

A close-up photograph of a hop plant. The image shows several green, cone-shaped hop cones (strobili) hanging from a vine. The leaves are green and serrated. The background is a soft-focus green field.

Weed Control in Hops

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Why ID Weeds First?

- One size does not fit all.
 - Ex: Mowing mature pigweed in the summer vs repetitive mowing of Johnsongrass.
- For assistance with weed identification, visit the local Extension office or search on <http://oak.ppws.vt.edu/weedindex.htm>
- This site has detailed ID info (leaf, stem, flower features)
- Plant ID lab at VT-talk to your agent to submit a sample

Know the Enemy-

Classifications

- **Annuals:** These weeds complete their life cycles within one year.
- **Biennials:** These weeds complete their life cycles over the course of two years. Most are broadleaves.
- **Perennials:** These weeds can live for many years. Furthermore, some perennials are “creeping,” meaning that they can spread asexually through structures like rhizomes or stolons.

Examples-Annuals

Crabgrass



Examples-Biennial



Bull Thistle

Examples-Perennials



Bermudagrass/Wiregrass

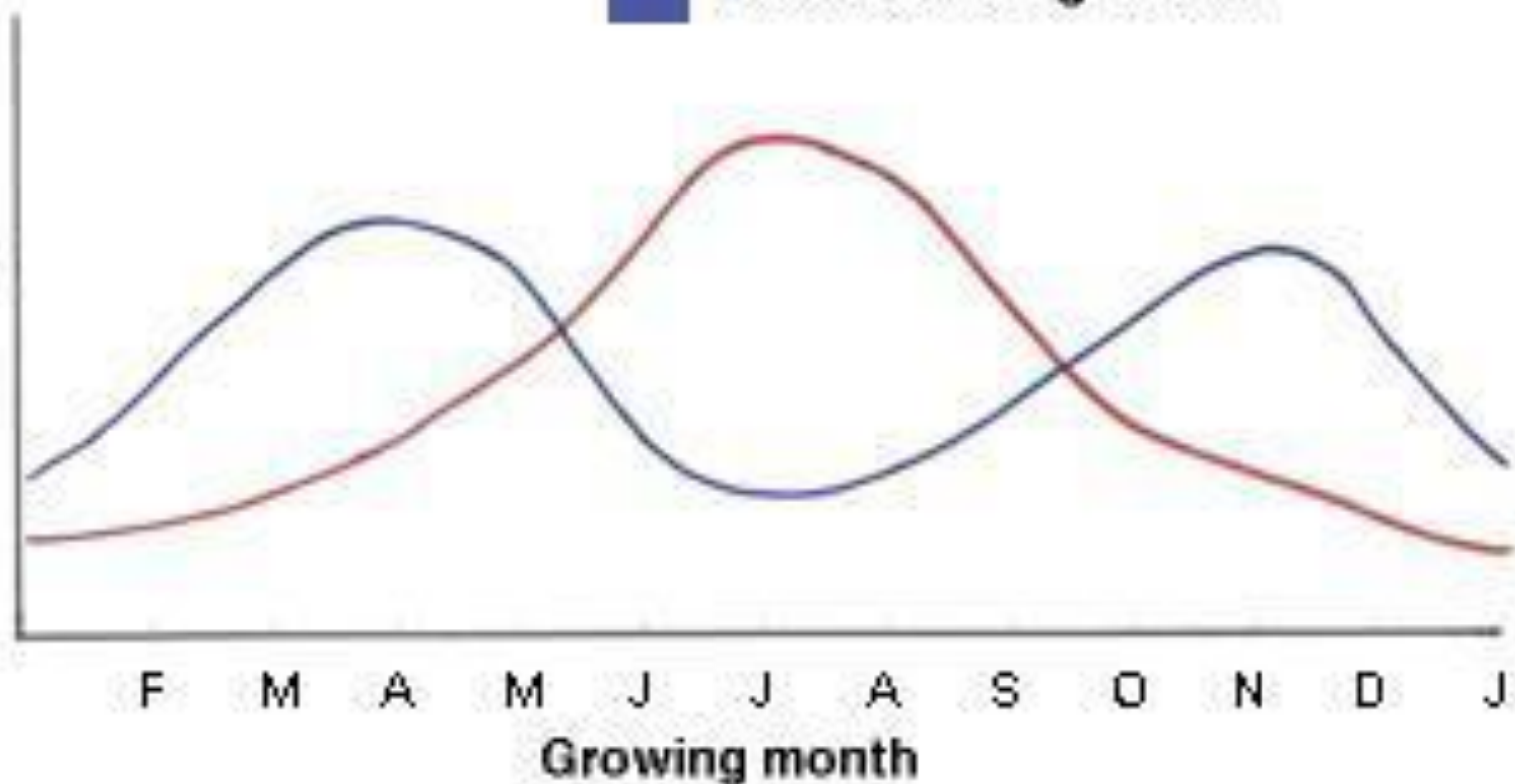


Know the Enemy- Classifications

- **Seasonal Growth Habits:**
- Summer annuals dominate between the spring and fall frost. Summer annuals will be killed by fall frosts, while perennials such as Bermuda grass may go dormant until spring returns.
- Winter annuals prefer cooler temperatures when moisture is abundant. They grow rapidly in the fall and die off in the late spring when temps get hot and weather is dry

- Warm-season grasses
- Cool-season grasses

Growth rate



Lambsquarter

Examples-Summer Annual



Examples-Winter Annual

Henbit and Deadnettle

Virginia Tech Weed ID Guide



Purple Deadnettle

Henbit

Know the Enemy-

Classifications

- **Broadleaf plants (dicots):** This term applies to plants that have two seed leaves (cotyledons) when they germinate from seed. Certain selective herbicides exist which can be used to control broadleaf weeds without killing grasses or sedges.

Know the Enemy-

Classifications

Monocots: These plants have one seed leaf (cotyledon) when they germinate from seed. Two major subgroups within the monocot group are the grasses and the sedges. It is important to tell these two groups apart as most grass herbicides do not affect sedges and most sedge herbicides do not control grasses.

- **Grasses:** This term applies to plants that have round or flattened stems, and long, narrow leaves with parallel veins. Leaves are two ranked. Certain selective herbicides exist which can be used to control grasses without killing desirable broadleaf plants.
- **Sedges:** These plants have a grass-like appearance but are not grasses. Sedges have triangular stems and the leaves are three ranked. To differentiate between sedges and grasses, use the reminder that “sedges have edges.” The products needed for chemical control of sedges can also differ from products appropriate for grass control.

