



Managing Small Grains for Livestock Forage

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Small grains (*wheat and barley*) are grown predominately as a grain crop in Kentucky. They are the fourth most valuable cash crop in Kentucky and exceeded in importance only by corn as a feed grain. Managed properly, these small grains and others (*oat, rye, and triticale*) are a multi-purpose crop that can also be used for grazing, silage, and hay production while serving as winter cover crops for soil erosion control, nurse crops, and as scavengers of residual fertilizer N following heavily fertilized summer annuals.

Nutritive Quality

In general, digestible energy and protein contents of small grains are comparable to other forage species at the same stage of maturity. However, small grain forage quality (like that of other cool and warm season forage species) will be affected by stage of growth, species selection, and nutrient availability.

Forage quality of small grain crops changes markedly as they mature. Crude protein content of small grains ranges from approximately 18-22 percent during the fall, winter, and early spring and drops rapidly during stem elongation and seed formation.

Crude fiber content is quite low in small grains until seedheads begin to develop; therefore, dry matter digestibility ranges from approximately 70-75 percent during the vegetative growth period and declines rapidly with increasing maturity.

Small Grain Selection

■ Barley

Barley is not as winterhardy as wheat or rye; therefore, it must be sown earlier in the fall (Sept. 20-Oct. 10) to become well established before winter. Barley is best adapted to rich, well-drained, loamy soils and should not be planted on poor, sandy, or wet soils. 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. 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 2-3 bu/ac and cut in the late soft-dough stage.

■ Wheat

Wheat is one of the most versatile small grains for a farming operation. Due to its excellent winterhardiness, wheat can be sown later in the fall than barley and is a good choice for planting following corn or soybean harvest. Wheat is well adapted to most soils in Kentucky, performing best on loamy, well-drained soils having medium to high fertility. Wheat will withstand wetter soils than barley or oats but tends to be less tolerant of poorly drained soils than rye and triticale.

Newer winter wheat varieties with Hessian fly resistance can be seeded (2-3 bu/ac) as early as late August and produce an abundance of excellent fall grazing. Hessian fly resistance is highly dependent upon the type of Hessian fly in Kentucky during a particular season; therefore, some risk is still involved when planting these newer varieties. Early planting also increases the potential for recovery of residual or left-over 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 (6-10 T/Ac at 65% moisture) than barley (5-8 T/Ac) and be of higher quality than rye when cut at the bloom stage (Feekes GS 10.5; refer to Figure 1). At this stage, wheat yields are often 50% higher than at the boot stage with little loss in quality (Table 1). For highest silage yields, the taller wheat varieties should be considered and not seeded until early to mid-October.

■ Rye

Rye (along with wheat) has been a traditional winter cover crop grown in rotation with corn and soybeans or strictly as a cover following tobacco. Rye is the most winterhardy of all small grains. Like wheat, rye can be sown in late August (at 2-3 bu/ac) 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 it declines rapidly in palatability with maturity.

The recent release of several "abruzzo" types of rye (Winterking and Aroostook) has provided better varieties for silage. Recent trials indicate that these newer varieties of winter 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) and harvested in the late boot stage, wilted and ensiled. Research has shown that at this stage of growth rye protein is efficiently digested in the rumen with over 75% being utilized.

■ Winter Oats

As a rule, the hardiest winter oat variety (Kenoat) is considerably less winterhardy than common wheat and barley varieties. However, in the southern areas of Kentucky, winter oats will usually survive most winters and produce high yields of forage (4-8 T/Ac). 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 2.5-3 bu/ac) 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 wheat or rye. Winter oats produce a high quality silage; however, lower yields are common compared to the other small grains.

■ Spring Oats

The acreage of spring oats grown in Kentucky is relatively small; however, spring oats have a place in the northern half of the state where fall-sown oats usually winterkill, or in areas where a fall-sown crop has failed.

Oats are the only one of the small grains which have spring varieties adaptable to Kentucky. Spring seeding of winter varieties will result in very low yields since winter varieties require vernalization for reproductive growth. Forage yields of spring oats may be substantially lower than those of the winter oat varieties. Even though spring oats are typically 10 days to two weeks later than winter wheat in maturity, quality is comparable to winter wheat high quality at the boot stage (Table 1).

Spring oats can be used for hay, silage, or as a companion crop for spring-seeded legumes and grasses. The normal rate of seeding (2.5-3 bu/ac) should be reduced by one bushel per acre when other forages are seeded with it. Spring oats should be sown as soon as the ground can be worked in late winter or early spring. Seeding in February or early March when soil conditions permit increases the chances for high yields. Spring oats may be seeded as late as early April for establishing temporary ground cover as a companion crop.

