 29 fl oz	Phytogen cultivars with the WideStrike trait can be treated with Liberty. Tolerance to Liberty in these cultivars is not complete, and varying levels of crop injury may be observed. Greater injury can be expected when Liberty is mixed with insecticides or other herbicides. Growers assume the liability of crop injury when cotton with the WideStrike trait is treated with Liberty. It is suggested that the rate not exceed 29 fl oz per application with a maximum of two applications per year. It is also suggested that Liberty not be applied beyond the 8-leaf stage of cotton and that AMS not be included in the application. See above comments concerning Liberty application to Liberty Link cultivars, including application time of day.
Many broadleaf weeds	Glyphosate 1.0 lb ae + 2,4-D 0.95 lb ae	Enlist Duo 3.3S 4.75 pt	For use only on cotton varieties designated as Enlist. Enlist Duo contains the choline salt of 2,4-D. It is the only brand of 2,4-D registered for this use. Can be applied from cotton emergence to mid-bloom. Can be applied twice postemergence; allow minimum of 12 days between applications. See website Enlisttankmix.com for approved adjuvants, drift reduction agents, and other tank mixes. See Enlist Duo federal label for details on drift management, including recommended nozzles and pressures, wind speed, boom height, temperature inversions, buffers, and susceptible plants.

Table 5.106 - Postemergence: Over-the-top (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Many broadleaf weeds	2,4-D 0.95 lb ae	Enlist One 2 pt	For use only on cotton varieties designated as Enlist. Enlist One contains the choline salt of 2,4-D. It is the only brand of 2,4-D registered for this use. May be mixed with glufosinate. Can be applied from cotton emergence to mid-bloom. Can be applied twice postemergence; allow minimum of 12 days between applications. See website Enlisttankmix.com for approved adjuvants, drift reduction agents, and other tank mixes. Can be mixed with Dual Magnum, Everprex, Moccasin, Staple LX, or Warrant for residual control; the addition of these products will increase foliar burn. See Enlist One federal label for details on drift management, including recommended nozzles and pressures, wind speed, boom height, temperature inversions, buffers, and susceptible plants.
Many broadleaf weeds	Dicamba 0.5 lb ae	Engenia 5S 12.8 fl oz or XtendiMax 2.9S 22 fl oz	For use only on cotton varieties designated as XtendFlex. Should be mixed with glyphosate. Engenia and XtendiMax contain dicamba. These are the only brands of dicamba registered for this use. Can be applied any time from cotton emergence to 7 days prior to harvest. Can be applied multiple times postemergence, not to exceed a total of 51.2 oz Engenia or 88 oz of XtendiMax. Only two postemergence applications suggested, preferably before first bloom. Separate applications by at least 7 days. Engenia, FeXapan, and XtendiMax can be mixed with glyphosate, Dual Magnum, Outlook, Warrant, and various other brands of Group 15 herbicides; the addition of these products will increase foliar burn. See websites Engeniatankmix.com and xtendimaxapplicationrequirements.com for approved adjuvants, drift reduction agents, and other tank mixes. See federal labels and supplemental labels for use in dicamba-tolerant cotton for details on drift management, including recommended nozzles and pressures, wind speed, boom height, temperature inversions, buffers, and susceptible plants. Applicators must hold a VA pesticide license and receive annual training to use Engenia and Xtendimax

Table 5.106 - Postemergence: Over-the-top (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Large crabgrass, goosegrass, fall panicum, foxtails and suppression of yellow nutsedge	S-Metolachlor 0.96-1.25 lb ai	Dual Magnum 7.62EC 1.0-1.3 pt	Apply over-the-top postemergence or directed to the soil surface to cotton at least 3 in tall. Applications should be prior to weed emergence or after clean cultivation since Dual Magnum does not control emerged weeds. At least 1/2 inch of rainfall is required within 10 days after application. If rainfall does not occur, a shallow, uniform incorporation will improve control. Over-the-top postemergence applications should be made not later than 100 days before harvest and directed postemergence applications may be made not later than 80 days before harvest. Can be applied with glyphosate on Roundup Ready Flex, GlyTol, Enlist, or XtendFlex and glufosinate on LibertyLink, Enlist, or XtendFlex cotton varieties. Do not add additional spray adjuvants, surfactants, fertilizers, or their additives to these tank mixtures if applied over-the-top, or unacceptable cotton injury may occur. Follow instructions on the Dual Magnum and glyphosate labels for rates, application methods, and application timing restrictions.
Controls most annual grasses and broadleaf weeds in conventional and reduced tillage production systems. Control or temporary suppression of many weeds including hemp dogbane, yellow nutsedge, and rhizome johnsongrass. Provides residual control of large crabgrass, goosegrass, fall panicum, foxtails, and the suppression of yellow nutsedge.	[Glyphosate + S-metolachlor] 0.70-0.98 lb ae + 0.94-1.31 lb ai	Sequence 5.25L 2.5 to 3.5 pt	For use only on cotton varieties designated as Roundup Ready Flex, GlyTol, Enlist, or XtendFlex. Apply postemergence over-the-top to cotton that is 3 inches tall to the four-leaf stage of cotton development. Do not apply later or severe crop injury will occur, including yield loss. Do not exceed 2.5 pt/A of Sequence per application or 3.5 pt/A of Sequence per growing season. If tank-mixing or applications follow other s-Metolachlor products, do not exceed 1.9 lb s-Metolachlor ai/A per season on coarse-textured soils. Over-the-top postemergence applications should not be made later than 100 days before harvest. At least 1/2 inch of rainfall is required within 7 days after application to activate the s-Metolachlor. Do not add additional spray adjuvants, surfactants, or fertilizers to Sequence when applied postemergence over-the-top, or unacceptable cotton injury may occur. Extreme care must be used to avoid drift to adjacent crops or other desirable vegetation. Do not graze or feed treated cotton. See label.

