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Using Cereal Grain Forages and Mixtures With Annual Ryegrass for Grazing

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Introduction

Routinely, wheat, oats, rye and annual ryegrass are sod-seeded into dormant bermudagrass and other warm-season grass sods to provide fall, winter and spring grazing. These winter annuals can be seeded as mixtures or in monoculture. They also can be drilled into clean-tilled, prepared seedbeds. While this practice is used extensively in stocker enterprises throughout the lower Midwest, it is less commonly observed throughout Arkansas, primarily because many soils throughout the Ozark region are not conducive to annual tillage. Regardless of the establishment method, cereal grains and annual ryegrass have excellent forage quality characteristics and are good forage options, especially for stockers or dairy cattle that have very high nutrient requirements.

Management

Overview. The establishment of cereal grains in clean-tilled, prepared seedbeds offers some advantages over sod-seeding methods, but this technique also requires additional investments in time and tillage. In addition, there are increased risks of soil erosion, and clean-tilled pastures are less supportive of cattle traffic under wet conditions than sod-seeded stands. The major advantage of establishing cereal-grain forages in prepared seedbeds is that there is no competition from the base sod of warm-season grasses. If managed properly and planted early (around September 1), this will greatly increase the availability of forage in the fall.

Fertilization. Before establishment, soil testing is always advised. Up to 60 lbs phosphate (P_2O_5) per acre should be applied if soil-test P levels are low (<60 lbs/acre). No additional P_2O_5 is necessary if soil-test P is greater than 100 lbs/acre; intermediate application rates can be used if soil tests indicate P levels to be between 60 and 100 lbs/acre. Typically, applications of potash (K_2O) that range between 30 and 60 lbs/acre are recommended if soil test potassium (K) levels fall below 200 lbs/acre. About 60 lbs nitrogen (N) per acre should be applied at or near planting; additional applications of 60 to 70 lbs N/acre can be made in the late fall or early spring to meet production needs. For each application of 60 lbs N/acre, producers can usually expect about 100 animal unit grazing days. If broiler litter is used as a preplant fertilizer, an application rate of two tons/acre is common; however, this may not be enough to meet all the nutrient requirements for the crop.

Most soft-red winter wheat varieties grown in the Southeast are more acid tolerant than those hard-red varieties grown in the Midwest. Most varieties common to Arkansas will perform adequately if the soil pH is 5.5 or above. The University of Arkansas recommends no application of lime if the soil pH is over 5.7.

Seeding rates. Wheat and rye can be established in monocultures by drilling at a rate of about

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2 bushels/acre. For annual ryegrass planted alone with a drill, typical seeding rates are between 20 and 30 lbs/acre; if broadcasting techniques are used, the rate should be increased to 30 to 40 lbs/acre. Oats planted alone should be drilled at a rate of 3 to 4 bushels/acre. When establishing mixtures of annual ryegrass with cereal grains, producers should cut the rate of annual ryegrass to 15 to 20 lbs/acre. Similarly, the planting rate for the wheat or rye component of the mixture should be cut from 2 to 1 bushel/acre. When used in combination with annual ryegrass, plant oats at a rate of 1.5 to 2 bushels/acre.

Timing of establishment. Cereal grains can be planted anytime between September 1 and early November; however, fall forage production will usually be optimized by planting as early in September as soil moisture and other climatic variables permit. Early establishment does increase the risk of damage by several types of armyworms and other pests; therefore, producers should monitor their fields closely for signs of damage.

Considerations for sod-seeded establishment. Most recommendations for sod-seeded establishment of cereal grains are similar to those for clean-tilled establishment. Generally, anything that reduces the competitiveness of the base warm-season sod is desirable for establishment of cereal grains and annual ryegrass. Some techniques that are typically used include 1) closely clipping or grazing the warm-season grass sod prior to planting, 2) light tillage/soil disruption, 3) waiting until the base sod of warm-season grass is dormant before planting and 4) adjusting the timing of fertilizer application. It is not a good practice to apply N fertilizers while warm-season sods are still actively growing. If possible, some tillage/sod disruption is likely to increase fall growth; however, the potential for fall growth in sod-seeded stands is greatly reduced relative to clean-tilled establishment.

