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Growing Small Grains for Forage in Virginia

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Introduction

Cereal crops are used throughout the world for livestock feed. When they are managed properly they provide excellent grazing and high-quality silage or hay. It is important to remember that grazing should occur during the vegetative stage and silage or hay harvest should occur during flowering to early seed fill. Corn is one of the few annual crops that will provide quality forage after seed maturity. In fact, some ask why cereal crops are even considered for silage production given the high yields and high quality of corn. The following figure provides one answer to this question for Virginia where year-to-year variation in precipitation can have a huge impact on corn silage yield. Data presented is the yearly average corn silage yield for the commonwealth.

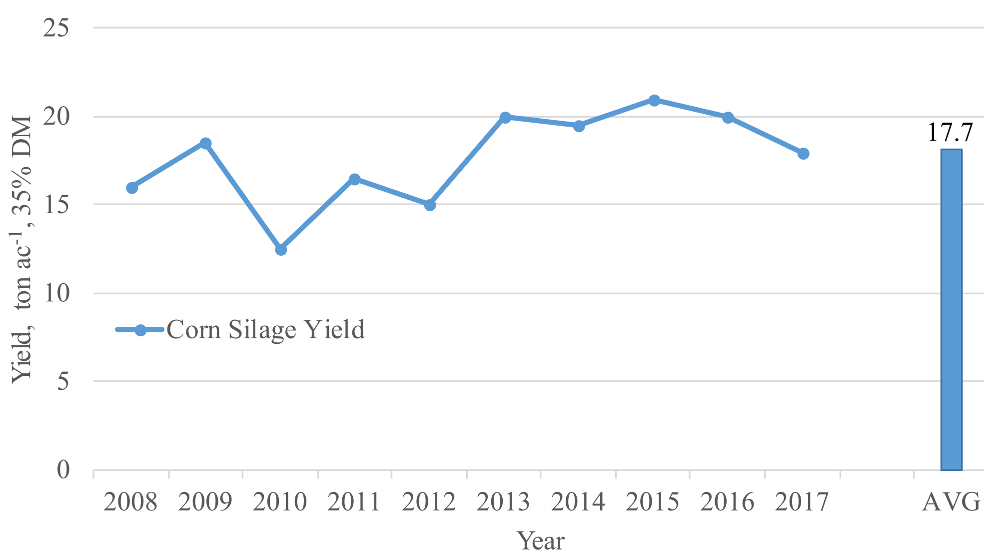
Cereal Grains as Forages

Cool-season cereal crops form the backbone of many farm enterprises in the United States, and Virginia is no exception. However, except for rye, Virginia producers make limited use of the tremendous forage potential provided by cereal crops. This publication provides an overview of the major cereals and how they can fit into a forage system.

Wheat

Wheat is one of the most versatile small grains for a farming operation. Due to its excellent winter hardiness, wheat can be sown later in the fall than barley and is a good choice for planting following a corn or soybean harvest. Wheat has good potential for pasture,

Statewide AVG. Corn Silage Yields, 2008-2017



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silage, or hay production. Wheat will withstand wetter soils than barley or oats, but tends to be less tolerant of poorly drained soils than rye or triticale. It is not used as an all-purpose forage crop to the extent that it could be. Very short, semi-dwarf varieties have less forage yield potential than taller varieties. When grown for forage instead of grain, wheat should be planted earlier and at a higher seeding rate. Hessian fly and wheat streak mosaic can be greater concerns in early-planted wheat. Newer winter wheat varieties with Hessian fly resistance can be seeded (2 to 3 Bu/A) as early as late August and produce an abundance of excellent fall grazing. Early planting also increases the potential for recovery of residual or leftover nitrogen from the previous summer crop that might otherwise leach below the rooting zone during the winter months. Managed properly, wheat can be grazed in the fall, again in early spring, and finally harvested for hay or silage. As silage, wheat is of excellent quality and will normally produce more tonnage (6 to 10 T/A at 65 percent moisture) than barley (5 to 8 T/A) and be of higher quality than rye when cut at the bloom stage. At bloom stage, wheat yields are often 50 percent higher than at the boot stage with little loss in quality. For highest silage yields, the taller wheat varieties should be considered and not seeded until early to mid-October. Plant height may become a more important consideration than grain-yield potential when growing wheat for grazing, silage, or hay. However, if wheat is to be grazed and then used for grain production, grain-yield potential should be an important factor in variety selection. Another consideration in variety selection is the length and roughness of awns. Livestock tend to favor cultivars with small or no awns. Forage potential is greatly reduced when wheat is grown on soils with a pH of 5.5 or less.