Table 5.106 - Postemergence: Over-the-top (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Fall panicum, crabgrass, foxtails, goosesgrass, pigweeds, carpetweed, purslane, lambsquarters, nightshade, waterhemp	Acetochlor 0.9375-1.5 lb ai	Warrant 3ME 1.25-2 qts/A	Apply this product postemergence to cotton and preemergence to weeds. This product will not control emerged weeds. Apply when the crop is small or direct spray to the soil surface. Can be applied with glyphosate on Roundup Ready Flex, GlyTol, Enlist, or XtendFlex and glufosinate on LibertyLink, Enlist, or XtendFlex cotton varieties. DO NOT exceed 4 qt Warrant/A per season when making a second application. DO NOT make postemergence applications using a sprayable fluid fertilizer. DO NOT graze treated area or feed treated forage to livestock following application of this product. If replanting cotton into previously applied Warrant, wait at least 3 weeks prior to replanting cotton in no-till or 2 weeks if fresh soil is brought into planting zone via ripper shanks.
Cocklebur and suppression of yellow nutsedge	MSMA 0.75-1.0 lb ai	Various brands and formulations 2.66 pt MSMA (6.0 lb/gal formulations)	May be applied over-the-top of crop and weeds when cotton is 3 to 6 inches tall. Crop response may include stunting, stem reddening and delay of maturity. Check label for surfactant recommendations.
Cocklebur, jimsonweed, pigweed	Fluometuron 1.0 ai	Cotoran 4L 1.0 qt	May be applied over-the-top of crop when cotton is 3 inches, high to layby. Weeds should be 2 inches or less. For use only where crop loss due to weeds is likely. Moderate to severe crop injury may occur and may include maturity delay and yield reduction.
Pigweed species, Pennsylvania smartweed, spurred anoda, velvetleaf, jimsonweed. May be weak against tall morningglory, common cocklebur, and prickly sida	Pyrithiobac 0.065-0.095 lb ai + 0.25-0.50% nonionic surfactant	Staple LX 3.2SL 2.6-3.8 oz + nonionic surfactant at 1.0-2.0 qt/100.0 gal	Can be applied with glyphosate on Roundup Ready Flex, GlyTol, Enlist, or XtendFlex varieties or glufosinate on LibertyLink, Enlist, or XtendFlex varieties. Apply 2.6-3.8 oz Staple LX with 0.25-0.50% v/v (1.0-2.0 qt/100.0 gal) nonionic surfactant to control small annual broadleaf weeds listed. Staple may be applied postemergence broadcast over-the-top of cotton, in a band over-the-top of cotton, or post-directed to cotton but over-the-top of weeds. Make applications to small, actively growing weeds after cotton has a true leaf. Cotton may be injured from Staple LX applied under cool, wet conditions. For best control, rainfall should not occur for 4 hours. Do not exceed 5.1 fl oz/A per year. See label.

Table 5.106 - Postemergence: Over-the-top (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Bristly starbur, common cocklebur, coffee senna, volunteer corn (non-IT/IR), Florida beggarweed, hemp sesbania, common lambsquarters, morningglory spp., common ragweed, redweed, sicklepod, velvetleaf, volunteer soybean (non-STs), wild poinsettia, yellow nutsedge.	Trifloxysulfuron-sodium 0.0047-0.0070 lb ai + nonionic surfactant 0.25% v/v	Envoke 75WGD 0.10-0.15 oz + nonionic surfactant 1.0 qt/100.0 gal	Can be applied with glyphosate on Roundup Ready Flex, GlyTol, Enlist, or XtendFlex varieties or glufosinate on LibertyLink, Enlist, or XtendFlex varieties. Apply 0.10-0.15 oz/A Envoke with 0.25% v/v (1 qt/100.0 gal) nonionic surfactant to control small annual broadleaf weeds listed. Envoke may be applied postemergence broadcast over-the-top of cotton, or post- directed to cotton but over-the-top of weeds. Make applications to small, actively growing weeds after cotton has a minimum of 5 true leaves. Cotton may be injured from Envoke applied under cool, wet conditions and if cotton is less than in the 5-leaf stage of growth. For best control, rainfall should not occur for 3 hours. The higher rates of Envoke may be required to adequately control yellow nutsedge and velvetleaf. Envoke tank mixed with glyphosate on Roundup Ready Flex, GlyTol, or XtendFlex cotton can cause injury by way of boll loss, delayed maturity, and/or loss of yield. Sequential Envoke applications must be 14 days apart and should be used only for a salvage treatment.
Compared to Envoke alone, mix is better on jimsonweed and spurred anoda. Compared to Staple alone, mixture is better on common ragweed, common lambsquarters, tall morningglory, and sicklepod.	Trifloxysulfuron 0.0047-0.0070 lb + Pyriithiobac 0.033-0.053 lb + nonionic surfactant 0.25% v/v	Envoke 75 WGD 0.1-0.15 oz + Staple LX 3.2SL 1.3-2.1 fl oz + nonionic surfactant 0.25% v/v	Postemergence overtop of cotton with at least 5 true leaves. Use a minimum of 10 gal water/A and apply to cotton with at least 5 true leaves. Occasional yellowing of cotton leaves can occur but yields are not affected.

Table 5.107 - Postemergence Directed

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Cocklebur, yellow nutsedge, purple nutsedge	MSMA 2.0 lb ai	Various brands and formulations 2.66 pt MSMA (6.0 lb/gal formulations)	Apply as a directed spray to cotton at least 3 inches tall. Do not apply after first blooms appear. Refer to the product label to determine if surfactant should be added. Two applications/season may be made. May be tank mixed with fluometuron.
Cocklebur, jimsonweed, lambsquarters, morningglory, pigweed, ragweed, tropic croton	Diuron 0.8-1.2 lb ai + MSMA 2.0 lb ai	Direx 4L 1.6-2.4 pt + Various brands and formulations 2.66 pt MSMA (6.0 lb/gal formulations)	Apply as a directed spray to cotton at least 12 inches tall. Rate varies by soil type. See application precautions on label. Add nonionic surfactant at 1 to 2 quarts per 100 gal spray solution or crop oil at 1 gal per 100 gal spray solution. See label for rotational restrictions. Do not apply MSMA after first bloom. Aim (1 oz/A) or Cobra (6 to 8 oz/A) may be added to improve control of larger morningglory. Cotton should be at least 16 inches when applying Aim. Do not allow Aim to contact green stem tissue.
Cocklebur, jimsonweed, lambsquarters, morningglory, pigweed, ragweed, tropic croton, yellow nutsedge, and most annual grasses	Fluometuron 1.0-2.0 lb ai + MSMA 2.0 lb ai + S-metolachlor 0.95-1.27 lb ai	Cotoran 4L 1.0-2.0 qt + Various brands and formulations 2.66 pt MSMA (6.0 lb/gal formulations) + Dual Magnum 7.62EC 1-1.33 pt	Apply as directed spray to cotton at least 3 inches tall up to first bloom. Do not apply MSMA after first bloom. Add surfactant according to Cotoran label. Dual Magnum gives residual control of annual grasses and pigweed and suppresses yellow nutsedge. See comments for Cotoran + MSMA.
Cocklebur, jimsonweed, lambsquarters, morningglory, pigweed, ragweed, tropic croton	Fluometuron 1.0 lb ai	Cotoran 4L 1.0 qt	Apply as a directed spray. Apply with a nonionic surfactant at 2.0 qt/100 gal spray solution. Do not apply within 60 days of harvest. See label for crop rotation.

