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Tall Fescue Production and Utilization

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Contents

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Introduction

Introduction

Tall fescue is a cool-season perennial grass species, adapted to the climate and soils of the eastern one-third of Kansas. It is well adapted to the low pH and slowly drained soils in southeast Kansas. Tall fescue can persist under limited fertility conditions and, when compared with smooth brome, tolerates wet soils, grazing abuse, claypan soils, and summer drought better.

Fescue can be used not only for forage but also for waterways, pond dams, farm lanes, and lawns. Fescue will grow when average temperatures are as low as 34 degrees Fahrenheit but does better with temperatures above 45 degrees Fahrenheit. Summer growth is retarded by high temperatures and low moisture, with little growth occurring above 85 degrees Fahrenheit.

Animals readily graze fescue during April, May, and June and again in the fall. With consideration for both the grass and animals, grazing should be avoided during late June, July, and August. Tall fescue grazed during the summer results in low animal performance and possible damage to the grass. It should be "rested" during summer months to allow the plants to increase vigor.

Tall fescue is the best adapted cool-season grass in Kansas for winter use. Thus, fescue can provide most of the spring, fall, and winter feed for a beef-cow herd. Tall fescue should be used in conjunction with warm-season forage crops such as native grasses, bermudagrass, or summer annuals to provide summer forage.

Tall Fescue Toxicity

In 1973, a USDA researcher observed fescue pastures being grazed by two separate herds of cattle on a farm near Mansfield, Ga. One herd looked unhealthy, while the herd in the adjacent pasture appeared healthy. During the next three years, Joe Robbins and C.W. Bacon studied the pastures and cattle. In 1976, plants from the pasture with the cattle that looked unhealthy were found to be 100 percent infected with an endophytic fungus (*Acremonium coenophialum*). The other pasture was less than 10 percent infected with the endophyte. That association marked a major breakthrough in finding the cause of fescue toxicity.

Fescue Toxicity Syndrome in Cattle

Three separate syndromes appear to be associated with tall fescue toxicity. A brief description of each follows:

Fescue toxicity or summer slump. Livestock show poor gains, reduced conception rates, intolerance to heat, failure to shed the winter hair coat, elevated body temperature, and nervousness. This summer slump is most noticeable during summer, but the adverse effects can occur throughout the year. This syndrome has serious effects for Kansas cattle producers.

Fescue foot. The clinical signs are a rough hair coat, weight loss, elevated body temperature and respiration rate, leg tenderness, and actual loss of hooves and/or tail switch. Fescue foot occurs mainly in winter and may be noticed a few days after the first real cold snap of winter. Cattle must be eating infected grass or hay at the time. This is a serious syndrome, but its occurrence in Kansas is infrequent in relation to the large acreage of tall fescue.

Bovine fat necrosis. Cattle with this syndrome have hard masses of fat in the abdominal cavity. This syndrome, which results in upset digestion and difficult births, has been associated with very high nitrogen rates commonly associated with poultry litter applications. This syndrome hasn't been identified in Kansas but has been found in the poultry-growing areas of southwest Missouri and northwest Arkansas.

Fescue Toxicity Syndrome in Horses

Fescue toxicity has serious reproduction effects on mares. Specific indicators are abortion, prolonged gestation, difficult birth (dystocia), thick placenta, foal death, retained placenta, little or no milk production (agalactia), and, sometimes, death of mares during foaling. Pregnant mares should not be allowed to feed on infected tall fescue grass or hay during the final 60 to 90 days of the expected gestation period.

Biology of the Fungal Endophyte

The terms "fescue fungus," "endophyte," "fungal endophyte," and "fescue endophyte" have been used to denote the organism in question. "Endo" (within) plus "phyte" (plant) means a plant that lives within another plant. The fungus lives its entire life cycle within the fescue plant.

Two characteristics of the endophyte are significant: The organism does not affect either the growth or appearance of the grass and requires microscopic examination to detect, and it is seed transmitted only.

The alkaloid, ergovaline, is thought to produce the animal symptoms observed in livestock feeding on infected tall fescue. Ergovaline is found in the fescue plant and threshed seed of infected plants. In southern states, researchers have found that the endophyte fungus may actually help the tall fescue plant survive and improve its durability. They associate it with insect resistance and improved drought tolerance. To date, that connection has not been proven in Kansas, Missouri, or other states farther north.

When planting new stands of fescue, the producer should use seed that contains no live endophyte. Infected pastures come from infected seed. Fungus-free plants remain free of the fungus. The only way a fungus-free pasture becomes infected is when fungus-infected seed is brought into the pasture. When those seeds germinate, they produce an infected plant. Seed can be brought into pastures by the grazing animal being moved from one pasture to another and by feeding hay that contains mature infected seed. A small amount of seed will pass through the animal and also may produce infected plants. A study in Cherokee County, reported in Table 1, indicates that a renovated pasture has shown some increase in infected plants since initial sampling in 1986. One can expect some increase in infected plants when the original stand is thinned by drought and infected plants are present in the pasture.