Barley

Barley is generally more susceptible to winterkill than wheat, especially when it has been overgrazed. It should not be grazed as short or as late into the fall as wheat. Barley does best on fertile, well-drained soils, but is also well adapted to sandy soils. Barley is sensitive to acidic soil conditions and pH should be maintained at 5.5 or higher. Barley produces good-quality silage or hay, but because of lower tonnage, usually produces lower yields of total digestible nutrients per acre than the other small grains. Barley also has higher digestibility and lower cell-wall content, acid detergent fiber, and acid detergent lignin than the other small grains. For best forage yields, barley should be seeded in early to mid-September at 2 to 3 Bu/A and cut in the late soft-dough stage. Some varieties have barbed awns that can affect the palatability of hay, but other varieties have smooth awns. Barley yellow dwarf virus (BYDV), leaf rust, and smut can be serious problems for winter barley. Early planting tends to favor the occurrence of BYDV. Good-quality grazing can be obtained from early seeded barley, but it should not be grazed as close or as late in the fall as wheat or rye.

Triticale

The use of triticale as a forage crop is gaining popularity throughout the country and particularly in the Midwest. Triticale generally has a higher forage yield, but lower quality than wheat. Triticale is a cross between rye and wheat. As such, it is adapted to a range of soils and does well on sandy sites. Tolerance to low pH is better than wheat but not as good as rye. Although pure triticale will not contaminate adjacent wheat fields with rye, triticale seed is sometimes contaminated with rye seed.

Rye

Rye is the most cold tolerant and least exacting in its soil and moisture requirements of all the small-grain cereals. Like wheat, rye can be sown in late August at 2 to 3 Bu/A to provide fall grazing, excellent winter ground cover, and spring grazing. The rapid growth of rye, both in the fall and spring, makes it the most productive of the small grains for pasture. Rye is the earliest maturing small grain for silage with good quality when harvested at the proper stage of growth. Traditionally, rye has been a poor choice for silage because of its higher fiber content compared to wheat, oat, barley, and triticale and its palatability declines rapidly with maturity.

The recent release of several “abruzzi” types of rye (Winterking and Aroostook) has provided better varieties for grazing and silage. Recent trials indicate that these newer varieties of rye are able to maintain quality longer than triticale, but not as long as wheat. When grown for silage, rye should be seeded in early October (and until late November), harvested in the late-boot stage, wilted, and ensiled. Research has shown that at this growth stage rye protein is efficiently digested in the rumen with over 75 percent being utilized. Rye is a more consistent producer of spring pasture than wheat, although it quickly becomes stemmy and unpalatable in late spring.

Winter Oats

As a rule, the hardiest winter-oat variety (Kenoat) is considerably less winter hardy than common wheat and barley varieties. However, in the southern United States, winter oats will usually survive most winters and produce high yields of forage (4 to 8 T/A). Due to the lateness of maturity of most winter oat varieties, they are not well suited for double-cropping systems. However, the earlier maturing varieties of oat may be successfully used as silage when cut at the boot stage and wilted before ensiling. Similar to barley, winter oats must be seeded in mid-September at 2.5 to 3 Bu/A to be well established before cold weather arrives. Winter oats are best adapted to well-drained clay and sandy loam soils. They do not perform as well under extremely dry or wet conditions as do wheat or rye. Winter oats produce a high-quality silage; however, lower yields are common compared to the other small grains.