Table 5.107 - Postemergence Directed (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Cocklebur, lambsquarters, morningglory species, nightshade species, pigweed species, velvetleaf, spurred anoda, purslane, hemp sesbania, prostrate spurge, Pennsylvania smartweed, purple nutsedge, yellow nutsedge	Flumioxazin 0.064 lb ai + MSMA 2.0 lb ai	Valor SX 51WDG 2 oz + MSMA Various brands and formulations 2.66 pt MSMA (6.0 lb/gal formulations)	Apply as directed spray only to cotton at least 16 inches tall. Direct the spray to the lower 2 inches of the cotton stem. Do not allow spray solution to contact green portion of stem. Add nonionic surfactant at 1 qt per 100 gal spray solution. Do not use crop oil concentrate, methylated seed oil, organo-silicant adjuvants, or any adjuvant product containing any of these. Do not apply MSMA after first bloom. No rotational restrictions of concern in Virginia. May be applied under a hood on cotton at least 6 inches tall. Do not allow spray solution to contact cotton
Cocklebur, lambsquarters, morningglory species, nightshade species, pigweed species, velvetleaf, spurred anoda, purslane, hemp sesbania, prostrate spurge, Pennsylvania smartweed, purple nutsedge, yellow nutsedge, most annual grass species	[Flumioxazin + Pyroxasulfone] 0.143 lb ai + MSMA 2.0 lb ai	Fierce 76WDG 3 oz + MSMA Various brands and formulations 2.66 pt MSMA (6.0 lb/gal formulations)	Flumioxazin + pyroxasulfone is a premix product. Can be applied with hooded sprayer after cotton is at least 6 inches tall. Do not allow spray solution to contact cotton. Can be applied with layby applicator after cotton is at least 16 inches tall, but do not contact more than the lower 2 inches of cotton stalk. Add non-ionic surfactant according to label. Do not use crop oil concentrate, methylated seed oil, organo-silicant adjuvants, or any adjuvant product containing any of these. Do not apply MSMA after first bloom.
Cocklebur, jimsonweed, lambsquarters, morningglory, pigweed, ragweed, tropic croton, yellow nutsedge, and most annual grasses	Fluometuron 1.0-2.0 lb ai + MSMA 2.0 lb ai + S-metolachlor 0.95-1.27 lb ai	Cotoran 4L 1.0-2.0 qt + Various brands and formulations 2.66 pt MSMA (6.0 lb/gal formulations) + Dual Magnum 7.62EC 1-1.33 pt	Apply as directed spray to cotton at least 3 inches tall up to first bloom. Do not apply MSMA after first bloom. Add surfactant according to Cotoran label. Dual Magnum gives residual control of annual grasses and pigweed and suppresses yellow nutsedge. See comments for Cotoran + MSMA.
Cocklebur, ragweed, jimsonweed, lambsquarters, pigweed, prickly sida, smartweed, tropic croton, velvetleaf	Lactofen 0.2 lb ai + MSMA 2.0 lb ai	Cobra 2EC 12.5 oz + MSMA (6 lb/gal 2.66 pt formulations)	Apply to cotton at least 6 inches tall. Apply with nonionic surfactant (2.0 pt/100 gal spray mix) or crop oil concentrate (0.5-1.0 pt/A). Apply only with precision-directed spray equipment. Make only one application of Cobra/ season. ¹ Do not apply MSMA after first bloom.

Table 5.107 - Postemergence Directed (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Cocklebur, ragweed, jimsonweed, lambsquarters, pigweed, prickly sida, smartweed, tropic croton, velvetleaf	Lactofen 0.094-0.2 lb ai + Diuron 0.4-0.6 lb ai + MSMA 2.0 lb ai	Cobra 2EC 6-12.5 oz + Direx 4F 0.8-1.2 pt + Various brands and formulations 2.66 pt MSMA (6.0 lb/gal formulations)	Apply as directed spray or with hooded sprayer. Cotton should be at least 12 inches tall. See Cobra label for weeds controlled and directions on weed size and application rates. Add 1 qt per acre crop oil concentrate. See rotational restrictions on Direx label. Do not apply MSMA after first bloom. The herbicide combinations with MSMA do not need an additional surfactant if the MSMA already contains it. If not, then add it according to herbicide label directions.
Cocklebur, ragweed, jimsonweed, lambquarters, pigweed, prickly sida, smartweed, tropic croton, morningglory (suppression)	Prometryn 0.5-0.65 lb ai + MSMA 2.0 lb ai	Caparol 4L 1.0-1.3 pt or Cotton-Pro 4L 1.0-1.3 pt + Various brands and formulations 2.66 pt MSMA (6.0 lb/gal formulations)	Apply to cotton at least 6 inches tall. Apply only with precision -directed spray equipment. ¹ Aim (1 oz/A) or Cobra (6 to 12.5 oz/A) may be added to improve control of larger morningglory. Cotton should be at least 16 inches when applying Aim. Do not allow Aim to contact green stem tissue. Do not apply MSMA after first bloom.
Bristly starbur, common cocklebur, coffee senna, volunteer corn (non-IT/IR), Florida beggarweed, hemp sesbania, johnsongrass (seedling), common lambsquarters, morningglory spp., smooth pigweed, redroot pigweed, common ragweed, redweed, sicklepod, velvetleaf, volunteer soybean (non-STs), wild poinsettia, yellow nutsedge	Prometryn 0.790-1.185 lb ai + Trifloxysulfuron-sodium 0.0070-0.0105 lb ai + MSMA 2.0 lb ai	Various brands and formulations 2.66 pt MSMA (6.0 lb/gal formulations)	Apply 1.0-1.5 lb/A Suprend + MSMA to control small annual broadleaf weeds listed and provide some residual control of these weeds. Suprend must be applied post-directed to cotton but over-the-top of weeds. Apply to cotton at least 6 inches tall and only with precision-directed spray equipment. Sequential Suprend applications must be at least 14 days apart. Do not exceed 2.7 lbs/A of Suprend per growing season from all applications. Do not exceed a total of 0.0188 lb ai/A of trifloxysulfuron-sodium per growing season resulting from all applications of Suprend or Envoke. Do not exceed a total of 5.15 lb ai/A of prometryn per growing season resulting from all applications of Suprend, Caparol 4L, or Cotton-Pro 4L. If these totals for trifloxysulfuron-sodium and/or prometryn are exceeded, injury to cotton may result in addition to alterations in crop rotation restriction intervals. Do not apply MSMA after first bloom.

Table 5.107 - Postemergence Directed (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae	Glyphosate See labels	Roundup Ready Flex, GlyTol LibertyLink, or XtendFlex cultivars only. Glyphosate alone can be directed up to 7 days prior to harvest. When using glyphosate alone, contact with cotton is not of concern; the primary reason to direct is to obtain better coverage of weeds under the crop canopy. Use of other herbicides, in addition to glyphosate, is recommended to aid in resistance management. When tank mixing, follow directions on the label of tank mix partner concerning cotton size for application, application directions, and rotational restrictions. Glyphosate-resistant Palmer amaranth and common ragweed are present in Virginia.
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + Acetochlor 1.125 lb	Glyphosate See labels + Warrant 3ME 3 pt	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Can be directed up to first bloom. See comments for glyphosate applied alone. Warrant does not control emerged weeds, but it does provide residual control of pigweed and most annual grasses.
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + Carfentrazone 0.016-0.024 lb	Glyphosate See labels + Aim 2EC 1-1.5 oz	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Cotton should be at least 16 inches tall. Extreme care should be exercised in application. See directions and precautions on Aim label. Contact on green stem tissue will lead to severe injury. Add crop oil concentrate according to label. See comments on Aim label concerning sprayer cleanout. Aim will improve control of larger morningglory. See comments for glyphosate alone.
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + Dimethenamid-P 0.56-0.75 lb	Glyphosate See labels + Outlook 6EC 12-16 oz	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Can be directed to cotton up to mid-bloom. Outlook does not control emerged weeds, but it does provide residual control of most annual grasses and pigweed. Suggested rates are 12 oz on coarse soils, 14 oz on medium soils, and 16 oz on fine soils. See comments for glyphosate alone.