Selecting a forage or mixture. While all cereal grains and annual ryegrass produce excellent forage, there are some traits of each species that may make them more or less appropriate choices. In the spring, rye will develop faster than the other forages, typically producing 35 to 40 percent of its total dry matter yield by March 1. A recent study at Batesville showed that full emergence of the reproductive head occurred 19 days earlier in rye than in oats; developmental characteristics of wheat are intermediate between those of rye and oats. Producers wishing to harvest wheat as grain should remove cattle from wheat pastures by the time the plants begin to joint, which is likely to occur in late February or early March, depending on weather and location.

Annual ryegrass develops slower in the spring than the cereal grains, but may continue to produce forage well into June. It also possesses extremely aggressive regrowth characteristics. **Annual ryegrass is also an extremely aggressive reseeder; producers who want to retain the potential to harvest cereal grains for grain in future years should avoid planting ryegrass on these sites. Once established, volunteer annual ryegrass is difficult to remove from cereal grains. Much of the seed produced by these volunteer plants will remain viable well beyond the next fall planting season.**

Grazing management. Cereal grains can be used for grazing in the fall, winter or spring. Grazing can't be initiated until plants develop a sufficient root system to prevent them from being uprooted by grazing animals. When these forages are drilled into prepared seedbeds in early September, it may be possible to initiate grazing by late October. The accumulation of forage dry matter for wheat or oats at this time can realistically be expected to be 2,000 lbs/acre (8 to 12 inches in height) under most Arkansas conditions and will support a stocking rate of about 500 lbs of liveweight/acre. At highly productive sites, this stocking rate can sometimes be increased by up to 40 percent or to about 700 lbs liveweight/acre if growing conditions are ideal. **In contrast, when sod-seeded techniques are employed, the fall growth potential is greatly reduced; oftentimes, there is no grazable forage until early spring.** When spring growth begins, producers can safely double the stocking rate that was recommended for the fall. In the fall and winter, some care should be given to avoid overgrazing. It is best to make certain that there are always some green leaves below grazing level. Maintaining a 3- to 6-inch stubble height is highly desirable.

Controlled grazing techniques, such as strip grazing, various rotational schemes or using these pastures as short-term (1 to 2 hours daily) supplements can be helpful in improving forage use and avoiding losses of forage due to trampling. If possible, it is desirable to remove cattle from pastures if pastures become excessively soft or muddy.

Effects on subsequent crops of warm-season grasses. When sod-seeding techniques are used, under use of winter annuals in the spring will suppress (primarily by shading) the development of the initial crop of bermudagrass or other warm-season grasses. If maximizing the production of bermudagrass is a major goal within the production system, producers may wish to remove ungrazed forage in the late spring by clipping or as a cutting of hay or silage.

Cautions. Typically, forages with high concentrations of crude protein and low concentrations of fiber (NDF) are most likely to be associated with pasture bloat. Cool, moist weather conditions may also increase the incidence of pasture bloat. Producers should be cautious when

offering winter annual pastures to cattle, and these animals should be observed regularly. To aid in preventing pasture bloat, do not allow hungry cattle unlimited access to wheat or other similar pastures. Products that control pasture bloat such as Bloat Guard® (Smith-Kline-Beecham Animal Health, Exton, PA 19341) are available, and their use should be strongly considered to avoid losses of livestock.

Another potential problem for cattle grazing these types of pasture is grass tetany. This is observed most frequently in mature cows that have recently calved; however, stockers also can be susceptible. Mineral supplements containing magnesium are often recommended. Finally, nitrates will occasionally accumulate in cereal grain forages; this may occur in response to drought, hailstorms or late (spring) frosts. Producers may wish to have their forages evaluated if growing conditions are stressful.

Forage Quality of Clean-Tilled Wheat

Clean-tilled winter wheat has been used to develop stocker cattle in the lower Midwest for many years. This practice can also be used by producers in Arkansas who have tillage equipment and appropriate soil types for this practice. The forage nutritive value of clean-tilled winter wheat has been evaluated in a study repeated over several years in Batesville. Soft-red winter wheat was drilled into a prepared (clean-tilled) seedbed in early September. These pastures were grazed continuously and sampled monthly over a five-month experimental period. The quality characteristics of these monocultured wheat forages are summarized in Table 1.

The forage quality of winter wheat is clearly exceptional. Between the October and February sampling dates, there was a gradual reduction in the concentration of crude protein and concurrent increases in concentrations of NDF and ADF; however, these changes are not terribly important because the quality characteristics over the entire grazing period were more than adequate to support excellent weight gains. The digestibility of these forages exceeded 92 percent on all sampling dates; this compares favorably with the expected digestibilities of many concentrates. Cattle on these trials were supplemented with 2 lbs of corn per day plus a mineral mix containing an ionophore (monensin). Average daily gains for these cattle generally exceeded 2.5 lbs per day.