Small Grains for Silage

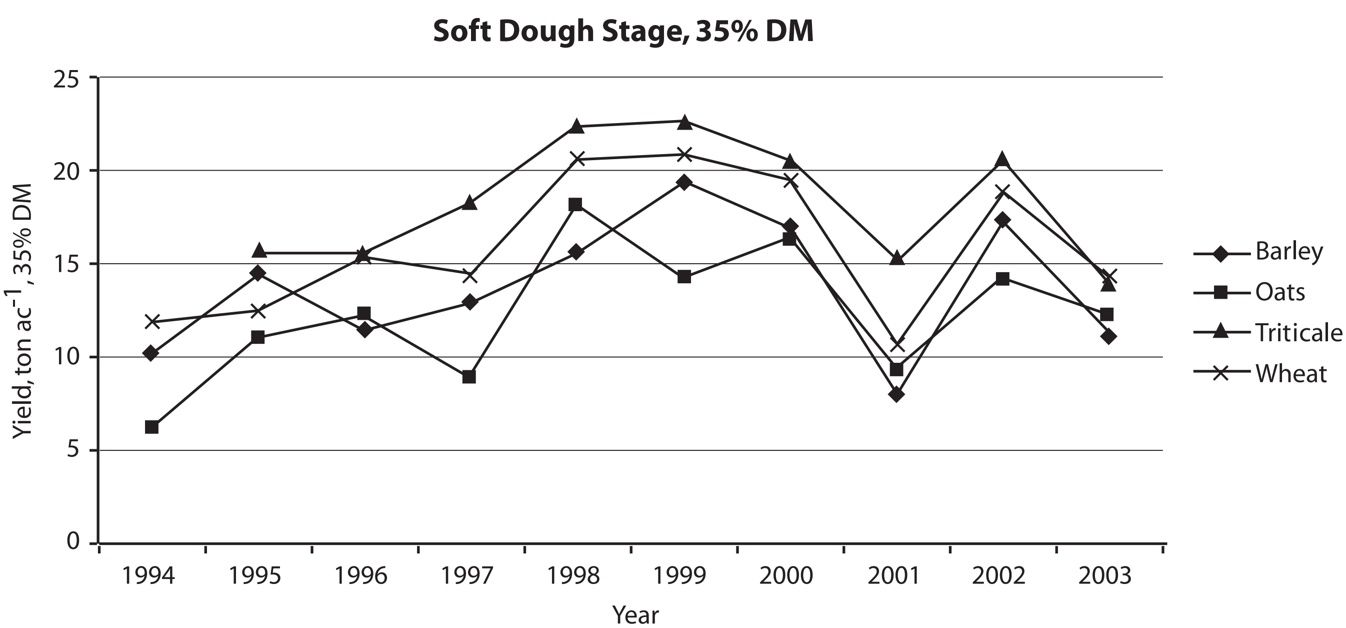
With limited acreage for growing row crops, a large percentage of small grain is being grown in a double-cropping system for an additional silage crop. Small-grain silage also permits greater utilization of silage storage and feeding equipment. One of the most important decisions in producing high-quality small-grain silage is determining the stage of maturity at which to harvest. Several factors to be considered are:

- cropping system (double-cropping or only harvesting one crop per season);
- species and variety of small grain used;
- whether small grain is being used as a companion crop for grasses and legumes; and
- kind of livestock to be fed.

In general, high-quality silage with good animal performance is obtained from small-grain silage cut at the head emergence stage. Data from the University of Georgia indicates that animal intake is higher for silage cut at early head emergence compared to the milk or dough stage. Daily milk production was about 15 pounds higher for cows fed small-grain silage cut at early heading.