Table 5.107 - Postemergence Directed (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + Diuron 0.5-0.75 lb ai	Glyphosate See labels + Direx 4L 1-1.5 pt	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Use 1 pt of Direx on cotton 8 to 12 inches tall. Increase rate to 1.5 pt on cotton greater than 12 inches. Add surfactant according to label of glyphosate brand used. Compared to glyphosate alone, this combination controls larger morningglories and provides residual control of small-seeded broadleaves, such as pigweed. Tank mix may give less grass control of larger grasses than glyphosate alone under dry conditions. See Direx label for rotational restrictions. See comments for glyphosate alone.
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + Flumioxazin 0.031-0.063 lb	Glyphosate See labels + Valor SX 51WDG 1-2 oz or Valor EZ (4SC) 1-2 fl oz	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Cotton should be at least 16 inches tall. Direct the sprayer to the lower 1 to 2 inches of the cotton stem; minimize cotton contact as much as possible. Do not allow spray solution to contact green portion of stem. Add nonionic surfactant at 1 qt per 100 gal spray solution. DO NOT use crop oil concentrate, methylated seed oil, organo-silicant adjuvants, or adjuvant products containing any of these. No rotational restriction of concern in Virginia. Compared with glyphosate alone, the combination will give better control of larger morningglories plus residual control of susceptible broadleaf weeds. May be applied under a hood on cotton at least 6 inches tall. Do not allow spray solution to contact cotton. See comments for glyphosate alone.

Table 5.107 - Postemergence Directed (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + [Flumioxazin + pyroxasulfone] 0.143 lb ai	Glyphosate See labels + Fierce 76WDG 3 oz or Fierce EZ (3.04SC) 6 fl oz	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Fierce and Fierce EZ are premixes containing flumioxazin plus pyroxasulfone. Can be applied with hooded sprayer after cotton reaches 6 inches in height. Do not allow spray solution to contact cotton. Can be applied with layby applicator after cotton is at least 16 inches tall, but do not contact more than lower 2 inches of cotton stalk. Add non-ionic surfactant according to Fierce label. Do not use crop oil, methylated seed oil, organo-silicant adjuvants or adjuvant products containing any of these. See comments for glyphosate alone.
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + Fomesafen 0.25-0.375 lb ai	Glyphosate See labels + Reflex 2L 1-1.5 pt	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Use as a layby application to cotton with a minimum of 4 inches of bark on the stem. Add surfactant or crop oil according to the Reflex label. May include Caparol, Direx, Dual Magnum, Envoke, Layby Pro, or Suprend in the mixture. Do not use Reflex at layby if Reflex was used preemergence. See comments for glyphosate alone.
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + Prometryn 0.5-1 lb ai	Glyphosate See labels + Caparol 1-2 pt	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Direct to cotton at least 6 to 8 inches tall. Use 1 to 1.3 pt of Caparol on cotton 6 to 12 inches tall; rate can be increased to 2 pt on cotton at least 16 inches tall. Add surfactant according to glyphosate label. See precautions and rotational restrictions on Caparol label. Compared to glyphosate alone, this combination will improve control of larger morningglory and provide residual control of small-seeded broadleaves, such as pigweed. This mixture will give less control of larger grasses than glyphosate alone under drier conditions. See comments for glyphosate alone.

Table 5.107 - Postemergence Directed (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + Pyroxasulfone 0.040-0.112 lb ai	Glyphosate See labels + Warrant 3ME 3 pt	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Zidua is labeled at a rate of 0.75 to 1.5 oz/A on coarse- and medium-textured soils and 1.5 to 2.1 oz/A on fine-textured soils. Do not use on soils with greater than 10% organic matter. Avoid contact with cotton foliage. Apply postemergence directed when cotton is from 5-leaf stage to beginning of bloom stage. Do not apply overtop. Zidua does not control emerged weeds but gives residual control of many annual grasses and pigweed species. See comments for glyphosate alone.
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + Pyroxasulfone + Carfentrazone-ethyl 0.043-0.119	Glyphosate See labels + Anthem Flex (4 SE) 1.4 to 3.8 fl oz	Anthem flex contains pyroxasulfone plus carfentrazone. Apply as a directed spray only to cotton that is a minimum of 6 inches in height. Hooded or shielded sprayers should be used when cotton is less than 6 nodes to avoid contact with green tissue. Apply layby treatments as a directed spray to cotton 12 inches or greater when stem has sufficient bark of at least 4 inches in development. Direct spray solution to base of cotton plant for minimal contact to green stem tissue or foliage. Follow label directions for weed size and addition of surfactant. See Anthem Flex label for maximum application rates per season and rotational restrictions.
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + S-metolachlor 0.95-1.27 lb ai	Glyphosate See labels + Dual Magnum 1-1.33 pt	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Can be applied to cotton 3 inches tall through layby. Dual Magnum does not improve control of emerged weeds, but it can give residual control of annual grasses, pigweed species, and spreading dayflower plus suppression of yellow nutsedge. Do not apply to sand or loamy sand soils. See comments for glyphosate alone.

Table 5.107 - Postemergence Directed (cont.)

Weed problem	Chemical rate per acre	Product per acre	Remarks and Precautions
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	[Glyphosate + S-metolachlor] 0.70 lb ae + 0.94 lb ai	Sequence 5.25L 2.5 pt	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Glyphosate alone can be directed up to 7 days prior to harvest. When using glyphosate alone, contact with cotton is not of concern; the primary reason to direct is to obtain better coverage of weeds under the crop canopy. Use of other herbicides, in addition to glyphosate, is recommended to aid in resistance management. When tank mixing, follow directions on the label of tank mix partner concerning cotton size for application, application directions, and rotational restrictions. Glyphosate-resistant Palmer amaranth and common ragweed are present in Virginia.
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + [Prometryn + Trifloxysulfuron] 0.8-1 + 0.007-0.0088 lb ai	Glyphosate See labels	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Direct to cotton at least 6 to 8 inches tall. Add surfactant according to glyphosate label. See precautions and rotational restrictions on Suprend label. Compared to glyphosate alone, this combination will improve control of larger morningglory and nutsedge, and provide residual control of small-seeded broadleaf weeds, such as pigweed. This mixture may give less control of larger grasses than glyphosate alone under drier conditions. See comments for glyphosate alone.
Annual grasses, broadleaf weeds, nutsedge, suppression of perennial weeds	Glyphosate 0.75-1.13 lb ae + Trifloxysulfuron 0.0047-0.0094 lb ai	Glyphosate See labels + Envoke 75WDG 0.1-0.2 oz	Roundup Ready Flex, GlyTol LibertyLink, Enlist, or XtendFlex cultivars only. Direct to cotton from 6 inches tall through layby. Add nonionic surfactant according to the Envoke label. Compared to glyphosate alone, the combination is more effective on nutsedge and morningglory and provides residual control of susceptible broadleaf weeds. See comments for glyphosate alone.

