Forage News
Mississippi State University Extension Service

Cool-Season Forages Establishment and Maintenance

Rocky Lemus
Extension Forage Specialist

Planting Considerations

Temperature: Although small grains are cool-season plants, they do require temperatures warm enough for the plants to maintain growth. When average temperatures drop below 50 degrees, plant processes and growth begin to slow. If early grazing is needed, begin planting in early October to make use of fall rains, to graze by mid-November under good growing conditions. Earlier planted oats or wheat may try to head out before the onset of winter if not grazed. Armyworms can be a problem in early-planted small grains.

Establishment: The first step in establishing winter annuals is selecting a suitable site. The best soils for winter annuals are well-drained and fertile. Winter annuals can be established using tillage or no-till (sod seeding). The primary advantage of using tillage to establish winter annuals is that stands can be planted earlier and established faster to produce more fall forage when competition from existing sod is absent. Winter annuals can be broadcast planted, but risk of failure is higher than with drilling. Broadcasting is better suited to ryegrass than to small grains. Light disking before or after (or both) broadcasting may improve soil-seed contact and result in better stands. When seed is broadcast planted, planting rates should be increased by at least 20 percent. Winter annual seed can be mixed with fertilizer and broadcast planted with a fertilizer spreader. However, if this is done, it is vital that seed be planted immediately after mixing because prolonged contact with fertilizer may kill seeds.

Competition from warm-season sods that have not yet gone dormant is the most serious problem for early sod-seeding of winter annuals. Warm-season grass on no-tilled sods must be controlled in some way prior to planting winter annuals. Actively growing warm-season grasses rob water and soil nutrients from winter annual seedlings, and shade from a tall grass canopy slows down seed germination and seedling growth. Even if already dormant, thick dried grass residue also shades seedlings and can interfere with correct seed placement when drilling. For best annual stands, warm-season grass residue should be no more than 2 inches in height when annuals are drilled, and the warm-season grass should not be actively growing. Residue can be managed by close grazing, bush-hogging or making hay prior to drilling. Shallow (1 inch) disking of sods to destroy no more than one-third of the sod before or immediately after planting may allow earlier planting and earlier growth of winter annuals on sandy or loamy soils. Disking of heavy clay soils also is undesirable because it increases roughness of the field. Establishment of winter annuals into bahiagrass is likely to be more difficult than into bermudagrass because of the extremely competitive nature of bahiagrass, which grows later into the fall than bermudagrass. The easiest method of sod control is to delay planting until the sod is dormant or nearly so. Overseeding permanent grass pastures with winter annuals usually decreases annual yield of the perennial grass to some extent as a result of shading and competition in spring. This is especially a concern with annual ryegrass because it grows so late into summer. Pastures should be stocked heavily enough in April and May to prevent formation of a dense canopy of headed-out ryegrass that will shade the understory warm-season grass and delay its growth.

Seeding Depth and Planting Rates: Recommended planting date for winter annuals in southern Mississippi late September to late October. In northern Mississippi winter annuals are sod-seeded in early September to early October. Ryegrass and clover seeds should be planted shallower (1/8 to ¼" depth) than large seeded small grains (½ to 1" depth). Ball clover should be broadcasted. Planting rates vary depending on the planting method used and the species mixtures. Mixing ryegrass seed with fertilizer and broadcasting with spreader equipment is popular. Plant the seeds the same day they are blended, especially where high rates of nitrogen fertilizer are used. If legumes are included in the

seeding mixture, do not mix freshly inoculated legume seed with fertilizer because fertilizer can damage the inoculant.

Table 1. Characteristics of winter annual forages.

Forage	Advantages	Disadvantages
Oats	Early grazing High forage quality (gains) Germinates under limited moisture	Poor cold tolerance Poor disease tolerance in many varieties
Annual Ryegrass	Most popular cool-season grass Can be seeded by surface broadcast Few bloat problems Late Maturing (long spring grazing)	Limited fall grazing Poor winter grazing in cold weather Contamination of fields for other small grains
Rye	Most drought tolerant Most cold tolerant Rapid fall growth	Early maturity (early termination) Unpalatable at boot stage Can become infested with ergot (poisonous)
Wheat	Good Cold tolerance Can be grazed or grained Drought tolerant	Least productive cool-season grass Low disease tolerant Bloat and grass tetany problems

Source: Stichler and Livingston (Texas A&M).