The plant changes rapidly from head emergence to bloom as the stem stiffens. Fiber and lignin increase within the stem so the plant will be able to support the filled head. The vegetative ratio of leaf to stem goes down, and there is little nutrition in the head to offset this change. As the head fills, carbohydrate content goes up, which offsets some of the loss in quality due to greater fiber and lignin.

Small-grain silage cut prior to the soft-dough stage will be high in moisture and should be wilted to 35 percent dry matter. This will take one to six hours or more depending on drying conditions and stage of maturity. If equipment is not available to cut, wilt, and pick up from a windrow, then small grain should be allowed to reach the dough stage and direct chopped for acceptable silage. Direct-cut immature plants will cause seepage of silage, loss of nutrients, and acid silage, which is less



palatable to animals and has an offensive odor. Small grains may become excessively dry if harvested when the grain is in the dough stage. In this case, water may need to be added or a high-moisture green chopped forage mixed with the small-grain forage.

Special attention should be given to the length of cut on small grain silage. Chopper knives should be kept sharp and adjusted for a 3/8- to 1/2-inch cut for good packing of the ensiled material. Long stems can be a direct channel for feeding oxygen into the silage, causing spoilage. The addition of 100 to 200 pounds of ground corn per ton of small-grain silage will improve the quality and feed value of silage. The use of a silage inoculant should be considered for late-summer seeded small grains chopped during late October. Cooler temperatures during this period may reduce ensiling bacteria populations needed to properly store silage. The beneficial use of silage inoculants for later cuttings during warmer weather has not been well documented. Small-grain silage can be stored in any upright or horizontal type silo, but packing is more difficult in the horizontal type silos. When filling horizontal silos, wheel tractors should be run continuously during filling to ensure adequate packing. A plastic cover held in place by a layer of sawdust, lime, or old tires should be used to seal the silo upon completion of filling. Small-grain silage can also be made and stored as round bales with the use of bale-wrapper equipment.

Liming and Fertilization

High-quality small-grain forage production is most likely to occur where soil acidity has been corrected and a good fertilization program is followed. A soil test should be used to determine lime and fertilizer needs. In many cases, small-grain cover crops planted early for livestock forage benefit from carryover fertilizer applied to the previous summer annual. This practice makes valuable use of available plant nutrients that might otherwise be lost by leaching or surface runoff.

Nitrogen (N) increases vegetative growth and promotes tillering. Typical recommended N fertilizer rates for small-grain forage are 30 lb of N per acre in the fall and 30 lb topdressed in early spring. The amount of N needed will depend on the small grain species, soil type, crop use, previous crop, and planting date. When small grains are to be grazed, an additional 30 lb of N should be applied at seeding. A late-February to early-March application of 30 lb will stimulate tillering and early spring growth. Less nitrogen should be applied following tobacco or when N uptake from the previous summer annual was limited due to drought and/or poor plant growth. Split applications can help reduce lodging and the possibility of nitrate poisoning. In a total graze-out program, all the fertilizer can be applied preplant—except on sandier soils—or regular topdress applications can be made through the fall and early spring. If the crop is to be grazed until early spring then grown for grain, a split application is often best, with at least half the fertilizer applied preplant and the remainder topdressed after the cattle have been removed.

Phosphorus (P) stimulates rapid, early growth. If P is needed, it should be applied at or before seeding. Potassium (K) response in small grains has been less than for N or P. However, low levels of soil K should be corrected to aid standability and increase yield. Small grains harvested for silage remove large amounts of K from the soil, approximately 50 lb K_2O/A. Therefore, fall-applied K should be based on the needs of the small-grain silage crop rather than the following summer annual crop.

Seeding rates

Wheat	120-150 lb/A or ~ 32-36 seeds/sq ft
Barley	120 lb/A or ~ 30 seeds/sq ft
Triticale	120-150 lb/A or ~ 32-36 seeds/sq ft
Rye	90-100 lb/A
Oats	65-80 lb/A or 25-30 seeds/sq ft

Increase seeding rates by 10 percent when planting no-tillage into heavy residue.