Table 5.108 - Relative Effectiveness of Herbicides for Grass Weed Control in Cotton¹

	Goosegrass	Broadleaf signalgrass	Crabgrass	Fall panicum	Foxtails	Johnsongrass (seedling)	Johnsongrass (rhizome)	Texas panicum	Purple & Yellow nutseidge	Shattercane	Bermudagrass
<i>Preplant Incorporated</i>											
Prowl	G	G	E	G	E	G	P	G	N	G	P
Treflan	G	G	E	G	E	G	P	G	N	G	P
<i>Preemergence</i>											
Brake + Reflex	G	F-G	G	-	-	-	N	P	P-G	-	N
Brake + Cotoran	G	P	G	F	F-G	P	N	P	N	-	N
Cotoran	F-G	P	F-G	F	G	P	P	P	P	P	P
Direx	F	P	F-G	F	F-G	P	P	P	P	P	P
Reflex	-	F-G	F-G	-	-	-	-	F	P-G	F	N
Staple LX	P-F	P	P	P-F	P	F-G	N	N	F	-	N
Warrant	E	G	E	E	E	P-F	N	P-F	P	N	N
Warrant Ultra	E	G	E	E	E	P-F	N	P-F	P	N	N
<i>Postemergence/Postemergence Directed</i>											
Assure II/Assure II	E	E	F	E	E	E	E	E	N	E	G
Caparol/Cotton-Pro	P	P	P	P	P	P	P	P	P	P	P
Cobra	P	P	P	P	P	P	P	P	P	P	P
Cotoran	P	P	P	P	P	P	P	P	P	P	P
Dual Magnum ²	E	G	E	G-E	E	F	N	P-F	F	P-F	N
Enlist Duo	E	E	E	E	E	E	G	P-F	F-G	E	F
Engenia/XtendiMax + Glyphosate	E	E	E	E	E	E	G	E	F-G	E	F
Envoke	P	P	P	P	P	P	N	P	P-G	P	N
Fusilade	E	G-E	G	E	E	E	G-E	G	N	E	G-E
Fusion	E	E	G	E	E	E	G	G	N	E	G
Layby Pro	G-E	G-E	G-E	G-E	G-E	P	P	G-E	N	P	N
Liberty 280	G	G	G	G	G	G	P-G	G	P-G	F	P
Linex	P	P	P	P	P	P	P	P	N	P	N
MSMA/DSMA	G	G	G	G	G	G	F	P-F	F-G	G	P
Poast	E	E	G	E	E	E	G	E	N	E	F-G
Glyphosate	E	E	E	E	E	E	G	E	F-G	E	F
Select Max	F	E	G	E	E	E	G	E	N	E	G
Sequence	E	E	E	E	E	E	G	E	F-G	E	P-F
Staple LX	N-P	N-P	N-P	N-P	N-P	N-P	N-P	N-P	N-F	N-P	N-P
Warrant ²	E	G	E	E	E	P-F	N	P-F	P	N	N
Zidua ²	E	G	E	G-E	E	F	N	F	P-F	P-F	N

¹E (Excellent) = 90 to 100 percent control, G (Good) = 80 to 90 percent control, F (Fair) = 60 to 80 percent control, P (Poor) = 20 to 60 percent control, N (None) = less than 20 percent control.

²Dual Magnum, Warrant, and Zidua will not control emerged weeds. These products provide residual control only.

Table 5.109 - Relative Effectiveness of Herbicides for Broadleaf Weed Control in Cotton¹

	Cocklebur	Jimsonweed	Lambsquarters	Morningglory (annual spp.)	Pigweed	Tropic Croton	Common Ragweed	Sicklepod	Smartweed	Spurred anoda	Prickly sida or teaweed	Velvetleaf
<i>Preplant Incorporated</i>												
Prowl	N	N	G	P	G	P	N	N	P	N	N	P-F
Treflan	N	N	G	P	G	P	N	N	P	N	N	N
<i>Preemergence</i>												
Brake + Reflex	G	G	E	F	E	G	G	P	-	G	-	-
Brake + Cotoran	G	G	E	G	E	F-G	E	G	G	G	G	F
Cotoran	F	F	E	F	G	F	G	F	F	F	F-G	F
Direx	F	G	E	F	G	F-G	G	F	G	F	F	P-F
Reflex	G	G	E	P-F	E	F-G	G	P	-	-	-	-
Staple LX	P	F-G	G	P-F	G	F-G	N-P	P-F	G	G	E	E
Warrant ²	N	N	P-F	N	E	N	P	N	N	N	P	N
Warrant Ultra	G	-	E	P-F	E	F-G	G	P	-	-	-	-
<i>Postemergence/Postemergence Directed</i>												
Aim	G	F	G	G	G	-	P	N-P	G	G	P	G
Assure II/Assure II	N	N	N	N	N	N	N	N	N	N	N	N
Caparol/ Cotton-Pro	E	F-G	G	F	G	G	G-E	F	G	P	F-G	F
Cobra	E	G-E	P-F	P-F	E	F-G	G	P-F	F	F	E	G
Cotoran	E	F-G	G	F	G	P-F	G-E	F	G	P	F-G	P
Dual Magnum ²	N	N	P-F	N	E	N	P	N	N	N	N	N
Enlist Duo	E	E	E	E	E	E	E	E	G	E	G	E
Engenia/XtendiMax + glyphosate	E	E	E	E	E	E	E	E	E	E	G	E
Envoke	E	E	G-E	E	G-E	P-G	G-E	E	-	P-F	F-G	G
Fusilade	N	N	N	N	N	N	N	N	N	N	N	N
Fusion	N	N	N	N	N	N	N	N	N	N	N	N
Liberty 280	E	E	G-E	E	F-G	E	E	E	E	G-E	E	G-E
Layby Pro	G-E	G	G-E	G-E	G-E	F-G	G-E	G-E	G-E	P-F	G-E	G-E
Linex	G	G	G	F-G	G-E	P-F	F-G	G	F	P	F-G	P-F
MSMA/DSMA	E	F	P-F	P	P-F	P-F	F	P	P	P	P	P
Poast	N	N	N	N	N	N	N	N	N	N	N	N
Glyphosate	E	E	F-G	F	G-E	G	F	G-E	F	G	F-G	G
Select Max	N	N	N	N	N	N	N	N	N	N	N	N
Sequence	E	E	F-G	F	G-E	G	F	G-E	G	G	F-G	G
Staple LX	G-E	E	P	G	E	N	P	N-P	G-E	F-G	F-G	E
Valor	G	F	G	G	G	-	P	N-P	G	G	P	G
Warrant ²	N	N	P-F	N	E	N	P	N	N	N	P	N
Zidua ²	N	F	F-G	N	E	N	P-F	N	F	N	N	P

¹E (Excellent) = 90 to 100 percent control, G (Good) = 80 to 90 percent control, F (Fair) = 60 to 80 percent control, P (Poor) = 20 to 60 percent control, N (None) = less than 20 percent control.