Live endophyte in seed can be reduced when seed is stored for a period of time or aged. A study in Kansas showed that seed cleaned, bagged, and stacked on pallets in an unheated warehouse reached zero live endophyte level when stored for 15 months (Table 2). Data from Georgia indicate that 10 months of storage is adequate, and a study in Oregon showed that 24 months was required to reach the zero level. Seed piled in a bin may require considerably more time to age than seed that is bagged and stored on pallets.

The fungus is found in the crown of the fescue plant during winter. As spring growth occurs, the fungus slowly grows into tillers and eventually makes its way into the seed head. This growth is mycelium, or strands of the fungus. Fungus mycelium can be found in plant crowns, tillers, leaf sheaths, seed stalks, heads, and seeds. Little, if any, is found in the leaf blade. The toxins that affect animal performance are present in infected plants. Testing plants for the endophyte and finding it equates to toxic plants.

More than 500 pastures in Kansas have been tested for the endophyte, and approximately 95 percent were found to have infection. The average infection rate was 64 percent, with a range from 0 to 100 percent. Only about 20 pastures have been found free of the endophyte. The specific instructions on sampling pastures and testing seed for endophyte can be found in K-State Research and Extension publication AF-139, *Sampling and Testing Procedures for Fungal Endophyte of Tall Fescue*.

Table 1. Endophyte infection over time in a renovated pasture in Cherokee County (Wary & Kilgore, unpublished data).

Sampling Date[1]	Endophyte Infection, %
May 86	9.4
May 87	2.9
December 88	6.4
May 90	9.0
October 91	6.0
October 92	30.0

[1] Plants sampled at random throughout pasture but always greater than 50 feet from fence row.

Table 2. Effects of time in storage on tall fescue seed germination and live fungus infection.(1985–86 Kilgore, unpublished data).

Months After[1] Seed Harvest	Germination, %	Live Endophyte Infection, %
1	97.0	79.8
5	96.0	69.1
6	90.6	66.0
7	97.4	61.3
8	96.0	52.7
9	93.4	56.7
10	95.4	58.0
11	98.7	37.3
12	99.3	48.0
13	94.7	6.7
14	94.7	1.3
15	93.8	0.0
16	94.0	0.0
17	93.0	0.0

[1] Seed was cleaned, bagged in 50 lb. bags, and stored on a pallet in an unheated shed. Sampled monthly as indicated.

Cattle that consume infected fescue plants react to toxins that are produced either by the fungus or by the plant in reaction to the fungus. These toxic compounds remain indefinitely in stored hay or seed and can affect animals that eat it. Data from several states, including Kansas, suggest that for each 10 percent increase in endophyte level, there is reduction of approximately 0.10 pound in average daily gain (ADG) of growing beef animals. This can be much lower when tall fescue is only grazed March through May and September through November. Grazing infected pastures during July and August is especially deleterious to animal performance.

The initial steer-grazing study at Auburn University showed an 82 percent increase in ADG, and a 42 percent increase in gain per acre with endophyte-free fescue compared with endophyte-infected fescue. Research in Kentucky showed a 34 percent reduction in pregnancy in spring-calving cows grazing high-endophyte fescue pastures compared with grazing low-endophyte pastures. More data is shown in Table 3.

The level of the endophyte fungus in a stand of tall fescue has more effect on animal performance than most management practices. Because these animals are also more susceptible to heat stress when the temperature is above

Table 3. Effect of fungus-infected tall fescue pastures on growth and reproduction of replacement beef heifers at two locations in Alabama Black Belt and Tennessee Valley Substations (1984–86).

Fungus Level, %	ADG, lb	Pregnant, %
0–5	1.20	96
25–60	0.96	82
80–99	0.87	55

85 degrees Fahrenheit, the effects of the endophyte fungus are more apparent.

Given a choice, grazing animals will spend much more time grazing endophyte-free pastures, with greater forage intake, thus requiring a lower stocking rate. Fungus-free pastures are much more subject to damage by overgrazing. Fungus-free pastures require lower stocking rates but produce higher average daily gain and more beef per acre on grazing yearling cattle compared with pastures infected with the endophyte.

Novel Endophyte Fescue

Recently, researchers at the University of Georgia and at Ag-Research Limited of New Zealand isolated a strain of endophyte fungus that does not produce ergovaline. The new "novel" endophyte was successfully inserted into endophyte-free fescue plants of the varieties "Jesup" and "GA 5". The result was a novel endophyte or "friendly" endophyte fescue variety called MaxQ. Development of novel varieties allows the fescue plant to retain the benefit of stress protection because of the symbiotic relationship between plant and endophyte, without the detrimental effects on animal performance from the production of ergovaline. Currently, MaxQ is the only novel endophyte fescue available to producers. Development of additional fescue varieties containing a novel endophyte, however, is currently underway.