It is important to note that the grazing period for these trials covered the time interval from October through February. During this interval, wheat remained entirely vegetative. Producers wishing to continue grazing cereal grain forages beyond this time frame should expect rapid reductions in forage quality as these plants continue to mature in the spring. This general trend may be suppressed somewhat by grazing pressure, but not indefinitely.

Grazing Overseeded Cereal Grains and Ryegrass

A common practice, particularly in southern Arkansas, is to overseed winter annual cereal grains and ryegrass into existing sods of dormant warm-season grasses. A trial was recently completed at the Southeast Research and Extension Center in Monticello that evaluated overseeded ryegrass and ryegrass-rye or ryegrass-wheat mixtures for developing steers and heifers over the winter months. The performance of cattle on these pastures was also compared to a treatment where cattle were confined and maintained on bermudagrass hay and a concentrate mix.

Table 1. Characteristics of nutritive value for two cultivars of wheat (Jaypee and Hickory) continuously stocked at 500 or 750 lbs of beef per acre and fertilized at soil test recommendations or at soil test recommendations plus 50 lbs additional N/acre in the fall. All pastures were clean tilled prior to establishment and sampled monthly. Wheat cultivar, stocking rate and fertilization strategy had little effect on forage nutritive value and the data are averaged over these treatment factors. Forages were grazed during the winters of 1996-97 and 1997-98 in Batesville, Arkansas. (Source: L. B. Daniels)

Sampling Date	Crude Protein	NDF	ADF	Digestibility
	% of dry matter			
October	30.1	43.1	18.6	92.8
November	25.6	43.0	21.1	94.1
December	23.4	43.3	21.7	95.7
January	21.0	43.7	26.7	94.0
February	20.5	52.4	31.1	94.9

In this study, pastures were overseeded with 'Marshall' ryegrass, 'Madison' wheat and 'Bonel' rye in the early fall and grazing was initiated in mid-December of 1997, 1998 and 1999. Pastures were established by light disking, followed by broadcast seeding. Seeds were covered by lightly harrowing the pastures. After meeting the soil test recommendations for P and K, N fertilizer was applied at a rate of 50 lbs actual N/acre in the fall; a similar application was made in the spring. Stocking rate was set at one head per acre; the initial average body weight of the cattle was approximately 500 lbs. All cattle were supplemented at a rate of 2 lbs per day with a grain sorghum-based supplement that also contained an ionophore (monensin).

Concentrations of crude protein, NDF (structural plant fiber) and digestible dry matter were determined from samples clipped monthly. When evaluating these data, it is important to remember that forage samples were clipped to a 1-inch stubble height; therefore, unlike the data reported previously for clean-tilled wheat, these samples also contain considerable residue from the dormant warm-season grass sod. This generally tends to decrease concentrations of crude protein and digestible dry matter and increase concentrations of structural plant fiber (NDF). However, cattle are usually very successful at selecting diets with better forage quality characteristics than those found in samples representing the entire forage sward.

Concentrations of crude protein in these forages (Figure 1) were excellent (≥15 percent) through mid-March. Concentrations of crude protein in mono-cultured ryegrass pastures tended to lag about four to five percentage units behind the mixtures with rye and wheat on the December and January sampling dates. This may be explained, in part, because of the slower developmental characteristics of ryegrass. It is likely that dormant residues from the base sod made up a larger percentage of these samples. Concentrations of crude protein in all samples declined rapidly between mid-March and mid-April to levels ranging from 11 to 13 percent. This occurred in response to rapid stem elongation and the initiation of reproductive processes in these forages.

Concentrations of NDF and digestible dry matter (Figures 2 and 3, respectively) changed in patterns over time that were essentially mirror images of each other. Initially, concentrations of NDF were low (about 46 percent) for wheat and rye mixtures with ryegrass. Stands of monocultured ryegrass had higher concentrations of structural plant fiber (about 52 percent) largely because residues of the dormant warm-season sod made up a larger percentage of the clipped sample.