²Dual Magnum, Warrant, and Zidua will not control emerged weeds. These products provide residual control only.

Table 5.110 - Burndown Herbicides for Stale Seedbed and Conservation Tillage Cotton for Application 30 to 45 Days Prior to Planting

Weed Species/ Cover Crop	Herbicide & Rate per Acre				
	2,4D ¹ 1.0 pt	Gramoxone SL 3.0 pt	Glyphosate (see labels for rates)	Harmony Extra ² 0.5 oz	Valor ³ 1.0-1.5 oz
Annual grasses	N	G-E	E	P	P
Carolina geranium	P-F	G-E	P-F	G	G
Chickweed, common	P	E	G	E	P
Curly dock	F-G	N	P-F	G	P
Cutleaf eveningprimrose	G	P	P	F	G
Henbit	P	G	G	E	F-G
Horseweed (marestail)	P-F	P	G	G	P
Wheat/rye	N	E	E ⁴	P	P
Wild mustard	G-E	P-F	F	G	F
Wild radish	G-E	P-F	F	G	F

E (Excellent) = 90 to 100 percent control, G (Good) = 80% to 90%, F (Fair) = 60 to 80%, P (Poor) = 20 to 60%, N (None) = less than 20%.

¹Apply at least 30 days prior to planting.

²Apply at least 45 days prior to planting.

³Apply at least 30 days prior to planting (tank mixed with glyphosate products).

Table 5.111 - Burndown Herbicides for Stale Seedbed and Conservation Tillage Cotton for Application 7 to 21 Days Prior to Planting

Weed Species/Cover Crop	Herbicide & Rate per Acre		
	Clarity ¹ 8.0 oz	Gramoxone SL 3.0 pt	Glyphosate (see labels for rates)
Annual grasses	N	G-E	E
Carolina geranium	G	G-E	P-F
Chickweed, common	P-F	E	G
Curly dock	F-G	N	P-F
Cutleaf eveningprimrose	F-G	P	P
Henbit	F	G	G
Horseweed (marestail)	F	P	G
Wheat/rye	N	E	E
Wild mustard	F	P-F	F
Wild radish	F	P-F	F

E (Excellent) = 90 to 100 percent control, G (Good) = 80% to 90%, F (Fair) = 60 to 80%, P (Poor) = 20 to 60%, N (None) = less than 20%.

¹Following application of Clarity, a minimum accumulation of 1 in rainfall or irrigation water and a waiting interval of 21 days is required prior to planting cotton.

Table 5.112 - Application Rates and Perennial Grass Sizes for Treatment with Assure, Fusilade DX, Fusion, Poast, Poast Plus, Select¹, and Select Max¹

(Rain-free period is 1 hour for each herbicide listed below.)

Herbicide	Weed	Weed Size and Herbicide Rate (oz/A)	
		First Application	Second Application ²
Assure II	Rhizome johnsongrass	10- to 24-inch tall 5.0 oz	6- to 10-inch tall 5.0 oz
	Bermudagrass	up to 6-inch runners 10.0-12.0 oz	up to 6-inch runners 7.0 oz
Fusilade DX	Rhizome johnsongrass	8- to 18-inch tall 12.0 oz	6- to 12-inch tall 8.0 oz
	Bermudagrass	4- to 8-inch runners 12.0 oz	4- to 8-inch runners 8.0 oz
Fusion	Rhizome johnsongrass	8- to 18-inch tall 10.0-12.0 oz	6- to 12-inch tall 8.0 oz
	Bermudagrass	4- to 8-inch runners 12.0 oz	4- to 8-inch runners 8.0 oz
Poast	Rhizome johnsongrass	15- to 25-inch tall 24.0 oz	6- to 12-inch tall 16.0 oz
	Bermudagrass	6-inch runners 24.0 oz	1- to 4-inch runners 16.0 oz
Poast Plus	Rhizome johnsongrass	15- to 25-inch tall 36.0 oz	6- to 12-inch tall 24.0 oz
	Bermudagrass	6-inch runners 36.0 oz	1- to 4-inch runners 24.0 oz
Select	Rhizome johnsongrass	12- to 24-inch tall 8.0-16.0 oz	6- to 18-inch tall 6.0-8.0 oz
	Bermudagrass	3- to 6-inch runners 8.0-16.0 oz	3- to 6-inch runners 8.0-16.0 oz
Select Max	Rhizome johnsongrass	12- to 24-inch tall 12.0-32.0 oz	9.0-24.0 oz
	Bermudagrass	3- to 6-inch runners 12.0-32.0 oz	12.0-32.0 oz

¹Taken from product labels.²Make second application only if needed to control regrowth or new plants. Size refers to regrowth or new plants.

Table 5.113 - Application Rates and Annual Grass Sizes for Treatment with Assure II, Fusilade DX, Fusion, Poast, Poast Plus, Select¹, and Select Max¹

(Rain-free period is 1 hour for each herbicide listed below.)

Species	Poast		Poast Plus		Fusilade DX		Fusion		Assure II		Select		Select Max	
	Height (in.)	Rate (oz/A)	Height (in.)	Rate (oz/A)	Height (in.)	Rate (oz/A)	Height (in.)	Rate (oz.)	Height (in.)	Rate (oz/A)	Height (in.)	Rate (oz/A)	Height (in.)	Rate (oz/A)
Barnyardgrass	8	16	8	24	2-3	12	2-4	8	2-6	8-10	2-8	6-8	2-8	9-16
Broadleaf signalgrass	8	16	8	24	2-4	12	2-4	8-10	2-6	10	2-6	6-8	2-6	9-16
Crabgrass	6	16	6	24	1-2	12	1-4	8	2-6	8-10	2-6	6-8	2-6	9-16
Crowfootgrass	—	—	—	—	—	—	—	—	2-6	7-8	2-6	6-8	2-6	9-16
Fall panicum	8	16	8	24	2-6	12	2-6	8	2-6	7-8	2-6	6-8	2-6	9-16
Foxtails, Giant	8	16	8	24	2-6	12	2-8	7	2-8	7-8	2-12	6-8	2-12	9-16
Foxtails, Green	8	16	8	24	2-4	12	2-4	8	2-4	7-8	2-8	6-8	2-8	9-16
Foxtails, Yellow	8	16	8	24	2-4	12	2-4	8	2-4	7-8	2-8	6-8	2-8	9-16
Goosegrass	6	16	6	24	2-4	8	2-4	8	2-6	7-8	2-6	6-8	2-6	9-16
Seedling johnsongrass	8	16	8	24	2-8	6	2-8	6	2-8	5-8	4-10	6-8	4-10	9-16
Sandbur	3	20	3	30	2-6	12	2-6	8	2-6	7-8	2-6	6-8	2-6	9-16
Shattercane	18	16	18	24	6-12	6	6-12	6	6-12	5-8	4-10	6-8	4-10	9-16
Texas panicum	8	16	8	24	2-8	12	2-8	8	2-4	8-10	2-6	6-8	2-6	9-16
Volunteer corn	20	16	20	24	12-24	6	12-24	6	6-18	5-8	4-12	4-6	4-12	6-12

¹Taken from product labels; — control not claimed on label.**Table 5.114 - Rotational Restrictions**

The herbicides listed below, when used in cotton, may influence one's ability to rotate crops in a normal fashion. Labeled rotational intervals which are discussed below may be influenced by many factors such as the addition of other residual herbicides, soil type, soil pH, etc. Do not use these herbicides unless all rotational restrictions are understood.