Cultivar Selection: When selecting a variety, the key is to select one with a proven track record of good performance in the same region where it is to be used. Adaptation to soil conditions (soil type, drainage, pH), local climate (rainfall, minimum and maximum temperatures) and tolerance or resistance to local plant diseases and insect pests are the critical issues. When planting a cool-season pasture, it is wise to plant a mixture of species as each has slightly different growth habits. Planting mixtures of winter annual species stretches the supply of high-quality forage over a longer period when an early-maturing species is grown in combination with a later-maturing one. This will extend the grazing time and prolong the productivity of the pasture. Inclusion of legumes in the mix is also a good idea. Annual ryegrass is usually the most common planted species. It could also be mixed with small grains (rye, wheat, oats, and triticale). Commonly used mixtures are wheat/annual ryegrass and rye/annual ryegrass. A three-way mixture, such as wheat/rye/annual ryegrass, provides early-, mid-and late-season grazing.

Fertility

The three primary nutrients of concern for pastures in cool-season annual pastures are nitrogen (N), phosphorus (P), and potassium (K). Grasses generally use nitrogen (N), phosphorus (P) and potassium (K) in a 4-1-3 ratio. Testing a soil sample is the best way to determine which nutrients are adequate, which are lacking and at what amounts. With a soil analysis, a fertility program can be structured to add the insufficient nutrients. Without the analysis, nutrients may be wasted and add to ground or surface water pollution, or be insufficient for maximum production.

Table 2. Comparable characteristics of winter pasture crops under optimum rainfall conditions.

	Oats	Annual Ryegrass	Rye	Triticale	Wheat
Fall (Oct. – Dec.)	Excellent	Good+	Good+	Good	Fair
Winter (Jan. – Feb.)	Fair	Good	Good	Good	Good
Spring (Mar. – Apr.)	Good	Excellent	Fair	Good+	Good
Late Spring (May – Jun.)	Poor	Good	Poor	Fair	Poor
Winter hardiness	Poor	Good	Excellent	Good	Fair
Disease tolerance	Poor	Excellent	Good	Fair	Fair
Grazing quality	Excellent	Excellent	Excellent	Excellent	Excellent
Hay quality	Good	Excellent	Good	Good	Good
Planting rate (lb/ac)[1]	75 – 100	25 – 30	75 – 100	75 – 100	75 – 100
Yield Productivity (lb/ac)	5,500	9,500	7,500	7,800	4,100

[1]Planting in a prepared seed bed and in monoculture. Increase rates by 20% if broadcasting.
Source: Stichler and Livingston (Texas A&M).

Table 3. Characteristics of various ryegrass varieties.

Cultivars	Maturity (flowering)	Crown Rust Index*	Cold Tolerance
Gulf	Early to Mid	4.5	Low to Medium
Graze-N-Go	Mid to Late	2.5	High
Jackson	Mid to Late	2.5	High
Jumbo	Late	1.6	Medium to High
Marshall	Late	8.1	High
Passerel Pluss	Late	8.2	High
Prine Tetraploid	Mid to Late	5.5	High
Rio	Mid to Late	2.7	High
Ribeye	Mid	4.5	Medium to High
TAM 90	Mid to Late	4.6	Medium to High

*Crown rust index: 0 – 3 is highly resistant, 3 – 5 is resistant, 5 – 7 is susceptible, and above 7, highly susceptible.

Phosphorus is essential for early root development, particularly in cold soils during fall and winter. Phosphorus is less available to plants in cold soils. If phosphorus is limited, tillering can also be reduced. If a prepared seed bed, incorporate the phosphorous. Potassium is important to reduce plant stress (cold tolerance). Nitrogen improves both grass yield and protein content. It also improves the vigor of grass plants, which can thicken stands and reduce weed invasion. When adequate soil moisture is present, economical rates of nitrogen more than double forage production. Apply N just prior to the period of most rapid grass growth and when animals will get the best forage utilization. Do not apply N at seeding since it could leach out of the system reducing nitrogen use efficiency by the emerging plants. A good rule to remember is that it takes 0.36 pounds of nitrogen to produce 10 pounds of forage to produce 1 pound of gain in livestock.

- **Pasture Program**
  - Seeding: apply nutrients recommended in soil report.
  - After Emergence (2 to 4 leaf stage): 30 – 45 lb N/ac.
  - After First grazing: 45 – 60 lb N/ac.
  - After each subsequent grazing (or monthly intervals): 30 – 45 lb N/ac.

- **Hay or Silage Program**
  - At Seeding: apply nutrients as recommended on the soil report.
  - After Emergence (2 to 4 leaf stage): 30 – 35 lb N/ac.
  - After first cutting: 60 to 75 lb N/ac.
  - After 2nd cutting: 45 – 60 lb N/ac.
    - If third cut is harvested or if RG is grazed.