Research comparing steer performance on high-endophyte Kentucky 31, low-endophyte Kentucky 31, ArkPlus, and MaxQ was conducted by Lomas and Moyer (20) at the Southeast Agriculture Research Center in Parsons, Kan. Over a five-year grazing period between 2004 and 2008, average daily gains (ADG) of steers on high-endophyte Kentucky 31 was 1.06 pounds per head per day for a 223-day grazing season (Table 4). Compared to the high-endophyte Kentucky 31 pastures, significantly greater ADG were achieved for steers grazing on low-endophyte Kentucky 31, ArkPlus, and MaxQ where gains were 1.63, 1.65, and 1.74 pounds per head per day, respectively. In 2004, the amount of average available forage was similar between all four fescue varieties (Table 5). Between 2006 and 2008, however, low-endophyte Kentucky 31, ArkPlus, and MaxQ had significantly less available forage than high-endophyte Kentucky 31. Similar to low-endophyte fescues varieties, stocking rates on novel endophyte fescue varieties should be reduced since livestock consume more forage when the amount of ergovaline in their diet is reduced.

Table 4. Effect of fescue cultivar on steer performance for a grazing season of 223 days, 2004-2008 (20).

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	ArkPlus	MaxQ
No. of head	70	72	70	72
Initial weight, lb	556	557	557	557
Ending weight, lb	796[a]	917[b]	923[b]	938[b]
Gain, lb	240[a]	360[b]	366[b]	382[b]
Daily gain, lb	1.06[a]	1.63[b]	1.65[b]	1.74[b]
Gain/acre, lb	181[a]	271[b]	276[b]	288[b]

[abc] *Within rows, means without a common superscript differ (P<0.05).*

Table 5. Effect of fescue cultivar on season average available forage from steer grazing 223 days, 2004-2008 (20).

	Tall Fescue Cultivar			
Year	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	ArkPlus	MaxQ
	lb/a dry matter			
2004	2,868	2,599	2,676	2,850
2005	2,412[a]	2,133[c]	2,132[c]	2,257[b]
2006	1,756[a]	1,180[b]	985[b]	1,175[b]
2007	2,094[a]	1,809[b]	1,801[b]	1,750[b]
2008	4,867[a]	4,459[b]	4,526[b]	4,403[b]

[abc] *Within rows, means without a common superscript differ (P<0.05).*

Establishment and Maintenance

Soil Selection

Fescue will grow on almost any soil but produces best on fertile moist soils. The ability of fescue to withstand low fertility and wet soil is excellent. Tall fescue also can withstand submersion for a few days. It will produce on soils with pH of 5.2 to 8.0, but optimum growth occurs in the 5.8 to 7.0 pH range.

Varieties

Several new varieties are suitable for Kansas. New certified varieties are free of the endophyte fungus. Endophyte-free seed of older varieties like Kentucky-31 are also available. Check the seed tag to be sure of the endophyte level.

To avoid reduced animal performance resulting from endophyte-infected grass that is fed or grazed, livestock producers should plant seed free of live endophyte. Plants produced from fungus-free seed remain free of the endophyte. Information regarding several available tall fescue varieties is shown in Tables 6 and 7. The new variety, Martin, has produced well in Kansas. It has excellent quality and was selected for higher magnesium content to help reduce incidences of grass tetany in cattle. Pastures planted to fungus-free seed will have a 20 to 30 percent lower carrying capacity because the grazing animal eats more endophyte-free grass.

Seedbed Preparation

Fescue establishes best in a well-limed and fertilized seedbed that has been tilled 4 to 6 inches deep, leveled, and firmed before seeding. Several producers report successful stands by simply broadcasting the seed into existing overgrazed grass pastures in the fall. Even though the practice works, it is not recommended. A well-prepared seedbed improves chances of rapid stand establishment.

Stand Establishment

Figure 1 shows the proper planting time for each area in Kansas. On droughty, claypan soils, only fall plantings are recommended because winter and spring plantings will not survive when a hot dry summer follows planting. Deeper soils and/or good moisture supplies will result in successful winter or spring seedings. When planting in a well-prepared seedbed, 15 pounds per acre of clean, high-germinating seed is adequate. When seed germination is not known or the seedbed is less than desirable, a rate of 20 to 25 pounds per acre may be required for a satisfactory stand. For best results, seed should be covered with ¼ to ⅜ inch of soil.

Seeding fescue with winter wheat is often desirable. Planting a cover crop like wheat can protect the soil from erosion and furnish additional grazing or grain production income in the seeding year. If wheat is grazed, avoid grazing in fall or spring when new grass seedlings could be injured by trampling during wet weather.

Table 6. Tall fescue varieties, by date of release, source of release, and varietal characteristics.