Examples-Broadleaf

Horsenettle

Virginia Tech Weed ID Guide



Examples-Grasses

Nimblewill

Virginia Tech Weed ID Guide



Examples-Sedges

- Yellow and purple
- “Sedges have edges”



Other Common Weeds

Bluegrass (Annual, Kentucky)

- Boat-shaped tip



Johnsongrass

- Summer perennial



Bindweed (looks like Morning Glory)

- Perennial



Virginia Tech Weed I.D. Guide



Brambles



Broomsedge

- Perennial grass



Carpetweed

- Summer annual



Cocklebur

- Summer annual



Chickweed

- Common: winter annual
- Mouseear (fuzzy!): perennial



Dandelion

- Perennial



Deadnettle

- Winter annual



Dodder

- Parasitic vine



Virginia Tech Weed ID Guide



Dog Fennel

- Perennial



Virginia Tech Weed ID Guide



Garlic

- Perennial



Kudzu

- Let's hope this isn't what your hop yard looks like!



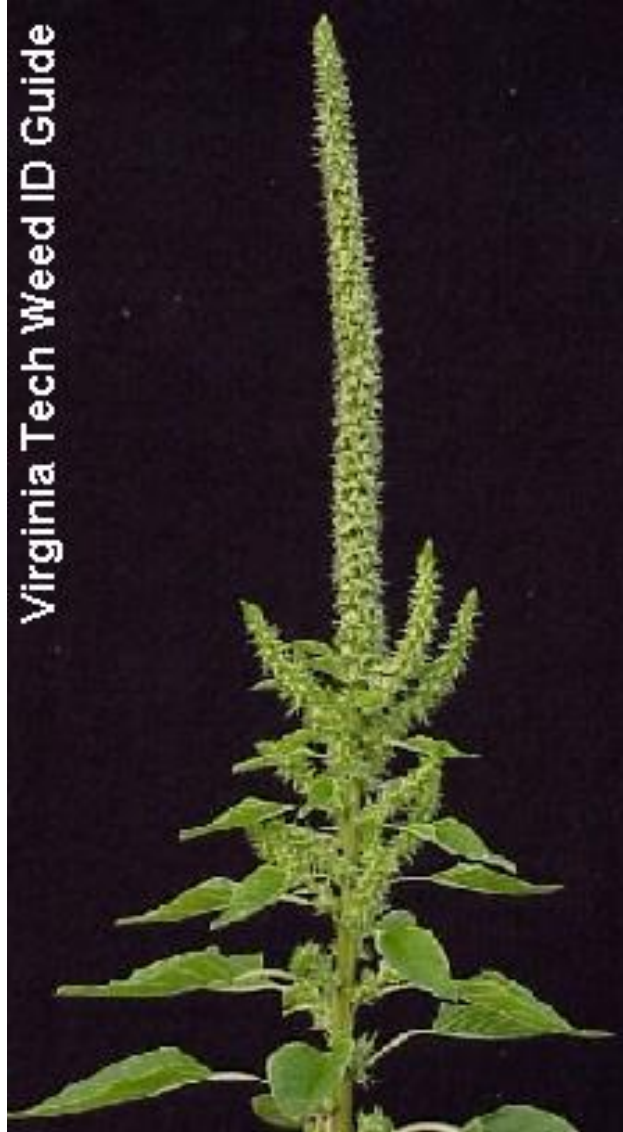
Milkweed

- Perennial



Palmer Amaranth

Summer annual





Pigweed (Redroot, Spiny, Smooth, Prostrate)