Legumes

Legumes can improve the production and nutritional value of pastures while reducing nitrogen fertilization requirements. It is important that a pH of at least 6.0 is maintained. A good legume stand should be 30% to 40% clover in the pasture. Legumes have several benefits: (1) they reduce the need for nitrogen fertilizers (they can provide form 50 to 200 lb N/ac/yr to the pasture), (2) they improve seasonal distribution of forage dry matter by boosting yields and extending the grazing season and (3) they improve forage quality by increasing protein levels and overall digestibility of the forage.

Table 4. Clover seeding rates and season of production.

Species	Seeding Rate (with ryegrass[1]) (lb/ac)	Production Time
Annuals		
Arrowleaf	5 – 10	February – June
Ball	2 – 3	March – early May
Berseem	10 – 15	November – June
Crimson	15 – 20	November – April
Persian	4 – 6	March – April
Rose	6 – 8	March – April
Perennials		
Red	6 – 8	March – June
White	2 – 3	October – May

[1]**Ryegrass seeding rate is 20 – 25 lb/ac**

Table 5. Maturity, bloating and reseeding potential of different clover species.

Species	Maturity	Bloat Potential	Reseeding Potential
Annuals			
Arrowleaf	Late	Low	High
Ball	Medium	High	High
Berseem	Medium	Low	Low
Crimson	Early	Medium	Low
Persian	Medium	High	Medium
Rose	Early-medium	Low	High
Perennials			
Red	Late	Low	Low
White	Late	High	High

Several clover species are suitable for winter forage production. **Red clover** also is an upright, crown-forming legume adapted to tall grazing heights and long rest periods. Although it is a short-lived perennial throughout much of the U.S., it tends to behave as an annual in the South. Red clover is more persistent under rotational grazing. **White clover** is a low-growing, clone-forming legume well adapted to

continuous grazing. In the northern regions of the U.S., it can be a long-lived perennial. In the far southern regions, it tends to behave as an annual. **Arrowleaf clover** has been a highly productive, annual clover with excellent reseeding potential. It matures later than most annual legumes and can grow 2 to 4 feet tall. Arrowleaf clover remains more productive if grazed to a height of 2 to 4 inches in early spring. Regrowth is limited after cutting for hay. **Crimson clover** also is a winter annual legume. Although it produces excellent forage, it has relatively poor reseeding abilities, necessitating reseeding each fall. Crimson clover will produce more forage at lower temperatures than other clovers and can be grazed throughout winter. Hairy vetch is a dependable, widely adapted, cool-season annual legume. If allowed to mature, hairy vetch has good reseeding capability. **Ball clover** is very tolerant to poor drainage. Bloat can be a problem. Ball clover is more tolerant to acidity than crimson clover. It tolerates heavy grazing and has good reseeding potential.

Table 6. Potential nitrogen fixed by various legume species and calculated value (patterned after MSU Publication 2497).

	N Fixed	Price of N					
Crop	lb/ac/yr	$0.70	$0.80	$0.90	$1.00	$1.10	$1.20
Alfalfa	150 - 250	105 - 175	84 - 200	135 - 225	150 - 250	165 - 275	180 - 300
Arrowleaf clover	50 - 110	35 - 77	62 - 88	45 - 99	50 - 110	55 - 121	60 - 132
Crimson clover	70 - 120	49 - 84	39 - 96	63 - 108	70 -120	77 - 132	84 - 144
Red clover	75 - 200	53 - 140	42 - 160	68 - 180	75 - 200	83 -220	90 - 240
Sweet clover	80 - 110	56 - 77	45 - 88	72 - 99	80 - 110	88 - 121	96 - 132
White clover	75 - 150	53 - 105	42 - 120	68 - 135	75 - 150	83 - 165	90 - 180
Vetch, Lespedeza, etc	50 - 150	35 -105	28 - 120	45 -135	50 - 150	55 - 165	60 - 180

Source: Oldham, 2008.

Grazing Management

Winter annual pastures are suitable for beef and dairy cattle, sheep, goats and horses. Forage quality is excellent. Consider the plant first when deciding on a grazing management plan. Plant leaves capture sunlight and convert it into energy. Without leaves, the plant cannot create energy. If the leaf area is reduced radically, plants start robbing the root system to replace the foliage. The root system starts to die if plants are not allowed to maintain sufficient foliage to develop or regrow after grazing. Before turning livestock on the field, forage should be at least 6 to 8 inches tall, 4 to 6 weeks after emergence and well tillered and well rooted. To maintain enough leaf area for continued growth, do not allow animals to graze forage to below 3 to 4 inches.