Herbicide	Rotation Restrictions
Aim	Corn, sweetcorn, popcorn, soybeans, grain sorghum, rice, wheat, barley, oats, buckwheat, pearl millet, proso millet, rye, teosinte, triticale, and wild rice may be planted any time following an application of Aim. Root and leafy vegetables may be planted after 30 days following an application of Aim. All other crops may be planted after 12 months following an application of Aim.
Assure II	Do not rotate to crops other than soybeans or cotton within 120 days of application. See label for additional rotational crops allowed.
Caparol/Cotton-Pro	Do not plant rotational crops until the following year.
Cobra	No crop rotation restrictions.
Cotoran	Do not plant crops other than cotton within 6 months of the last application of Cotoran/Meturon.
DSMA/MSMA	No restrictive statements listed on label.
Dual	Barley, oats, rye, or wheat may be planted 4 months following application. Crops on Dual label may be planted in the spring following application. All other rotation crops may be planted 12 months after application.

Table 5.114 - Rotational Restrictions (cont.)

The herbicides listed below, when used in cotton, may influence one's ability to rotate crops in a normal fashion. Labeled rotational intervals which are discussed below may be influenced by many factors such as the addition of other residual herbicides, soil type, soil pH, etc. Do not use these herbicides unless all rotational restrictions are understood.

Herbicide	Rotation Restrictions
Envoke	Crop rotation interval restrictions based on a total of 0.4 oz/A of Envoke per season are as follows: winter wheat and transplanted tomato (3 months); cotton, field and sweet corn, grain sorghum, peanut, soybean, and transplanted tobacco (7 months); transplanted bell pepper and Irish potato (12 months but based on field bioassay); and all other crops (18 months). If there is a cotton crop failure and no more than 0.15 oz/A of Envoke has been applied, cotton or STS-soybean (sulfonyleurea-tolerant soybean) may be replanted 30 or more days after the Envoke application, or 14 or more days after the first significant rainfall (≥ 0.5 inches) following the Envoke application.
Fierce	Crop rotation restrictions based on 3 oz/A of Fierce are as follows: Alfalfa (10 months); Conv. till field corn (1 month); Reduced till field corn (7 days); Conv. till cotton (45 days); Reduced till cotton (1 month); Edible peas and other edible beans except field peas (11 months); Grass grown for seed (18 months); Lentils (6 months); Peanuts (4 months); Field Peas (6 months); Potato (4 months); Rice (10 months); Small grains other than wheat (11 months); Soybean (0 days); Sugarbeet (15 months); Sunflower (4 months); Sweet potato (4 months); Tobacco (12 months); Wheat (1 month); Other crops not listed (18 months). Rotational restrictions vary by rate. Consult the label for restrictions at higher rates.
Fusilade DX	Do not plant rotational grass crops such as corn, sorghum, and cereals within 60 days of last application.
Fusion	Do not plant rotational grass crops such as corn, sorghum, and cereals within 60 days of last application.
Glyphosate	No rotational restrictions.
Goal	Do not rotate to barley, corn, oats, sorghum, triticale, or wheat within 10 months following application. Do not direct seed any crops other than Goal-labeled crops within 60 days of treatment. Do not transplant seedling crops other than Goal-label crops within 30 days of treatment.
Layby Pro	Only cotton, corn, and grain sorghum can be planted the spring following the Layby Pro post-directed application. All other crops cannot be planted in the treated area within 1 year after the last Layby Pro application, or severe injury to subsequent crops may occur.
Liberty 280	Canola, corn, cotton, rice, soybeans, and sugar beets may be planted at any time. Root and tuber crops, leafy vegetables, brassica leafy vegetables, and small grains may be planted in 70 days. All other crops may be planted in 180 days.
Linex	Do not plant rotational crops other than corn, soybeans or potatoes within 4 months after application.
Poast/Poast Plus	No rotational restrictions.
Prowl	Winter wheat or winter barley may be planted 120 days after application. Any crop other than sugar-beets, red beets or spinach may be planted the year following application.
Reflex	Cotton, dry beans, snap beans, and soybeans may be planted any time after last Reflex application. Small grains may be planted in 4 months; corn, peanuts, peas, rice, and seed corn in 10 months. To avoid injury, do not plant alfalfa, sunflower, sugar beets, sorghum or any other crop within 18 months after last Reflex application. A maximum of 1.5 pt/A of Reflex may be applied in alternate years in Region 2 (Virginia).
Select/Select Max	No rotational restrictions.
Sequence	Barley, oats, rye, or wheat may be planted 4 months following application. All crops with a label for metolachlor (Dual) may be planted in the spring following the application. All other rotation crops may be planted 12 months after application.
Staple LX	Crop rotation interval restrictions for Staple are as follows: winter wheat (4 months); field corn, peanut, soybean, and transplanted tobacco (10 months); and all other crops are based on field bioassay or a minimum of 10 months. If there is a cotton crop failure following a Staple application, cotton may be replanted anytime (without disturbing original seedbed) or STS-soybean (sulfonyleurea-tolerant soybean) may be replanted 30 days after the Staple application.

Table 5.114 - Rotational Restrictions (cont.)

The herbicides listed below, when used in cotton, may influence one's ability to rotate crops in a normal fashion. Labeled rotational intervals which are discussed below may be influenced by many factors such as the addition of other residual herbicides, soil type, soil pH, etc. Do not use these herbicides unless all rotational restrictions are understood.