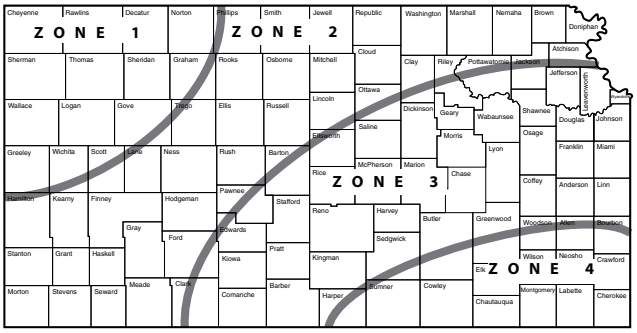
Variety	Year Introduced	State Releasing	Characteristics
Kentucky-31 (Ky-31)	Early 1940s	Kentucky	Collected in Menifee County, Kentucky, in 1931. Apparently grown on farm since 1887. Most popular variety in Kansas, grows on wide variety of soil types, highly productive, low palatability. Remains green well into winter.
Alta	1940	Oregon & USDA	Not as high in yield as Ky-31. Resists cold and drought.
Goar	1946	California	Early maturity, coarse. High seedling vigor, adapted to heavy texture alkaline soils.
Kenmont	1963	Montana	Similar to Ky-31, but sod more dense.
Fawn	1964	Oregon	About one week earlier in maturity than Ky-31. Narrow leaves, slightly higher protein, lower yield than Ky-31.
Kenwell	1965	Kentucky	Improved palatability, some disease resistance, not aggressive.
Kenhy	1977	Kentucky	Ryegrass—tall fescue derivative, much more palatable and digestible than Ky-31. Excellent animal performance, may not withstand hot dry summer as well as Ky-31.
Missouri-96 (Mo-96)	1978	Missouri	Excellent animal performance, matures later than Ky-31, but gives less fall growth.
Mozark	1985	Missouri	Superior crown rust and leaf spot resistance. Best adapted to the northern half of the tall fescue belt.
Martin	1985	Missouri	Excellent crown rust and leaf spot resistance. Excellent production in Kansas.

Table 7. Performance of fungus-free tall fescue varieties.

Entry	Yield, ton/a — Labette Co. 5-yr average	Franklin Co. 3-yr average	Relative Maturity[1]	Relative Maturity[2]
Phyter	6.91	—	—	2.3
Martin	6.64	3.69	–11	3.0
Forager	6.60	—	—	4.8
Festorina	6.71	3.54	–1	2.0
Mo-96	6.67	3.62	0	1.8
Kenhy	6.69	—	—	1.5
Cajun	6.42	—	—	4.0
Ky-31	6.55	3.72	0	3.1
Triumph	6.25	—	—	4.5
Fawn	6.38	—	—	4.3
Mozark	6.60	3.63	–11	3.8
Johnstone	6.08	3.39	0	1.8
Stef	5.59	3.20	+10	1.5
Average	6.47			
LSD(.05)	0.61	0.17		

[1] Days earlier(–) or later(+) in heading than Ky-31. Data from Franklin County trial. Janssen.

[2] Degree of heading. 0 = no heading, 5 = 100% headed, Labette County trial. Moyer.



	Zone 1	Zone 2	Zone 3	Zone 4
Fall	Aug 10–Sep 10	Aug 15–Sep 15	Aug 20–Sep 20	Aug 15–Oct 1
Winter	*	*	*	*
Spring	Mar 1–Apr 1	Feb 15–Mar 15	Feb 15–Mar 15	*

*Not Recommended

Figure 1. Planting dates for cool-season grasses.

Fertilization

A soil test should be taken well ahead of planting to determine lime and fertilizer needs, and needed lime and phosphate should be incorporated into the seedbed before planting. Your local K-State Research and Extension agriculture agent can provide fertilizer recommendations based on your soil test results. Once established, fescue production will depend on the amount of fertilizer applied and when it is applied.

Table 8 shows how important balanced fertility is for a low fertility soil. If soil tests show phosphate and/or potash is needed, additions of these nutrients can make the difference between good and poor yields. Research shows that 100 pounds of actual nitrogen produced only 1.6 tons of dry matter per acre; however, when adequate phosphate and potash were applied with the nitrogen, yields increased to 3.7 tons. Nitrogen rates should be adjusted to reflect forage production potential (Table 9).

Phosphate and potash should be applied once a year and can easily be applied with nitrogen. If only small amounts of

Table 8. Tall fescue response to fertilizer applications (KSU, Kilgore. 1978–1986).

Nutrient Rate, lb/a			Yield
N	P_2O_5	K_2O	ton/a
0	0	0	1.0
100	0	0	1.6
100	50	0	3.4
100	50	30	3.7
50	50	30	2.5

Table 9. Tall fescue response to various rates of nitrogen[1] (KSU, Kilgore. 1988–91).