Summer annual



Virginia Tech Weed ID Guide

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Plantain

- Perennial



Poison Hemlock

- Biennial

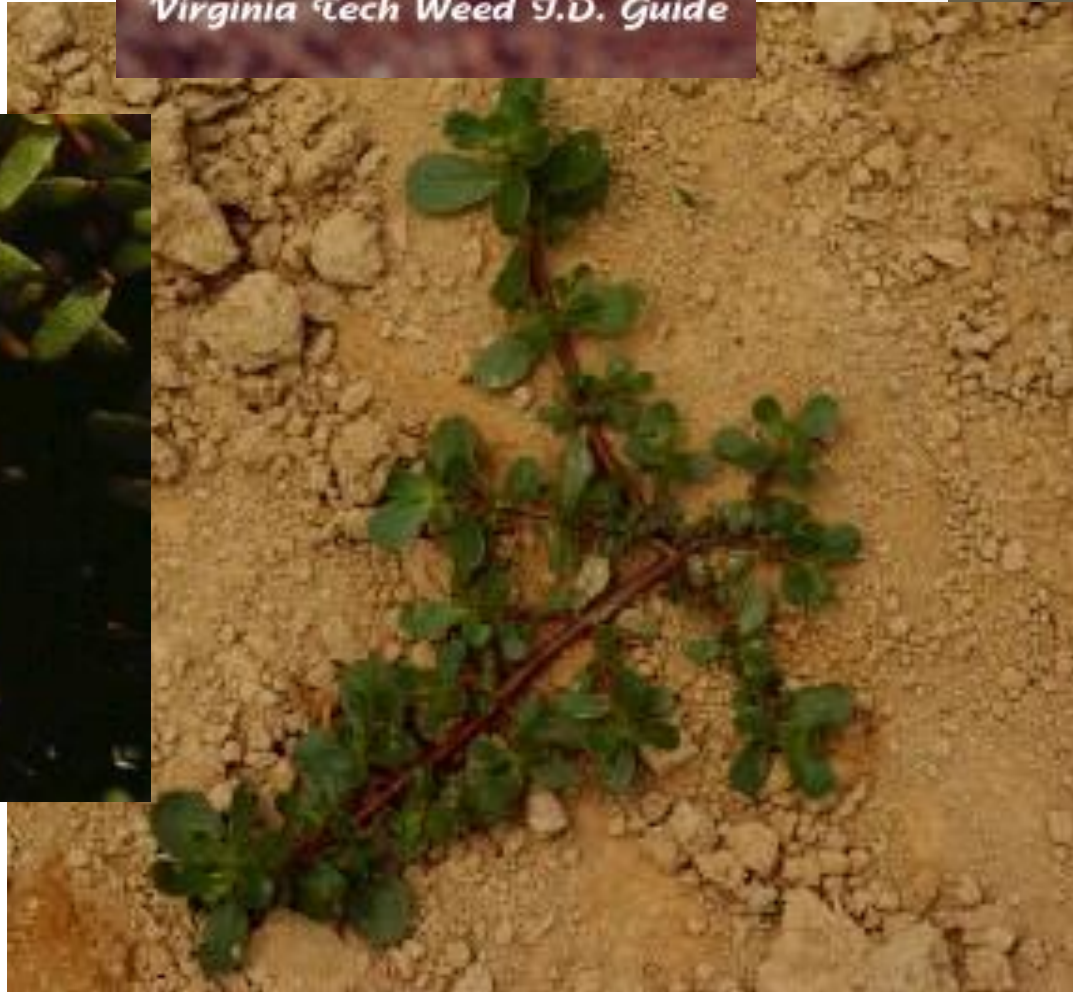


Poison Ivy



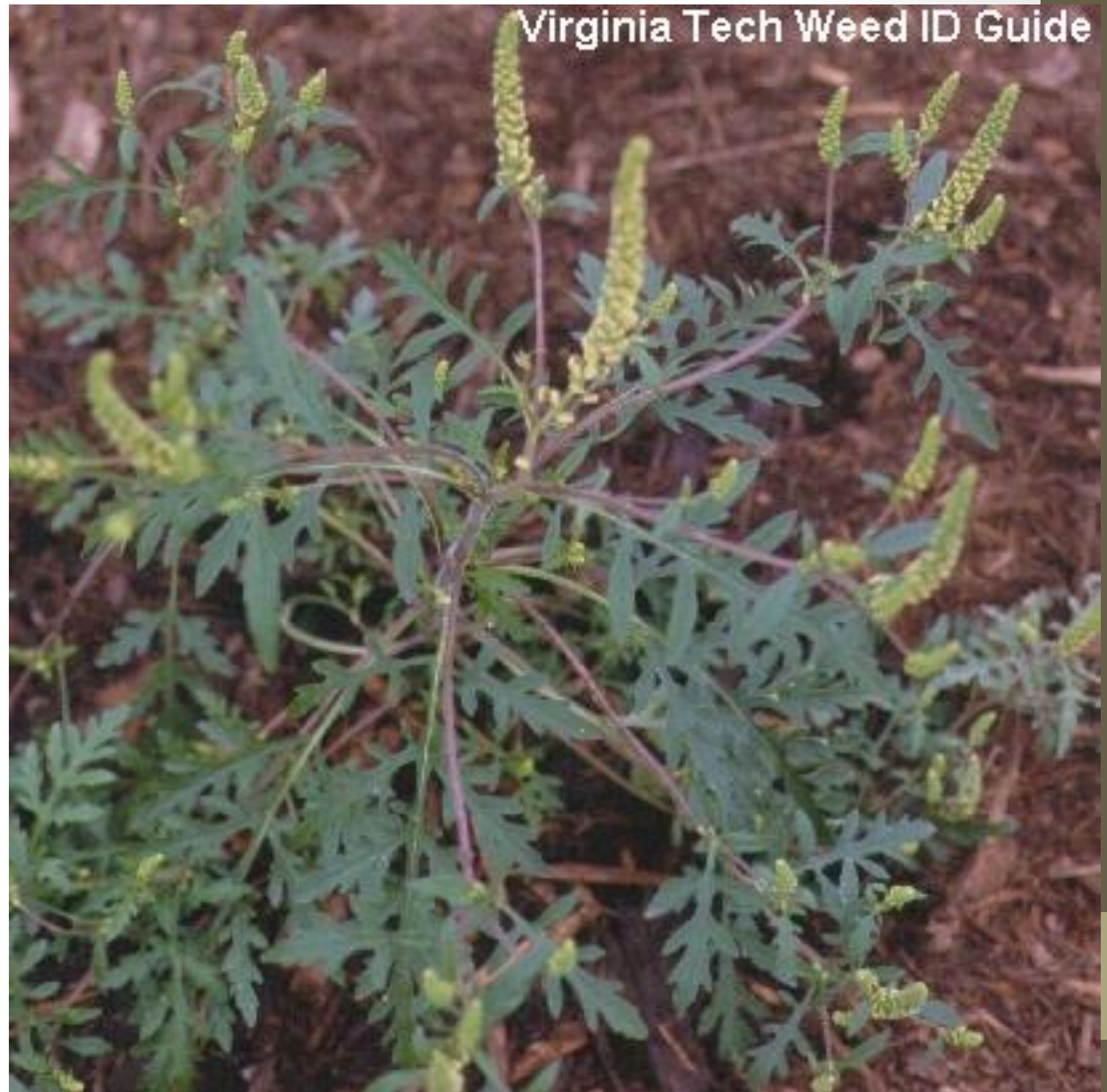
Purselane

- Succulent summer annual



Ragweed

- Summer annual



Tree-of-Heaven



Virginia Knotweed and Smartweed

-

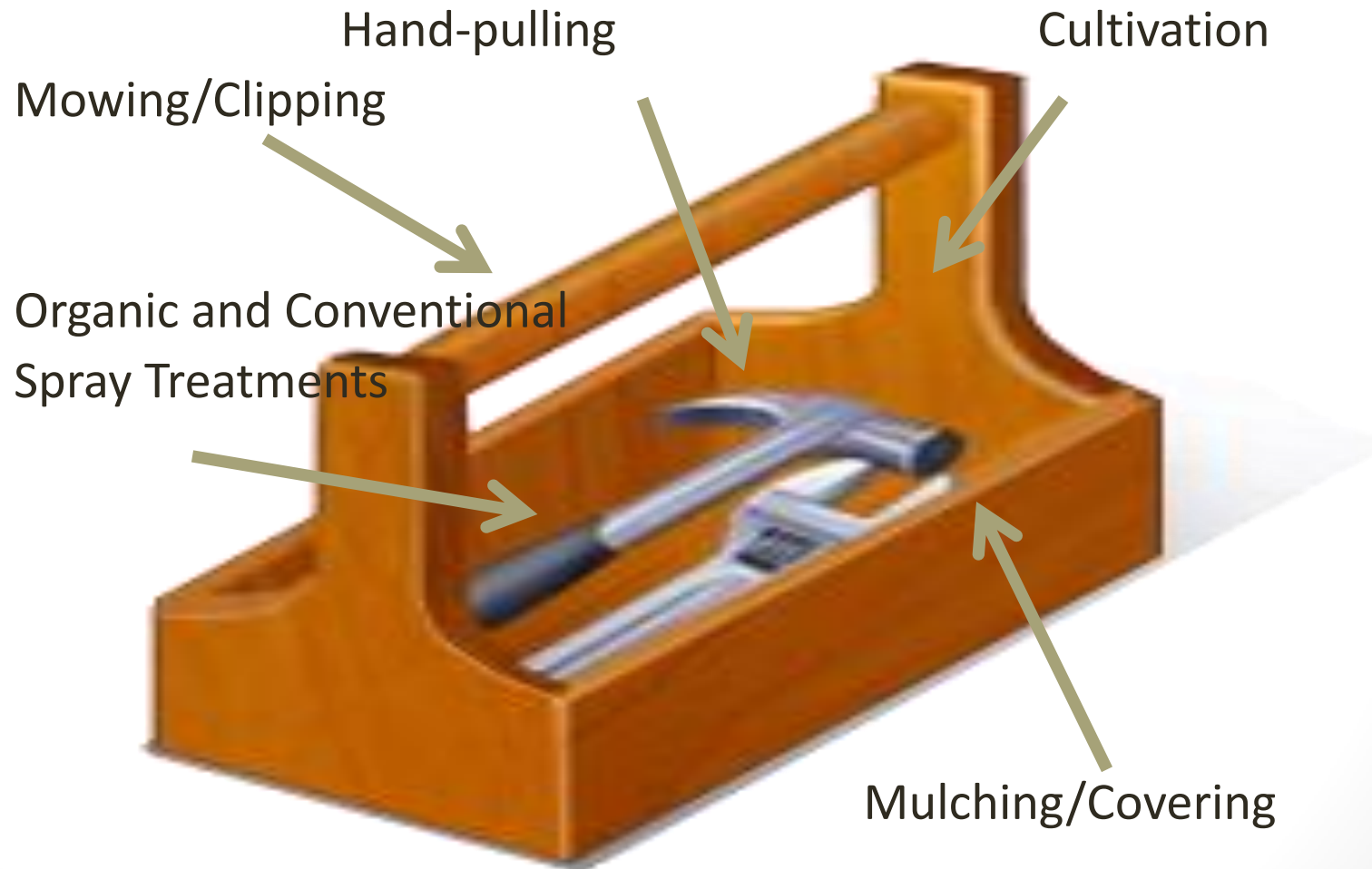
Smartweed- Summer annual



Which weed control options are in our toolbox?



Which weed control options are in our toolbox?



Tillage + Cultivation

- Cons:
 - Soil health, erosion
 - Labor/fuel
 - Damage if done close to crowns
 - Brings new weeds to surface, annuals take advantage
 - Some plants may survive and be spread by it
- Pros:
 - Smooth, weed-free surface
 - Can be highly effective at killing many weed seedlings such crabgrass
 - Can be used to incorporate cover crops, green manures, fertilizers
- If you till, get competitive edge before weeds do
- Try spot-cultivation-chopping, etc



Cover Crops behind Tillage

Legumes to build N:

- Alfalfa-spring, late summer
- Hairy Vetch-early fall
- Crimson Clover-spring, fall
- Fava Beans-early spring, late summer



- Barley, Wheat, Oats, Rye-fall
- Buckwheat-spring, summer



Hand-Pulling



- Cons:
 - Tedious and labor-intensive
 - Not the ideal option for weeds with tough taproots or those which reproduce asexually and leave pieces behind
- Pros:
 - Can be used to manage herbicide-resistant weeds
 - Can be ideal for managing highly prolific summer annuals (pigweed, lambsquarter-always pull these if they get large)
 - No need to bring out herbicide, fuel, equipment
- Burn or bag plants like pigweed and lambsquarter to ensure that seeds do not shatter off the plant.

Mowing/Clipping

- Cons:

- Requires fuel, equipment
- Not always feasible in a garden setting