Herbicide	Rotation Restrictions
Treflan	Sugar beets, red beets or spinach should not be planted within 12 months of a spring application. Vegetable crops other than those listed on the Treflan label should not be planted within 5 months of application.
Valor	<p>Crop rotation interval restrictions based on a total of 2 oz/A of Valor per season are as follows: cotton, field corn, sorghum, sunflower, tobacco, and wheat (30 days); barley, dry bean, field pea, rye, and sweet corn (4 months); alfalfa, canola, clover, oats, and all other crops not listed (12 months). At least one inch of rainfall/irrigation must occur between application and planting or crop injury may occur. Successful soil bioassay must be performed prior to planting alfalfa, canola, sugar beets, and other crops not listed.</p> <p>Preplant burndown applications of Valor 51WDG may injure cotton if planted too soon. Valor at 1.0 oz/A will give 2 to 4 weeks' control of lambsquarters, pigweed, prickly sida, spurge, and Florida pusley; and at 2.0 oz/A will give 6 to 8 weeks' control of these species. Application to cover crop or dense weed stand may reduce residual control. Tillage after application will reduce or eliminate residual control. A minimum of 14 days and a 1-inch rainfall must occur between Valor application and cotton planting when Valor is applied at 1.0 oz/A; 21 days must pass and a 1-inch rainfall when applied at 1.5 to 2.0 oz/A. Valor at 2.0 oz/A may be applied up to 14 days prior to planting strip-till cotton. A tillage application must occur between application and cotton planting in order to prevent any potential injury to emerging cotton plants. Failure to conduct strip-tillage operation prior to planting may result in cotton injury. Strip-tillage operation must incorporate soil to a depth of 1 to 2 inches.</p>
Warrant	<p>Corn (all types), cotton, soybeans, and milo (sorghum) may be replanted immediately, but could result in crop injury. When planting milo use only seed treated with protectant or safener. DO NOT exceed a total of 3 lbs acetochlor/A if additional product is applied.</p> <p>Nongrass animal feeds such as alfalfa, clover, and vetch species may be planted 9 months, after application. Wheat may be planted 4 months after application.</p> <p>The following crops may be rotated in next season: buchwheat, millet (pearl and proso), oats, rye, and certain bean species (<i>see label for additional information</i>).</p>
Zidua	<p>Crop rotation restrictions based on 2 oz/A of Zidua are as follows: Alfalfa (10 months); Canola/Rapeseed (12 months); Corn (0 days); Cotton (2 months); Edible peas, succulent edible beans, and other edible dry beans (11 months); Grain sorghum (6 months); Grass grown for seed (18 months); Lentils (6 months); Peanuts (4 months); Field Peas (6 months); Potato (4 months); Rice (12 months); Small grains other than wheat (11 months); Soybean (0 days); Sugarbeet (12 months); Sunflower (4 months); Wheat (1 month); Other crops not listed (18 months). Rotational restrictions vary by rate. Consult the label for restrictions at lower or higher rates.</p>

Table 5.115 - Cotton Herbicide Half-lives and Their Potential to Injure Fall-established Cover Crops

This table does not directly address preharvest establishment of cover crops such as interseeding or aerial seeding, which may be more restrictive. Cover crops that are harvested are subject to herbicide residue restrictions, which are not addressed in this table.

Trade Name	Common Name	Normal Rate/Acre	Half-life (days) ¹	Fall-established Cover Crops		
				OK to plant	Concern for	Other
2,4-D	2,4-D	1–2 pt	7	All grasses	Wait 30 days before planting sensitive broadleaves	Amine formulations more water soluble and can leach into seed zone
Assure II/Targa 0.88E	quizalofop	8 oz	60	Most broadleaves	All grasses if less than 120 days or at high rates	Plant anything after 120 days
Caparol 4L	prometryn	3.2 pt	60	None	Most crops	12 month rotation restriction to most crops
Cotoran 4L	fluometuron	3.2 pt	85	None	Most crops if less than 4 months	Application rate and weather can greatly influence persistence
Direx 4L/Karmex DF	diuron	1 qt	90	None	Most crops	Conduct field bioassay prior to planting
Dual II Magnum 7.62E/Cinch	metolachlor	1.33 pt	15–50	Cereal grains, legumes	Annual ryegrass or other small-seeded grasses	Higher rates and later applications more of a potential problem
Envoke	trifloxysulfuron	0.10 oz	5–15	Cereal grains	Most broadleaves, especially clovers and radishes	Warm, moist conditions cause to rapidly degrade in soil
Fusilade DX	fluazifop	4 fl oz	15	Broadleaves	Cereal grains if less than 60 days	
Glyphosate 4L	glyphosate	0.75–1.25 lb ae	47 ³	All	None	Glyphosate does not have soil activity at normal use rates
Gramoxone 2S	paraquat	2 pt	1,000 ³	All	None	Paraquat does not have soil activity at normal use rates
Liberty 2.34L	glufosinate	29–43 fl oz	7 ³	All	Food or feed residues rather than crop injury may be a concern	Glufosinate has no soil activity at normal use rates

Table 5.115 - Cotton Herbicide Half-lives and Their Potential to Injure Fall-established Cover Crops (cont.)

Trade Name	Common Name	Normal Rate/Acre	Half-life (days) ¹	Fall-established Cover Crops		
				OK to plant	Concern for	Other
Linex 4L/Lorox DF	linuron	2 pt	60	Cereal grains and radishes	Clovers and rapeseed	Spring applications are safe to fall planted cover crops.
MSMA 6.0	MSMA	2.66 pt	180			No restrictive statements listed on label
Outlook 6E	dimethenamid	16 fl oz	20	Most crops should be fine	Food or feed residues rather than crop injury may be a concern.	Nonfood/feed winter cover crops should be OK after corn harvest.
Prowl H2O 3.8CS	pendimethalin	1.1–1.6 pt	44	Cereal grains	Small-seeded legumes and annual ryegrass	We have not seen this herbicide carry over in the Mid-Atlantic; nonfood/feed winter cover crops should be OK.
Resource	flumiclorac	2–4 fl oz	1–6	None	None assuming at least 30 days	No rotational crop restrictions
Reflex 2E/ Flexstar 1.88E (Warrant Ultra)	fomesafen	1.0 pt	100	Cereal grains	Small-seeded legumes, sorghum. Do not plant mustards.	Since fomesafen is often applied postemergence, soil activity can surprise users.
Select 2E	clethodim	6–16 fl oz	3	All broadleaves	None assuming at least 30 days	Plant anything after 30 days
Staple LX	pyrithiobac	1.3–2.1 oz	60	Cereal grains if more than 4 months	Most broadleaves	Conduct field bioassay prior to planting.
Treflan	trifluralin	1.0–1.5 pt/a	164	Cereal grains	Small-seeded legumes and annual ryegrass	Carry over not observed in the Mid-Atlantic; fall planted cover crops should be OK.
Valor 51WDG	flumioxazin	1.0–2.0 oz	12–20	All grasses	Small-seeded legumes and mustards	Based on the half-life, all nonfood/feed winter cover crops should be OK.
Warrant	acetochlor	3 pt	10–20	Most crops should be fine	Food or feed residues rather than crop injury may be a concern.	Nonfood/feed winter cover crops are allowed after corn harvest.

Table 5.115 - Cotton Herbicide Half-lives and Their Potential to Injure Fall-established Cover Crops (cont.)

Trade Name	Common Name	Normal Rate/Acre	Half-life (days) ¹	Fall-established Cover Crops		
				OK to plant	Concern for	Other
Zidua	pyroxasulfone	1.5 oz	20	Most crops should be fine	Food or feed residues rather than crop injury may be a concern.	Nonfood/feed winter cover crops should be OK after corn harvest.

¹ The herbicide half-life is defined as the time it takes for 50 percent of the herbicide active ingredient to dissipate. See the "Managing Herbicides" section for additional information. Herbicide half-life estimates are derived for the WSSA Herbicide Handbook and other scientific literature.

² Common small-seeded legumes include alfalfa, clovers, and hairy vetch.

³ This herbicide does not have soil residual activity at normal application rates.