N Rate lb/a	Yield lb/a	lb Response To Added N	lb Dry Matter Per lb Added
0	2,000	—	—
50	3,600	1,600	32
100	4,800	1,200	24
150	5,200	400	8

[1] Plots also received P_2O_5 and K_2O when soil test called for it. Yield response to nitrogen would be much less if other nutrients were in short supply.

phosphate and potash are needed, a two-year supply could be applied every other year.

If fescue is grazed in the spring and fall, nitrogen should be applied in the winter and late summer. Research indicates that spring-applied nitrogen does not carry over for fall growth; likewise, fall applications of nitrogen do not increase spring performance. Table 10 shows that when nitrogen is applied in February, or winter months, the crude protein in April is high, but crude protein the following October and December is no higher than in unfertilized grass. The only way to increase protein in the fall and winter is to apply nitrogen before fall growth starts. Table 10 also shows that fall-applied nitrogen does not increase the crude protein the following spring.

Several nitrogen sources such as liquid urea-ammonium nitrate, dry urea or ammonium nitrate, or anhydrous ammonia are available for use on fescue pasture. Nitrogen source experiments generally have shown little difference under most conditions. However, differences have been found in a few cases. On a damp soil surface covered with grass residue, urea containing fertilizer falling onto the residue can be converted to ammonia by the urease enzyme, and some loss of the ammonia can occur. This is especially true under relatively warm temperatures with extended periods of high evaporation rates and no rainfall to wash the nitrogen into the soil after fertilizer application. Additional research is needed on the frequency and extent of that loss.

Although anhydrous ammonia has been an attractive form of nitrogen for cultivated crops because of its low cost, it has not been used extensively on permanent pastures because of difficulty in application. Conventional equipment has not been satisfactory for anhydrous ammonia application on fescue because of high power requirements, difficulty in avoiding nitrogen losses, grass-root destruction by applicator knives, and problems associated with application on rocky, shallow soils. Rolling coulter applicators with thin knife blades will eliminate some of those problems. If anhydrous is used, it must be placed deep enough to minimize volatilization losses. When properly applied, good yield responses occur.

Recent research has evaluated placement methods for liquid nitrogen and phosphorus. Generally, nitrogen and phosphorus application knifed 4 to 6 inches deep has shown consistent yield responses when compared with surface broadcast applications. Special applicators are required for this practice.

Soil pH

An existing tall fescue stand will tolerate pH as low as 5.0. On existing pastures with pH less than 6.0, 2 tons of ag-lime per acre, topdressed, will increase life of the stand and growth if legumes are present. Again, apply lime based on soil test results before stand establishment, and incorporate the lime.

Effect of Nitrogen Fertilizer on Grass Quality

Fall-applied nitrogen on tall fescue compared with no fertilizer can increase the protein levels affecting cattle performance and forage intake. Table 10 shows the effect of fall nitrogen

Table 10. Effect of nitrogen rate and time of application on fescue crude protein content at four sampling dates (KSU, Kilgore. 1984–85).

Nitrogen		Crude Protein, %			
lb/a	When Applied	April	June	October	December
0	—	11.6	5.1	10.1	7.4
50	February	18.2	5.3	10.5	7.9
100	February	21.4	6.0	10.4	7.8
50	August	11.0	5.0	14.2	13.8
100	August	11.8	5.4	16.4	14.0

Table 11. Brome and tall fescue intake study.

Date of Cutting	Protein, %	Estimated TDN1, %	Daily Hay Intake as Fed/lb	Body Weight on DM-Basis, %
Brome				
June 7	9.35	54.17	16.81	2.16
June 16	9.03	55.76	18.18	2.34
June 27	7.17	53.64	15.76	2.03
Fescue				
May 15	11.50	57.40	13.10	1.77
July 14	4.30	48.30	9.44	1.39

[1] Total digestible nutrients

fertilizer on crude protein level, and Table 11 shows the effect of grass quality on animal intake.

The increase in crude protein from nitrogen fertilizer for April forage samples may not be beneficial because 11.6 percent crude protein is normally high enough to meet the needs of most classes of cattle (Table 10). In December, however, unfertilized fescue crude protein level dropped to 7.4 percent, which is below the level of crude protein needed for performance of certain classes of cattle. Fall-fertilized fescue was 13.8 to 14 percent crude protein, which is above the level needed for cattle performance. Therefore, fall nitrogen fertilization can affect the supplementation program needed for stocker cattle and cows during the winter months.

Seed Production

Seed Production

Most of the fescue fields harvested for seed in Kansas are used for fall and winter grazing. This maximizes the total fescue crop but often reduces seed yields compared with fescue managed primarily for seed.

Two management practices are important in producing good seed yields. They are, clipping soon after the seed stalks are mature, or a seed crop is removed, and application of nitrogen during late fall to early winter.