Figure 1. Percentage of crude protein in rye-ryegrass, ryegrass and wheat-ryegrass pastures that were overseeded into mixed bermudagrass-dallisgrass sods during the winters of 1997-98 and 1998-99 at Monticello, Arkansas. Pastures were stocked in mid-December with one 500-lb steer or heifer per acre and sampled monthly by clipping all forage at a 1-inch stubble height. (Source: K. P. Coffey)

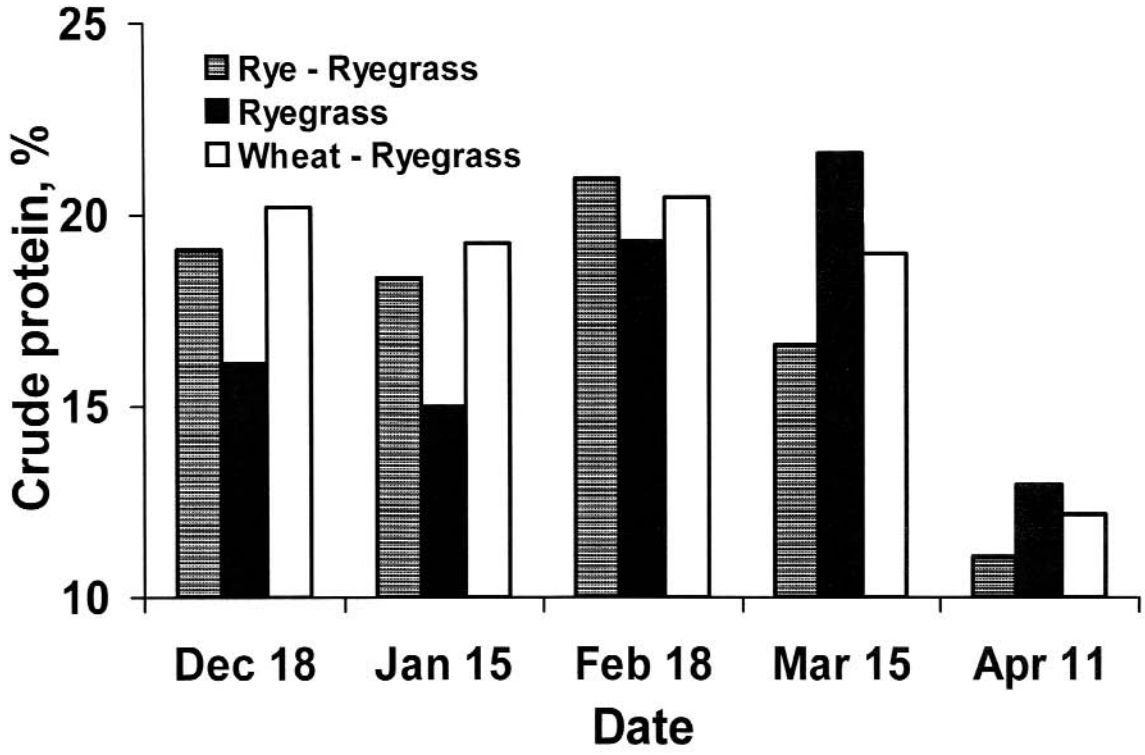

Figure 2. Percentage of structural fiber (NDF) in rye-ryegrass, ryegrass and wheat-ryegrass pastures that were overseeded into mixed bermudagrass-dallisgrass sods during the winters of 1997-98 and 1999-2000 at Monticello, Arkansas. Pastures were stocked in mid-December with one 500-lb steer or heifer per acre and sampled monthly by clipping all forage at a 1-inch stubble height. (Source: K. P. Coffey)