Grazing Systems with Small Grains

As stated previously, each of the small grains furnishes excellent pasture in the fall and early spring. For early forage production, early seeding is necessary. In Kentucky, rye, oats, and triticale seeded on August 3 yielded 1.3, 1.4, and 1.4 tons more dry matter per acre, respectively, than that seeded on September 30. Wheat for forage is often planted four to six weeks earlier than wheat planted for grain production and at much greater risk of being severely damaged by the Hessian fly. Researchers in Georgia found that low to moderate levels of Hessian fly damage reduced spring forage yield 14 percent to 46 percent but did not greatly affect the crude protein or acid detergent fiber content. Therefore, varieties with Hessian fly resistance should be considered.

Fall grazing should be delayed until the plants are well established (6 to 8 inches high). Small-grain plants grazed before this time will likely suffer from severe defoliation and result in lower fall and spring production. On the other hand, excessive delay will result in rank, succulent plants, which are easily damaged during grazing. Stocking rate should be light enough to avoid continuous complete removal of top growth (graze to about 2 to 3 inches). Rotational grazing increases the production of small grains similar to that of perennial pasture grasses. Intermittent grazing should be timed to allow plants to fully recover (6 to 8 inches high) before the next grazing period. Research has shown that livestock trampling during grazing can sometimes have an influence on surface soil physical properties (decreasing infiltration rate and increasing bulk density); however, no significant reduction in productivity has been reported. It is likely that most soil surface changes arising from trampling are corrected by the freeze-thaw and shrink-swell action of winter.

Wheat for Grazing and Grain

Stage of growth at the time of grazing and the length of the growing season remaining should be considered in managing wheat for both forage and grain. Wheat to be harvested for grain should not be grazed after the crop reaches the stem elongation stage and nodes begin to develop. At this stage, the spike (head) is above the soil surface and moving up the stem. Grazing after this stage can greatly reduce yields. Usually a plant will have about five to six leaves on the main shoot when internode elongation begins. To determine this stage, the stem can be sliced open lengthwise and the joint and developing head observed. Depending on seeding date and weather conditions, wheat may reach this growth stage by early to mid-March.

Research results are quite inconsistent in terms of grazing effects on grain yield of winter wheat. Grazing usually reduces grain yield of small grains (25 percent to 79 percent) although yield increases have been reported in Kansas, Texas, Oklahoma, Indiana, New Jersey, and Argentina.

Grazing of winter wheat can be used to good advantage under these conditions:

- when wheat is moderately grazed;
- when trampling losses are avoided;
- when abundant fall growth might lead to lodging or impeded regrowth in spring, and
- when severe weather conditions do not stress the crop beyond the levels of stress induced by grazing. An acre of small-grain pasture can carry approximately 500 pounds of live weight per acre.

Weaned calves can receive all their needed protein and energy from good small-grain pastures. The stocking rate can be increased when supplemental feeding is practiced. Several brood cows can be grazed per acre by allowing only one to two hours of grazing per day. Grazing should be managed to avoid continuous complete removal of top growth.

Cereal Hay Production

Small-grain cereals can be used as a hay crop, either as an emergency feed or as part of a planned early summer forage program. Yields often average 2 to 4 tons (air dry) per acre. The moisture content at baling should be about 15 percent to 20 percent for small, rectangular bales.