The stubble should be clipped to a height of 3 to 4 inches as soon as possible after harvesting the seed crop. If the fescue was not harvested for seed the previous year and is intended for seed the next season, clipping should be done by the time seed stalks are mature. It is best to remove the residue. This practice is necessary for the development of tillers. They develop during the fall and early winter and are responsible for next year's seed crop. Failure to clip and remove residue can reduce next year's seed crop as much as 30 percent. The new growth should be grazed only moderately and only in the late fall and winter. Grazing should be light until November 1, and all growth can be removed by grazing during the winter.

Timing of nitrogen application affects seed yields. For best seed production, fescue should be topdressed with 70 to 100 pounds of nitrogen during December or January. Phosphate and potash should also be applied according to soil test. Later nitrogen applications can cause lodging.

Tall fescue seed may be harvested by direct combining, or put in a windrow then combined. Fescue shatters easily when mature. Yields in standing fescue can be reduced at least 50 percent by shattering. Mowing should begin when the straw in the head starts to "yellow." K-State Research and Extension publication MF-924, *Seed Production Management for Bromegrass and Fescue*, provides additional tips regarding seed production.

Hay Production

Tall fescue has a reputation of being poor hay, but most of the reason for that reputation is the haymaker, not the grass. Anytime a cool-season plant matures, forage quality drops rapidly. In fact, crude protein will drop 0.5 percent per day from boot stage to mature seed stage. The secret to quality fescue hay production is adequate fertility and early cutting. Fescue hay should be cut no later than mid-May in southeast Kansas. Cutting the grass for hay at this stage also results in lower levels of the endophyte in the hay. Hay made late not only is low quality but also may contain higher levels of toxins, which reduce animal performance. Cut fescue when it starts to show a few heads. Delayed haying to get a seed crop results in very poor quality forage.

Nitrogen rates should be approximately 100 pounds of actual nitrogen. Rates higher than that frequently cause lodging. Phosphate and potash should be applied as needed.

Tall fescue hay can also be used as a summer grazing supplement. Research in Missouri shows that yearlings grazed in July and August showed good daily gains on fescue baled (small round bale) in mid-May and left in the field.

Tall Fescue–Legume Mixtures

Some producers like to grow legumes in their fescue. Legumes that can be used successfully in Kansas include medium red clover, ladino clover, and annual lespedeza.

Red clover is a short-lived perennial and will disappear from a stand in two to three years. Red clover can last longer by overseeding every other year or allowing existing clover plants to produce seed. Soil pH should be above 6.3, and annual applications of phosphorus and potassium may be necessary. Don't fertilize with much nitrogen, because fescue can smother the legume crop. Overseed current pasture with 8 to 10 pounds of seed per acre during winter months.

Ladino clover is an excellent fixer of nitrogen and is palatable. It is more tolerant in lower pH soils and withstands close grazing. It may not stand drought as well as red clover. To get a stand of ladino clover, broadcast 1.5 to 2 pounds of seed per acre along with phosphate and potash fertilizer as required on a closely grazed pasture in February.

Common lespedeza is popular in fescue pastures in southeast Kansas. It is an annual, reproducing by seed each year. Most lespedeza production is after June 15 and does especially well in August if it rains. It is a relatively low fixer of nitrogen, but nitrogen applications over 40 pounds per acre will reduce lespedeza levels in the pasture. Application of nitrogen in September will result in increased grass production in the fall without an overall effect on the lespedeza. There must be enough lespedeza growth in late August and September for it to reseed.

Lespedeza seed can be broadcast into closely grazed fescue pastures during winter months. Seeding rates of 20 to 30 pounds per acre will assure an adequate seed supply. Top dressed lime application generally will stimulate lespedeza growth.

Tall Fescue Utilization by Cattle

The following management practices help reduce the effect of the endophyte fungus.

Grazing Management. Grazing high-endophyte fescue pastures when they are lush and rapidly growing results in better animal gains. The reduction in average daily gain (ADG) of stocker cattle grazing highly infected tall-fescue pastures is less in April through May and September through November than the 0.10 pound per day for each 10 percent higher level of infection suggested by earlier research. Therefore, high-endophyte tall fescue pastures should be grazed only in the spring and fall to reduce the endophyte effect.

Table 12. Level of ergovaline in tall fescue herbage and seed (*11*).

Plant Part (June 1)	Ergovaline Level, ppm	Infection Rate, %
Leaf blade	.247 – .357	85–100
Sheath & stem	.208 – .495	85–100
Seed heads	.976 – 1.534	85–100

The toxin believed to cause fescue toxicity is ergovaline, and the concentration of ergovaline is lower in the leaves than in the sheath, stem, and seeds (Table 12). Grazing when the grass is lush with a high percentage of leaves would result in less toxicity occurrence compared with grazing mature grass. The seed head needs to be clipped early to prevent grazing by cattle and should improve animal gains and help reduce eye problems associated with grazing tall fescue pastures.