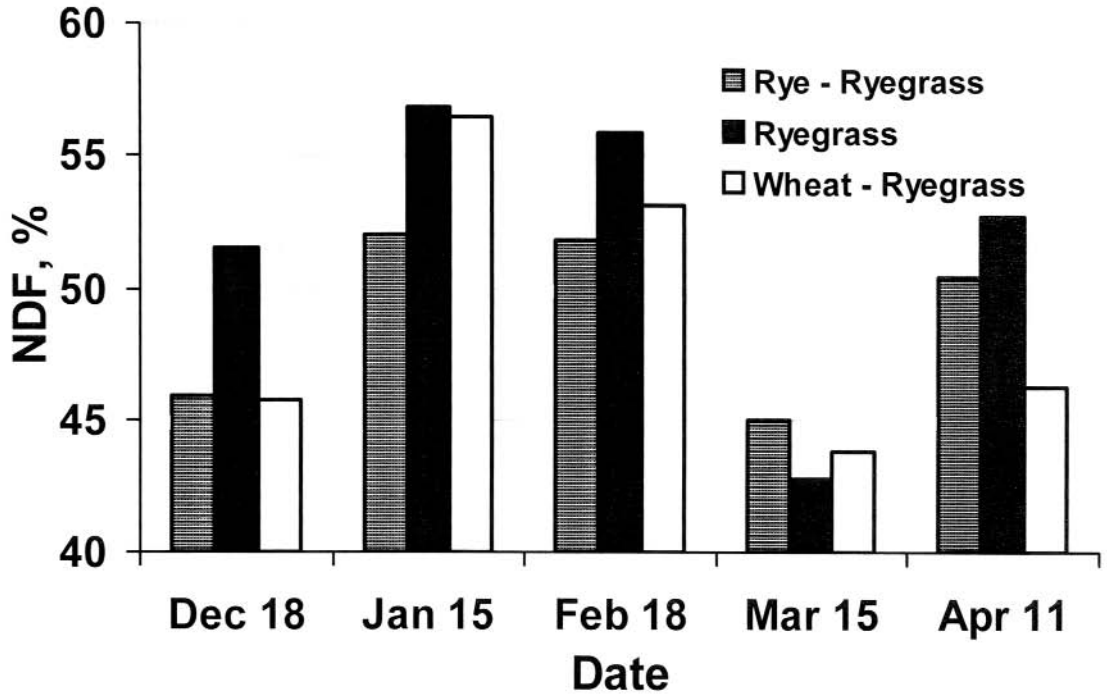

Figure 3. Percentage of digestible dry matter in rye-ryegrass, ryegrass and wheat-ryegrass pastures that were overseeded into mixed bermudagrass-dallisgrass sods during the winters of 1997-98, 1998-99 and 1999-2000 at Monticello, Arkansas. Pastures were stocked in mid-December with one 500-lb steer or heifer per acre and sampled monthly by clipping all forage at a 1-inch stubble height. (Source: K. P. Coffey)

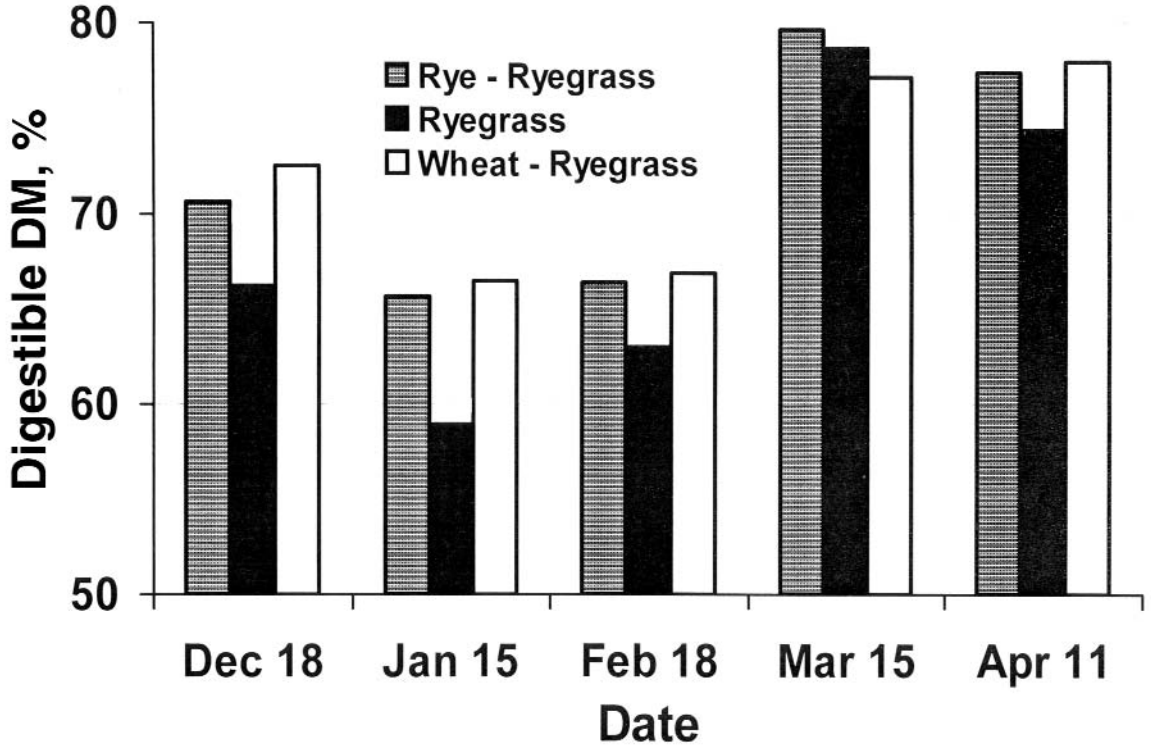

Table 2. Results of a study evaluating cattle performance on warm-season pastures overseeded with monocultured ryegrass, and mixtures of ryegrass with wheat and cereal rye conducted at the Southeast Research and Extension Center in Monticello, Arkansas. Pastures were stocked continuously at one steer or heifer per acre and grazed from mid-December through mid-April during three successive winters. Cattle were removed from pastures for about 45 days during the final year due to lack of forage availability. In these cases, weight gains in confinement were not included in the results. (Source: K. P. Coffey)