- Not a good idea for weeds which have nearly gone to seed-seeds will just be spread by mowing



- Pros:

- Close, frequent mowing requires the plant to expend root reserves
- Timely mowing can keep weeds from producing seeds. Most weeds which produce seeds are good candidates because clipping will delay seed production and will stress the plant
- Repeated mowings preceding a spray application are helpful for stressing weeds and preparing them to succumb to the product.
However, mowing should be halted a few weeks prior to herbicide application so that the weeds can re-grow enough leaf area for the product to properly contact them.

Mulching/Covering



- Cons:
 - Breakdown of mulch will consume some available N
 - May not suppress all weed seeds and many perennials, and weeds will emerge from any slits or openings
 - Can sometimes attract rodents around bases of plants
 - *Some materials carry in weed seeds unless properly composted*
- Pros:
 - Can be an excellent weed prevention strategy for many annuals.
 - Helps retain soil moisture
 - Creates a layer of composted as it decomposes.

Spraying

- Cons:

- Requires \$, application equipment, and/or mixing
- Few organic pesticides available for those sticking to organic program
- Using near hops in growing season could be calculated risk; hops are a broadleaf plant, so watch broadleaf and nonselective herbicides

- Pros:

- Highly effective at controlling weeds when used properly
- Products available to prevent germination OR kill existing vegetation

As a general rule, herbicides are more effective at warmer outdoor temperatures and some may need to be mixed with an adjuvant to help them adhere properly to weeds with waxy leaves.



How do herbicides work?

- To be effective must reach....
 - Target plants
 - Target sites on plant
 - Both above
 - ...in sufficient concentration
 - ...before degradation, volatilization, leeching, etc.