■ Triticale

Triticale is a cross between rye and wheat and at the present time is not recommended as a grain crop in Kentucky. Triticale is a high yielding forage crop that can produce approximately 10-12 T/Ac of high quality silage. Yield is comparable to that of rye but lower than that of wheat. For highest quality silage, triticale should be harvested at the boot stage and may require more time for wilting than rye and wheat. Triticale should be seeded at 2 bu/ac in late September to early October.

Grazing Management

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 ton dry matter per acre, respectively, on Sept. 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 to 46% but did not greatly affect crude protein or acid detergent fiber content. Therefore, varieties with Hessian fly resistance should be considered.

Fall grazing should be delayed until 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 2-3 inches).

Rotational grazing has been shown to increase production of small grains similar to 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.

Interseeding Small Grains into Established Pastures

Interest in interseeding small grains into established pastures to extend the fall and spring grazing seasons has increased with greater access to no-till pasture seeders in Kentucky. This practice has proven to be quite successful in the southern U.S. where interseeding small grains into warm season perennial forage crops like bermudagrass and bahiagrass can provide an additional 60 to 90 days of high quality forage grazing.

In Kentucky, fall no-till seeding of wheat or rye into cool season pastures may be a desirable practice particularly following a dry summer or when pastures are thin and composed predominately of warm season species such as crabgrass. Mowing or grazing pastures close before seeding small grains will also aid in controlling competition.

Little fall grazing is likely when wheat or rye are interseeded in late fall after cool season grass growth begins to slow. Approximately 30 lb of N per acre should be applied in the fall to stimulate growth for fall grazing. An early spring application of nitrogen at 30 lb per acre will also increase small grain forage availability for early spring grazing.

Wheat for Grazing & Grain

The 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 (Feekes GS 6) and nodes begin to develop (Figure 1). 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 to 79%) 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 needed protein and energy from good small grain pastures. 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.

Liming & 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-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.

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 standing ability and increase yield. Small grains harvested for silage remove large amounts of K from the soil (approx. 50 lb K₂O per acre). Therefore, fall-applied K should be based on the needs of the small grain silage crop rather than the following summer annual crop.

For the latest information on soil testing and fertilizer recommendations, refer to Extension publication AGR-1, "Lime and Fertilizer Recommendations," available from your county Extension office.

Small Grains for Silage

Producing and harvesting small grains as silage has continued to increase in Kentucky. Many farmers have increased livestock numbers on their farms and need additional feed. 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 (refer to Table 2 for specific recommendation). Data from the University

of Georgia indicate 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 silage cut at early heading.

The plant physiology 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. Table 2 lists the small grain species and their recommended harvest stage of growth for highest quality and yield.

Small grain silage cut prior to the soft dough stage will be high in moisture and should be wilted to 35% 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 and loss of nutrients, while also causing an acid silage which is less palatable to animals and has an offensive odor.

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 fall-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.

In 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

Table 1. Relative Differences in Growth Stage Development, Yield and Nutritive Quality of Various Small Grain Species¹

Species	Average Date for Growth Stage					
	Boot	Headed	Bloom	1/2 Seed	Milk	Soft Dough
Barley ²	4/19	4/22	5/4	5/11	5/18	5/26
Rye	4/29	5/2	5/9	5/17	5/23	6/1
Wheat	5/13	5/19	5/23	5/31	6/6	6/11
Triticale	5/15	5/21	5/26	6/3	6/10	6/14
Oat	5/21	5/28	5/31	6/5	6/12	6/16

Yield T/Ac @ 35% D.M.						
Rye	7	8	9	10	11	11
Wheat	7	8	10	10	11	12
Triticale	8	10	11	12	13	13
Oat	4	5	6	8	8	9

Crude Protein %						
Rye	13	11	9	7	6	5
Wheat	10	10	8	9	7	6
Triticale	11	9	8	7	6	5
Oat	12	10	9	9	8	7

Total Digestible Nutrients %						
Rye	63	52	46	45	47	50
Wheat	60	59	53	54	56	56
Triticale	56	46	46	45	50	52
Oat	65	60	53	53	56	57

¹ Average values of several years' research data from University of Kentucky, Agronomy Department.

² No forage quality data for barley reported due to lack of research data and its limited use as a forage crop.

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. In general, small grain forages are low in minerals; therefore, forage testing is highly recommended in order to provide livestock a properly balanced ration.