	Year	Ryegrass	Rye + Ryegrass	Wheat + Ryegrass	Hay and Grain
Total gain, lbs/head	1997-98	272	244	253	166
	1998-99	263	247	227	157
	1999-00	129	126	119	145
Daily gain, 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

Table 3. Steer performance on wheat-ryegrass pastures in the spring at Booneville, Arkansas, during 1993 and 1994. [Source: G. E. Aiken; *J. Prod. Agric.* 11:185-190 (1998)]

Grazing Treatment	Stocking Rate	Average Daily Gain	Liveweight Gain Per Acre
	lbs body weight/acre	lbs/steer/day	lbs/acre
Continuous	1461	2.07	428
Rotational – 3 paddocks	1878	2.36	599
Rotational – 11 paddocks	2028	2.21	618

Structural fiber increased in all pasture samples in January and February because forage growth for the winter annuals was slowed by cool temperatures, and these immature forages were preferentially selected by the grazing cattle, leaving increased proportions of dormant summer grass in the sward. With the initiation of accelerated spring (primarily vegetative) growth in March, concentrations of structural fiber declined by 10 to 15 percentage units, but then increased sharply by mid-April in response to stem elongation and the initial stages of reproduction.

The digestible dry matter in these forages remained high (>58%) throughout the entire trial (Figure 3). The digestibility of all samples increased to >76 percent in mid-March when there was active vegetative growth and low concentrations of structural plant fiber. The digestibility of these forages declined only slightly between mid-March and mid-April because the rapidly developing stem tissue was not yet heavily lignified.

Cattle Performance. The performance of cattle grazing these forages is summarized in Table 2. In the first two years, cattle performed substantially better on the overseeded pastures than they did in confinement on diets of primarily warm-season grass hay. The reduced performance of grazing cattle during the winter of 1999-2000 was largely due to limited forage availability caused by lack of rainfall. During the final winter of the study, cattle had to be removed from the pastures for approximately 45 days and supplemented with hay in confinement. Generally, gains of 2.0 to 2.5 lbs per day can be expected from this type of program, assuming that forage availability is adequate.

Steer Performance for Continuously and Rotationally Stocked Sod-Seeded Pastures

A two-year study was recently completed at the Dale Bumpers Small Farm Research Center in Booneville that compared the performance of steers grazing wheat-ryegrass pastures overseeded into a bermudagrass sod (Table 3). Grazing was initiated in late March and continued until mid-June. Three

grazing systems were evaluated. These included 1) continuous grazing, 2) rotational grazing – 3 paddock rotation and 3) rotational grazing – 11 paddock rotation. Both rotational systems allowed for 20 days of regrowth between grazing events, which lasted 10 days in the 3 paddock rotation and 2 days in the 11 paddock rotation.

Both rotational systems supported higher stocking rates and more liveweight gain/acre than the continuously stocked pastures. There was a small numerical advantage in average daily gain for the rotationally managed pastures, but this was not statistically meaningful. Regardless of the grazing system, wheat-ryegrass mixtures supported good gains. This is likely attributed to the excellent nutritional value of these forages throughout the study; estimates of digestibility averaged approximately 70 percent for samples collected throughout the course of the study.

Implications

Results of these grazing studies indicate that the forage quality characteristics of cereal grains, annual ryegrass and mixtures of these forages are excellent throughout the fall, winter and early spring. As these forages mature in the spring, quality characteristics decline quickly. Performance of cattle grazing these pastures is normally excellent (>2 lbs/day), but it is highly dependent on forage availability. This is probably a more important consideration in overseeded pastures than in clean-tilled situations because establishment in the fall is often delayed in order to reduce the competition from the existing sods of warm-season grasses that are not yet dormant. Grazing pressure can be used as a short-term technique to delay the rapid development of these forages in the spring. Characteristics of forage quality decline rapidly as plants enter the reproductive stages of growth.

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