Herbicide Fate In Soils

VOLATILITY

PHOTODECOMPOSITION

EROSION

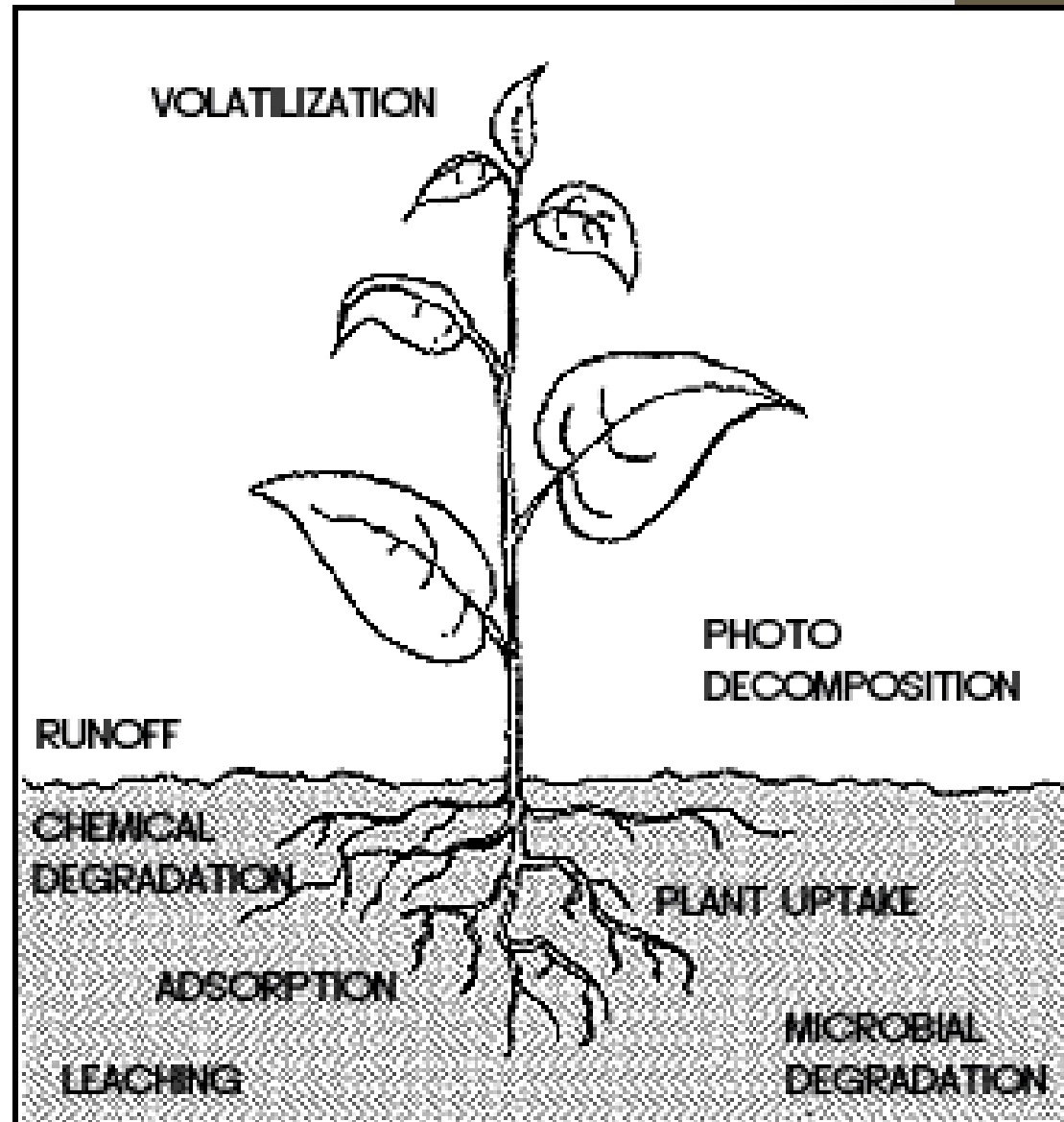
CHEMICAL DEGRADATION

PLANT UPTAKE

ADSORPTION

MICROBIAL DEGRADATION

LEACHING



What Herbicides Do To Plants

- Disrupt cell membranes
- Inhibit lipid production
- Inhibit amino acid production
- Inhibit growth
- Inhibit photosynthesis



Herbicide Classifications

- **Selective herbicides:** Kill a specific type of plant (Ex: most target EITHER broadleaf OR grass-type weeds)
- **Non-selective herbicides:** Kills both broadleaf and grass plants
- Hops are broadleaf plants. Weeds that can kill broadleaf plants could also hurt hops.
- Shield plants from spray drift
- Use large droplet size and avoid windy days
- Follow label directions-some MUST be applied only in dormant season or other specific times to avoid injury

Herbicide Classifications

- **Contact herbicides** kill plant tissue where the product touches the plant, don't kill underground plant parts
- **Systemic herbicides** are transported throughout the plant and can be used to kill entire plant
- **Preplant/Burndown** kills weeds during site establishment
- **Pre-emergence herbicides** control weeds right as they emerge
- **Post-emergence herbicides** act on established weeds



Herbicide Recommendations for Hops

- Use recommendations from our “PMG”-the Pest Management Guide. Located on our the VCE website—search “hops”
- These are the products which are recommended by our specialists-research-based recommendations
- Follow label instructions!

NO MATTER WHICH OPTION YOU CHOOSE...

- Product MUST be labeled for use on the site you choose.
 - Ex: using product labeled for lawns-only is not permitted for use in hop yard.
 - Always check! Labels can change.
- Product must be registered for use on your site/for your purpose AND approved for use in Virginia
 - Be aware when referring to out-of-state pubs, online sales

NO MATTER WHICH OPTION YOU CHOOSE...

- Some products are “Restricted Use” and require a certification to buy and apply. Homeowner products tend to be “General Use.” Visit <http://www.vdacs.virginia.gov/pesticides/certification.shtml> to find out when certification is required.
- Visit <http://www.kellysolutions.com/va/pesticideindex.htm> to check which products are registered, check which sites are approved for a product, view and compare labels for products, etc.



EPA Reg. No. 524-445

← **trade name**
name product
is sold under

common name →
identifies active
ingredient

AVOID CONTACT OF HERBICIDE WITH FOLIAGE, GREEN STEMS, EXPOSED NON-WOODY ROOTS OR FRUIT OF CROPS (EXCEPT AS SPECIFIED FOR INDIVIDUAL ROUNDUP READY® CROPS), DESIRABLE PLANTS AND TREES, BECAUSE SEVERE INJURY OR DESTRUCTION MAY RESULT.

2004-1

Not all products recommended on this label are registered for use in California. Check the registration status of each product in California before using.