The quality of hay made from wheat, barley, oats, and rye at the late-boot stage is similar. Of the small-grain cereals, triticale hay is the most variable in quality. Hay quality is more dependent on stage of maturity at harvest than is silage quality. Small-grain hays will have the highest quality when harvested at the late-boot stage. A popular time to harvest small-grain cereals for hay is at the early-milk stage, however. This is the best compromise between highest dry-matter yield and maximum hay quality. If protein content is an overriding factor, the crop should be harvested at the late-boot stage. Dry-matter yields are about 20 percent to 40 percent lower at this stage compared with the dough stage. Although the feeding value of small-grain hays is less than that of small-grain silages, hay can be excellent forage for young calves, replacement heifers, beef cows, and dry dairy cows. Rough awns in small-grain hay can cause cattle considerable soreness and irritation to the eyes, mouth, lips, gums, and lower surface of the tongue. A crop with rough awns should be ensiled rather than baled to minimize this occurrence. Also, harvesting at the late-boot stage rather than the dough stage reduces palatability problems caused by rough awns. Producers may want to consider planting awnless varieties of hard red winter and soft red winter wheat.

When harvesting small grains for hay in the late-boot stage, a crimper or crusher attachment will help speed the drying, but when harvesting in the milk or dough stages, these attachments increase kernel-shattering losses. If the crop is harvested in the dough stage, plants will not contain excess moisture, so crimping or crushing is seldom beneficial.

Occasionally, nitrates accumulate in small-grain cereals. This tends to occur as a result of drought, hailstorms, or late frost. Nitrate accumulation in small grains is more of a concern with hay than with silage. Oat hay is more likely to have a high nitrate level than other small-grain cereal hays. Additionally, small-grain hays tend to be more slippery than alfalfa or native grass hays, and the bales will be more difficult to stack.

Hay or Silage with Small Grains?

Assuming the same stage of maturity, any quality differences between small-grain silage and small-grain hay are likely to be in favor of small-grain silage. Leaf loss and kernel shattering are important factors contributing to quality loss in more mature small-grain hay. Research in South Dakota showed 24 percent to 48 percent loss advantage for oat silage over oat hay. This difference included the effects of field losses, storage losses, waste during feeding, and differences in forage quality and animal use. In addition, the data showed 21 percent to 27 percent faster gains for oat silage over oat hay when each feed comprised the entire ration. Kansas State University researchers also indicate that wheat silage has 10 percent to 20 percent greater feed value than wheat hay. When substantial amounts of grain are fed, the difference in animal performance between silage and hay would be decreased.

Nitrate Potential

Nitrates can accumulate in potentially toxic amounts in small-grain forages. Circumstances that interrupt normal plant development (i.e., periods of cool cloudy weather, hail damage, frost, and drought) may contribute to high nitrate accumulation. Oat hay appears to accumulate more nitrates than other cereal hays. Small-grain silages are less likely to contain dangerous levels of nitrates than hays made from the same crop since a 40 percent to 60 percent reduction of the nitrate level normally occurs during ensiling. Laboratory analysis for nitrate levels in a representative sample of hay should be considered if abnormal weather occurs just before hay harvest when hay is harvested at flowering or in earlier stages of growth. Toxic nitrate levels are very unlikely to occur in plants where growth conditions permit attainment of normal maturity and kernel development in hay harvested at the dough stage.

Nutritional considerations

In general, small-grain forages are low in minerals; therefore, forage testing is highly recommended in order to provide livestock a properly balanced ration. Mineral supplements containing magnesium are usually necessary when grazing cattle on small grain pasture to minimize the occurrence of grass tetany. Small-grain pastures can cause bloat. Daily supplementation with poloxalene (Bloat Guard) is highly effective in reducing bloat. Feeding high-quality grass hay, silage, and/or an ionophore such as Rumensin or Bovatec can also provide some protection against bloat. Rumensin and Bovatec have also been shown to increase stocker cattle weight gains on wheat pasture.

Summary

Small grains have the potential to provide supplemental nutrition to livestock as fall and spring pasture, as silage, and as a hay crop while serving as a winter cover, nurse crop, and/or scavenger of residual fertilizer nitrogen. Small grains managed for grain production should not be used as livestock forage unless the potential for lodging is considered high and total crop loss is likely.