Table 7. Cattle performance on warm-season pastures overseeded with monocultured ryegrass (Marshall), and mixtures of ryegrass with wheat (Madison) and cereal rye (Bonel). Pastures were stocked continuously at one steer or heifer per acre and grazed from mid-December through mid-April during three successive winters.

	Year	Ryegrass	Rye + Ryegrass	Wheat + Ryegrass	Hay & Grain
Total gain (lb/head)	1997 – 98	272	244	253	166
	1998 – 99	263	247	227	157
	1999 – 00	129	126	119	145
Daily Gains (lbs/day)	1997 – 98	2.43	2.17	2.26	1.49
	1998 – 99	2.35	2.21	2.03	1.40
	1999 – 00	1.65	1.61	1.53	1.86

Source: Jennings and Coffey, Univ. of Arkansas

If only cool-season grass pastures are to be used, extra management is required to ensure adequate forage for season long grazing. Forage production and quality can be optimized by splitting the pasture into paddocks then grazing in a rotation allowing time for regrowth to occur between grazing periods. Limit grazing is also a good strategy with annual ryegrass. If a producer is using strip grazing, makes sure that it begins close to water source to minimize losses by animal trampling. Rotational grazing requires more management than continuous grazing. Managers must decide when to rotate based on: (1) how many animal units a rotation can maintain, (2) when to move to another pasture; (3) when and how much additional nitrogen to apply; (4) whether to allow peak-hour grazing (i.e., 2 hours in the morning and 2 hours in the afternoon); and (5) how long to rest pastures before grazing.

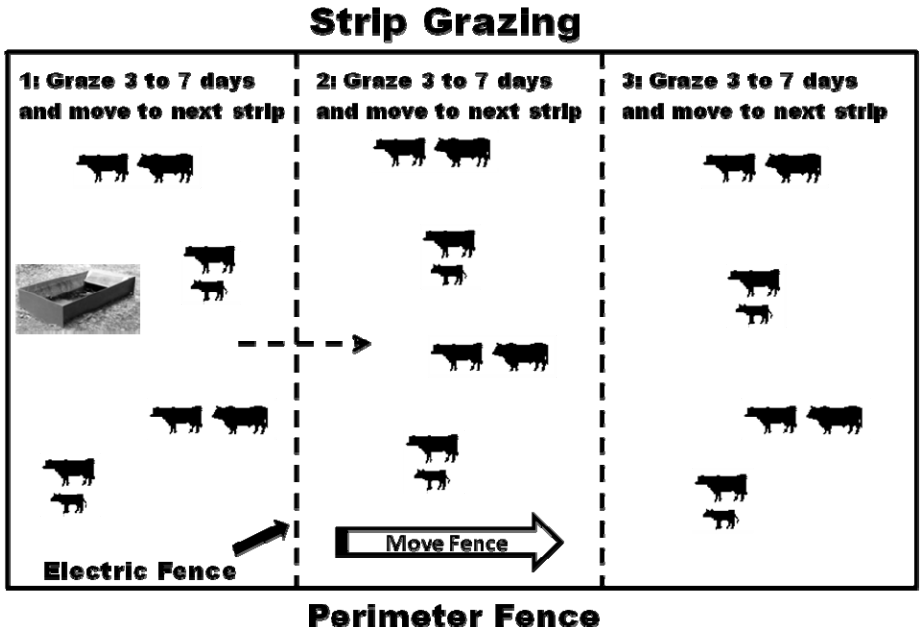

Figure 1. Strip grazing sequence.

Table 8. Steer Performance on wheat-ryegrass pastures in the spring

Grazing System	Stocking Rate (lbs body weight/acre)	Avg. Daily Gain (lbs/steer/day)	Live Weight Gain Per Acre
Continuous	1461	2.07	428
Rotational			
3 paddocks	1878	2.36	599
11 paddocks	2028	2.21	618

Source: **Aiken, 1998**

Stocking rate is a critical factor in the success of winter annual pastures. If stocking rate is too high during periods of slow grass growth, overgrazing will decrease the ability of the grass to recover during favorable period. Stocking rate will vary according to the productivity of the particular pasture and the amount of nitrogen applied, but 1 to 1.5 (fall/winter) and 1.5 to 2 (spring) stocker calves per acre is a realistic target in most cases. The minimum ADG for profitable stocker cattle production is 1.5 pounds per day, and this goal is easily achieved on winter annuals. Winter annual pastures can provide an abundance of high-quality forage. Producers can earn the most profits when they use best-management practices that fertility, variety, and grazing management.