Legume Interseeding. Legumes may be planted in high-endophyte fungus pastures to dilute the amount of tall fescue consumed. This practice is most beneficial if pastures are grazed during the summer. Legume interseeding has improved average daily gain of stocker cattle (Table 13) and conception rates in spring-calving cows.

Table 13. The effect of ladino clover on gains of steers grazed April–November (*6, 18*).

	High Endophyte Ky-31	Ky-31 & Ladino
ADG	.85	1.05

Table 14. Effect of zeranol on steers grazing high- and low-endophyte fungus tall fescue pastures (*8*).

	Low Endophyte (20%)			High Endophyte (82%)		
	Control	Zeranol 36 mg	72 mg	Control	Zeranol 36 mg	72 mg
No. animals	50	50	50	50	50	50
ADG (lb)	1.29	1.43	1.48	.95	1.29	1.38
Improvement (%)		10	17		37	47

Implanting. Implanting with 36 mg of zeranol (sold as Ralgro) has been shown to improve ADG more on high-endophyte pastures than on low-endophyte pastures (Table 14). A study with calves nursing cows grazing high- and low-endophyte fungus tall fescue pastures showed an improvement in ADG by implanting with 36 mg zeranol, but the magnitude was lower than in the previously mentioned experiment. For the first 66 days in a feedlot study, steers previously fed high-endophyte hay showed a greater response to zeranol than steers fed low-endophyte hay (Table 15).

Kentucky research (*14*) showed implanting with 24 mg estradiol 17-B (sold as Compudore) resulted in a 26 percent improvement in ADG on highly infested Ky-31 pasture compared with a 7 percent improvement on low-infested pastures. However, the response per day to implanting was no different.

Feeding Low Levels of Antibiotics. Aureomycin or terramycin at 300 to 500 milligrams per animal per day has improved steer gains 0.10 to 0.15 pound per day, improved weaning weights 20 pounds, and improved conception rates by 4 to 5 percent. Aureomycin 50 or Terramycin 50 can be added to mineral mixtures at the rate of 8 to 10 pounds per 100 pounds. Results of research in southeast Kansas are shown in Table 16.

Kentucky research data (Table 17) shows a beneficial effect of feeding antibiotic to cows grazing tall fescue pastures. Antibiotic feeding improved conception percentage and weaning weight, and reduced the incidence of pinkeye.

Vitamin A. Vitamin A supplementation during the summer may help reduce heat stress. However, vitamin A did not improve weaning weight or cow conception rates in a four-year Kentucky (*16*) study in which cow-calf pairs were grazing high-endophyte tall fescue pastures.

Mineral Supplementation. A good mineral program is needed on high-endophyte fungus tall fescue pastures. There appear to be some absorption problems with phosphorous even though the level in the plant is high. If cattle normally consume a mineral mixture at the rate of 0.10 pounds per animal per day, then a mineral mixture containing 10 percent phosphorous is needed for most classes of cattle. Research from West Virginia (*2*) showed phosphorous absorption problems when lambs were fed tall fescue hay (Table 18). It appears that phosphorous supplement is very important for cows grazing tall fescue pastures because of the role of phosphorous in reproductive efficiency.

A selenium deficiency has been suggested as being related to fescue grazing. Research (*5*) suggests that selenium deficiency is not a concern in Kansas but can be in states where tall fescue is grown on selenium-deficient soils. In those states, it may be necessary to add selenium to the mineral mixture. Cattle shipped from states where fescue is grown on soils that are low in selenium may need selenium supplementation for a short time after arriving in Kansas.

Research in Kentucky (*14*) showed a 3 percent improvement in pregnancy rates when selenium was injected every 28 days. Data in Missouri (*4*) showed a 0.2 pound gain response to selenium supplementation on grass, but that advantage was lost during the finishing period.

Table 15. Effect of zeranol on early feedlot gains after consuming high- and low-endophyte fungus tall fescue hay (*14*).

	Low Endophyte		High Endophyte	
	Control	36 mg Zeranol	Control	36 mg Zeranol
No. steers	24	24	24	24
Starting wt. (lb)	661.0	659.0	633.7	636.8
Final wt. (lb)	804.0	815.3	797.5	834.3
ADG (lb)	2.16	2.37	2.48	2.99
Improvement (%)		9.70		20.0

Table 16. The effect of Terramycin on gain of steers grazing 65–70 percent endophyte-infested tall fescue pastures (*15*).

	Control	Terramycin Mineral
No. steers	25	28
Starting weight (lb)	518	508
ADG (lb)	.98	1.24
Body temp. °F	103.3	103.1
mg/head/day	—	600

Table 17. The effect of Aureomycin fed to cows grazing tall fescue. Antibiotic feeding started 30 days after calving (*16*).

	Control	Aureomycin
No. months fed	5.5	5.5
Calf gain (lb)	243	264
Conception (%)	74.3	77.0
Pinkeye incidence (%)	10.7	2.4

Table 18. Mineral concentrations and absorptions by lambs (*2*).