Related Publications

- AGR-18 Grain & Forage Crop Guide for Kentucky
- AGR-1 Lime & Fertilizer Recommendations
- ID-101 Interpreting Forage Quality Reports

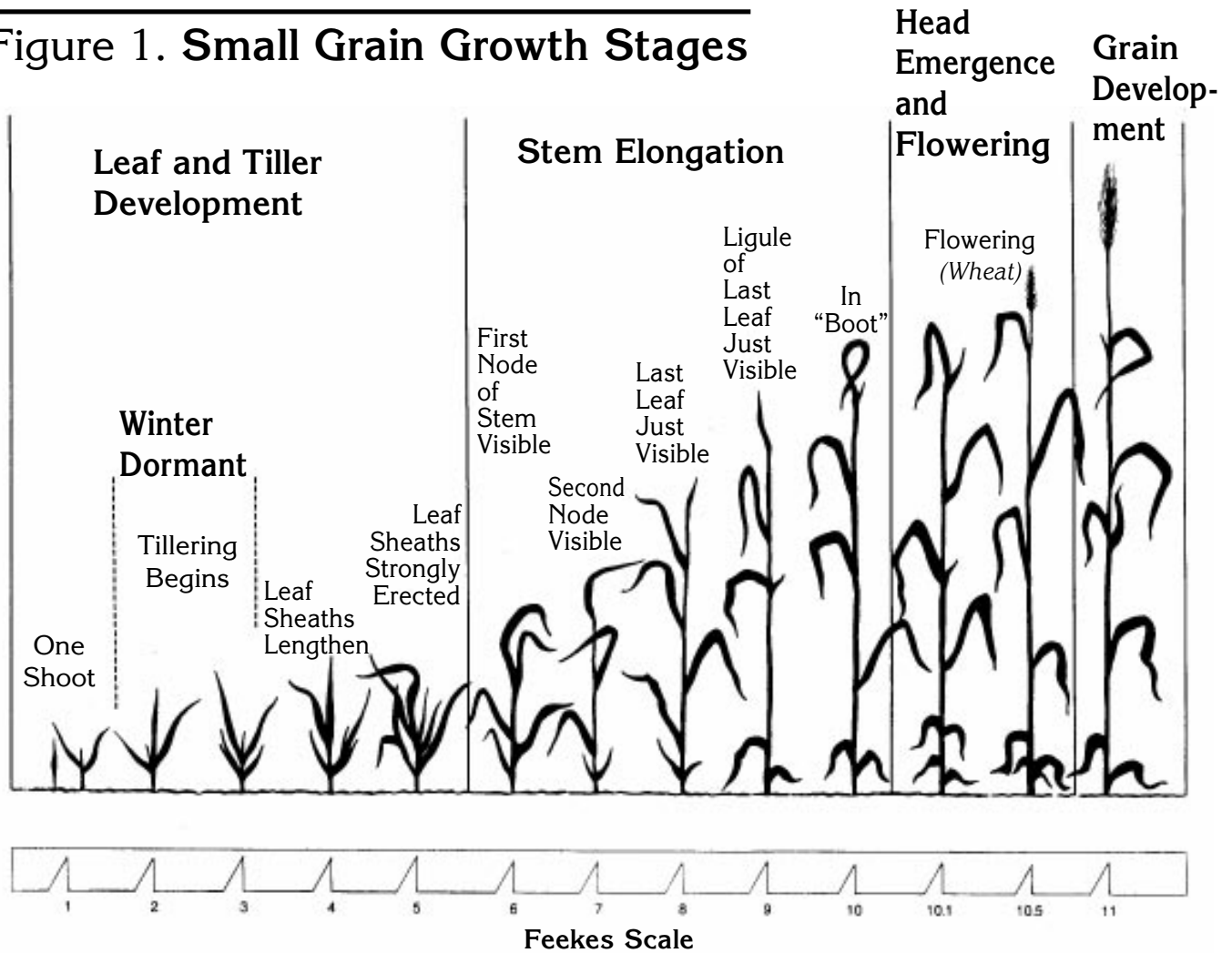
Table 2. Recommended Stage of Maturity to Harvest Small Grain Silage for Quality and Yield¹

Small Grain Species	Growth Stage
Rye & Triticale	Boot
Wheat	Bloom ²
Barley	Soft Dough Stage
Oats	Early Seed Set

¹ University of Kentucky, Department of Agronomy

² Bloom stage occurs approximately 7 days after heading.

Figure 1. Small Grain Growth Stages



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