Read the entire label before using this product.

Use only according to label instructions.

It is a violation of Federal law to use this product in any manner inconsistent with its labeling.

Read the "LIMIT OF WARRANTY AND LIABILITY" statement at the end of the label before buying or using. If terms are not acceptable, return at once unopened.

THIS IS AN END-USE PRODUCT. THIS COMPANY DOES NOT INTEND AND HAS NOT REGISTERED IT FOR REFORMULATION. SEE INDIVIDUAL CONTAINER LABEL FOR REPACKAGING LIMITATIONS.

1.0 INGREDIENTS

ACTIVE INGREDIENT:

*Glyphosate, N-(phosphonomethyl)glycine

in the form of its isopropylamine salt 41.0%

OTHER INGREDIENTS: 59.0%

100.0%

chemical name

describes the active ingredient

- Active ingredient
- PPE and requirements for when/how/where/how much to apply
- Preharvest interval and plantback interval

Rules of Thumb for Herbicide Treatment

- Adjuvant: Check label. May be needed to “stick” to leaves. Label provides guidance.
- Clean out sprayer properly (especially after 2,4-D!). Label provides guidance.
- Work better when temps are warm and leaves are dry-check label for application guidelines.
- If recently mowed, give time for regrowth (exception: garlic)

Herbicide Timing for *Perennial Weeds*



Spring flush



Toward foliage

SPRAY



Early-bud

Toward roots



Flower & seed set



Toward foliage

SPRAY



Fall growth

Toward roots



General direction of sugar and herbicide movement

Two periods are ideal for spraying perennials: the early-bud stage (the 2 weeks before flowering), and fall. Why?

1. Sugar direction is moving toward underground perennial structures
2. Plenty of leaf area to take in herbicide
3. Perennial structures at lowest energy level

Herbicide Timing for *Summer Annual Weeds*

SPRAY



Seedling
spring & summer

SPRAY



Vegetative
(less than 10" tall)



Flowering & seeding
Summer

Annuals are relatively simple to kill during the seedling and early vegetative stages. Increased size and age result in significantly reduced control.

Herbicide Timing for *Biennial Weeds*

SPRAY



Seedling
typically late summer or fall

SPRAY



Rosette
fall - early spring



Bolting
Late spring



Flowering
Summer

Biennials are relatively simple to kill during the seedling and rosette stage with most broadleaf herbicides. Once biennials begin to bolt in spring, control is significantly reduced.

Preventing Herbicide Resistance

- We all have the opportunity to understand and prevent it

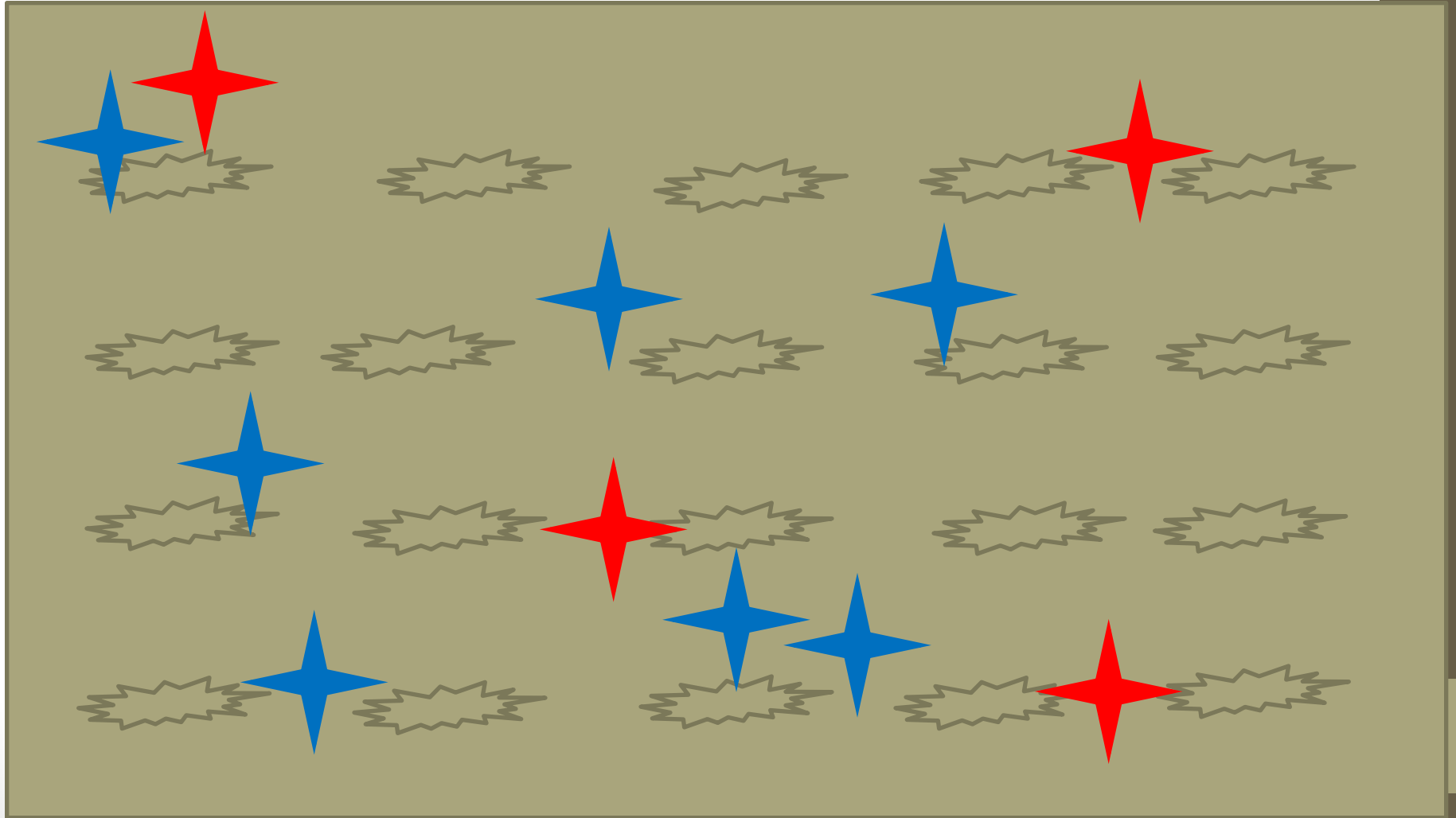
Definition of herbicide resistance :

Individual plants within a species that have developed the ability to withstand a herbicide treatment that would previously have been lethal to that species.