	Smooth Bromegrass	Orchard Grass	Tall Fescue
	---------- % ----------		
In grass			
Calcium	.33	.35	.41
Phosphate	.27	.28	.28
Magnesium	.10	.15	.24
Potassium	2.64	2.86	2.91
Sulfur	.21	.21	.28
Apparent absorption			
Calcium	30.1	31.2	20.2
Phosphate	20.6	14.7	–7.3
Magnesium	34.6	43.5	29.5
Potassium	89.6	88.8	88.3
Sulfur	61.5	59.8	67.9

Table 19. Energy supplementation on brome. 500- to 600-pound steers, 127 and 140 days on brome from May to August (*1, 3*).

	Pounds of Grain/Head/Day				
	0	2	2 plus Rumensin	4	6
ADG 1978, lb/day	.9	1.3	1.4	—	_
ADG 1979, lb/day	.8	1.2	—	1.6	1.8
lb Feed/extra lb gain, 1978	—	4.9	3.5	—	—
lb Feed/extra lb gain, 1979	—	5.0	—	5.0	6.0

Grass tetany may occur in early spring when tall fescue starts growing. To prevent it, a mineral mixture containing 12 to 15 percent magnesium oxide is needed during March and April. Magnesium oxide is not very palatable; consequently, adding 10 percent soybean meal or dried molasses may be required to ensure proper intake by grazing cattle. Fertilization beyond potassium requirements may increase the occurrence of grass tetany.

Breed Effect. Brahman and Brahman-cross cattle may be more tolerant of the endophyte fungus and heat stress than other breeds of cattle grazing high-endophyte fungus tall-fescue pastures.

Grain Supplementation on Lush Tall Fescue. The potential exists to improve cattle gain through use of grain supplementation on lush fescue. Research at the Southeast Agricultural Research Center has shown good response to feeding 2 pounds of grain on lush brome (Table 19). When an ionophore was added to the grain, the conversion of grain to gain was further improved. Early brome and fescue are high in protein but limited in energy. Grain may be required to get better protein utilization in the early pasture, and the amount of grain needed on high-endophyte fescue pastures should be evaluated. The dry matter intake is lower on high-endophyte fungus pasture compared with brome or fungus-free fescue, which would make energy even more limited. Supplementation with 4 to 5 pounds of grain may be necessary to dilute the intake of the endophyte and to help restore the energy lost through lower dry matter intake.

In most cases, limited energy is a factor with cattle grazing tall-fescue pasture. However, some of the protein in lush tall fescue is nonprotein nitrogen, which may be better utilized with the addition of grain. The concern in grain supplementation on lush pasture is that fiber digestibility declines as a result of lower rumen pH. A study on lush fescue, (*7*) however, showed that feeding 3 pounds grain with sodium bicarbonate did not improve ADG. Therefore, the change in pH may not be great enough to affect fiber digestibility to the point of reducing animal performance.

Feedlot Performance Following Grazing Tall Fescue. Performance of cattle following removal from infected fescue has been variable. Research in Kansas (*6*) in 1986 showed feedlot daily gain by cattle that previously had grazed infected tall fescue was greater than for cattle that had grazed fungus-free or tall fescue interseeded with ladino clover. Feed-to-gain ratios for steers from infected tall fescue were lower than for steers from interseeded or fungus-free pastures.

Hancock (*9*) reported reduced daily gains from the first 56 days in the feedlot but similar gains over the entire feeding period by steers that previously grazed tall fescue compared with orchardgrass-red clover or bromegrass-red clover pastures. However, Coffey (*13*) reported lower feedlot gains by steers that previously grazed 70 percent endophyte-infected tall fescue than those that previously grazed endophyte-infected tall fescue interseeded with ladino clover or Midland bermudagrass.

Others have reported that grazing endophyte-infected tall fescue had no effect on subsequent feedlot performance (*12, 19*). Cole (*10*) and McDonald (*17*) reported compensatory gain by steers that formerly grazed endophyte-infected tall fescue. The effect on feedlot gains of cattle previously grazing endophyte-fungus tall fescue pastures may vary with location, climate, season, weather, and other factors.

Handling Infected Pastures

- Manage to reduce effects. Keep grazed plants young. Use in March through May and September through November.
- Harvest for hay before heading. Don't stockpile for winter grazing.
- Implant calves and yearlings with 36 milligrams Ralgro every 100 to 120 days while grazing infected pastures.
- Dilute the endophyte. Use legumes in the pasture or supplement with other feeds such as grain or hay.
- Kill infected stands and replant. This process is complicated and methods depend on slope, rocks, and other factors. Producers should contact their local K-State Research and Extension agriculture agent to assist in developing a revegetation plan. Remember, any infected fescue pasture which will be replanted must not produce seed in the year before re-establishment to avoid volunteer plants with live endophyte.

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