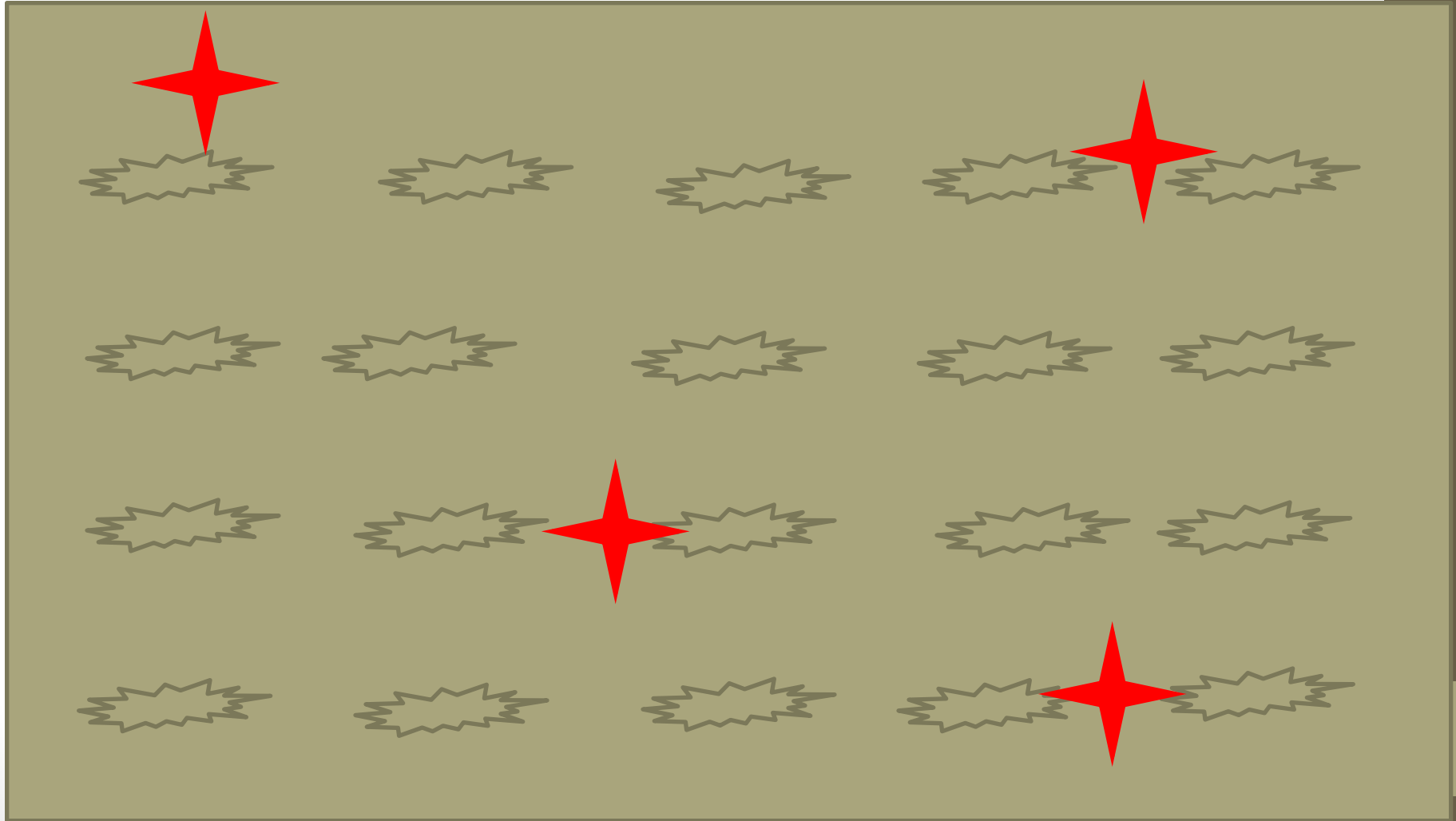
Resistance: What is Is

Garden: Pre-treatment



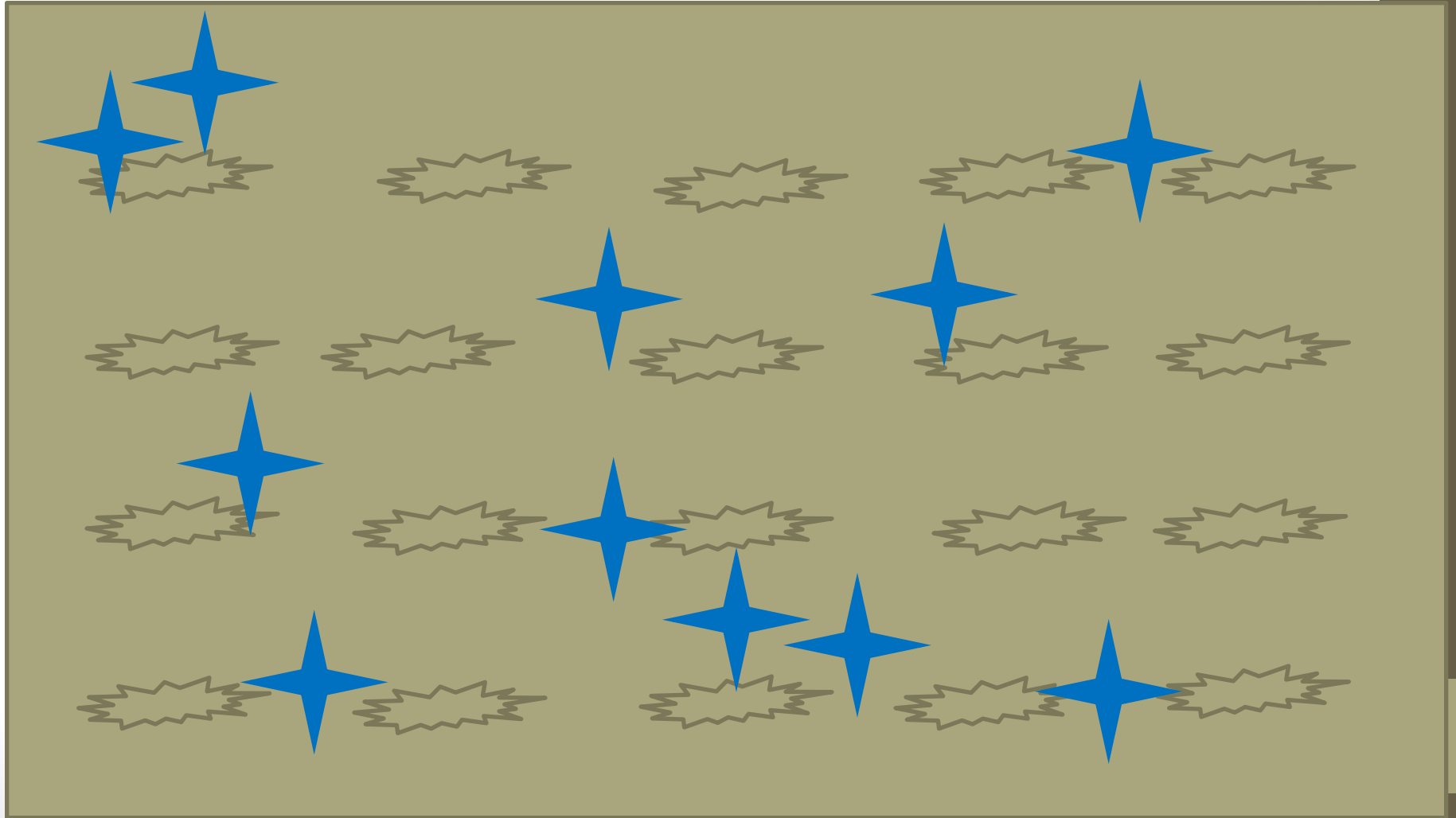
Resistance: What is Is

Garden: Post-Treatment



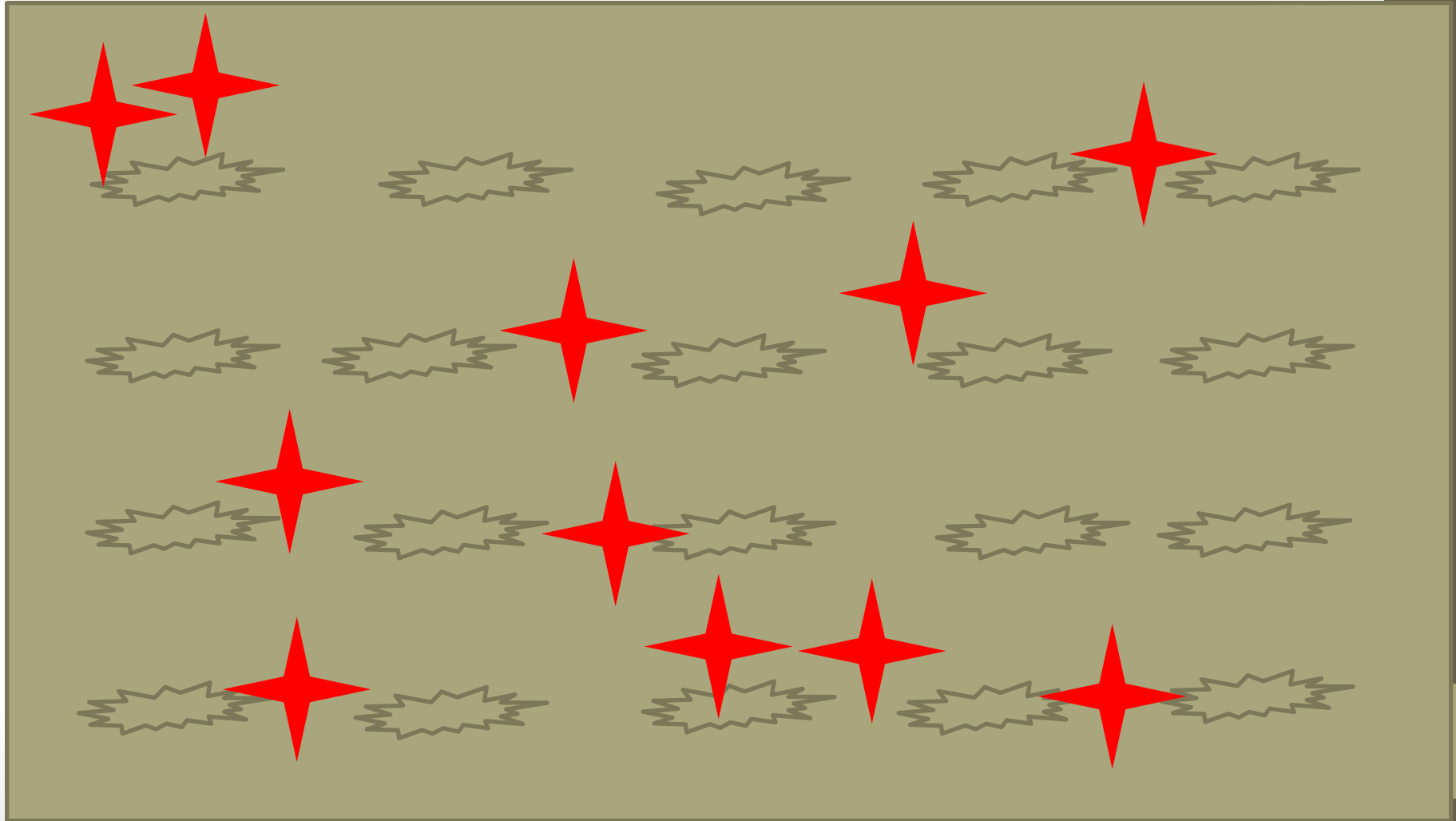
Resistance: What is Is Not

Garden: Pre-treatment



Resistance: What is Is Not

Garden: Post-treatment



Q&A

Does an individual plant become resistant over time?

NO.

With repeated selection pressure (ie. pesticide application and exposure), those individuals which are genetically unsusceptible survive and reproduce, therefore, contributing to a more resistant population in the future.

Q&A

Does the herbicide cause resistance?

NO.

Due to naturally occurring mutations, the resistant individuals have been part of the population for years/decades/centuries/ or longer.

The imposition of the selection pressure causes these resistant individuals to become an increasingly larger portion of the population.

Questions?

