Converting Pasture and Hayland from Toxic Endophyte Infected Fescue to Non-Toxic Grasses

Conservation Practice Information Sheet (IS-MO723C)

Introduction

Missouri has over 12 million acres of grassland and is the second leading state in beef cattle production. Forage production accounts for over half of Missouri's farm revenues. Due to its location climate and soils Missouri can produce a wide variety of forages; native warm season grasses, introduced warm season grasses, warm season annuals, cool season perennials, cool season annuals and legumes. However, tall fescue accounts for approximately 2/3 of the grassland acreage. (Figure 1)

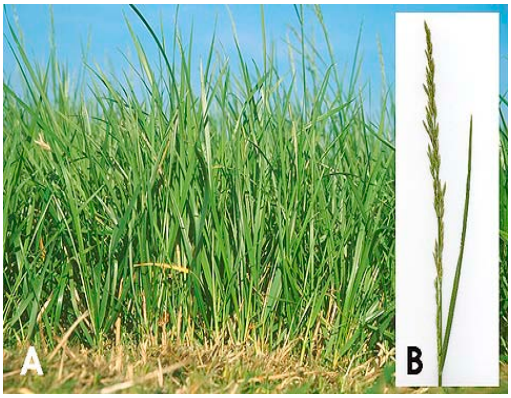

Fig. 1. A stand of tall fescue 18-inches high (A) with close-up view of its seedhead (B). (Photos by Robert Kallenbach and Greg Bishop-Hurley.)

Beef cattle grazing a tall fescue pasture in the Ozarks (NRCS Photo)

Nearly all of Missouri's tall fescue is infected with *Neotyphodium coenophialum*, a microscopic fungus.(Figure 2) This fungus is usually referred to as an endophyte, because it grows inside ("endo") the plant ("phyte"). Alkaloids produced by the endophytic fungus cause tall fescue toxicosis.

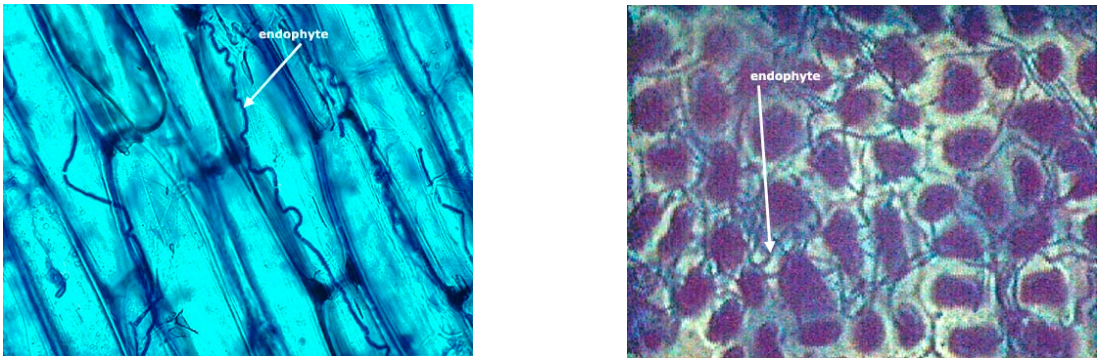

Fig. 2. The tall fescue endophyte (*Neotyphodium coenophialum*) in the tiller (left) and seed (right) as seen in a microscope. (Tiller photo by Nicholas Hill; seed photo by Craig Roberts.)

Tall Fescue Toxicosis

Tall fescue toxicosis is a syndrome most easily recognized by grotesque symptoms, such as fescue foot in cattle (Fig. 3). Toxicosis is also seen in cattle that fail to shed their winter coats in the summer and display a shaggy, unkept appearance (Fig. 4). Some of the most serious symptoms of tall fescue toxicosis, however, are not visible. These include vasoconstriction (narrowed blood vessels that causes restriction of blood flow), high core body temperature, increased respiration, low heart rate, altered fat metabolism (causing fat necrosis), low serum prolactin, agalactia (failure to produce milk), suppression of the immune system, reduced forage intake, and low rate of weight gain. Fescue toxicosis also causes serious reproductive problems, such as low pregnancy rate, thickened placenta, retained placenta, and dystocia (birthing difficulty). These latter symptoms are particularly severe in pregnant mares.

Fig. 3. Fescue foot in cattle. Toxic tall fescue can restrict blood flow to the extremities which may result in hoof loss, particularly during cold weather. (Photo by George Garner.)

Fig. 4. Steers near Mount Vernon, MO suffering from tall fescue toxicosis during July. Note the failure to shed the winter hair coat. (Photo by Greg Bishop-Hurley.)

Management of Tall Fescue Toxicosis

Producers can develop management strategies to alleviate tall fescue toxicosis. The most logical way to alleviate toxicosis involves alkaloid management. This refers to the adoption of practices that reduce the amount of ergot alkaloids ingested by the animal. Alkaloid management can involve replacement of toxic tall fescue with another forage, or it can involve a series of practices for farms that retain toxic Kentucky 31. The key to alkaloid management is to begin limiting the ingestion of alkaloids in the pasture long before severe symptoms appear in grazing animals.

The first step in proper management is endophyte testing. At present, there are two methods of testing: a microscopic procedure and a chemical procedure. The most popular chemical procedure was developed by Agrinostics, Ltd. Co. (Watkinsville, GA). It is gaining popularity because it is fast, accurate, and costs about the same as the microscopic test. In addition, the chemical method is performed on a special test paper; this paper can be stored as a permanent record of endophyte infection level. Both the microscopic and chemical tests report presence or absence of endophyte as a percentage of plants in the field. These tests do not measure concentrations of the toxins in the plant. However, the tests do reflect animal performance, even without measuring toxin concentrations. As a rule, for every 10% plants infected with the toxic endophyte, steer gains can decrease 0.10 lb/day. Endophyte tests can also determine the proportion of infected seed in a seed lot. Sampling methods for seeds and pastures are specific and should be obtained from the laboratory performing the test.

If the endophyte test reveals that 20 to 35% of the plants are infected, producers should consider eradicating the toxic tall fescue and replanting the pasture with another grass. It should be pointed out that researchers generally consider infection levels of 20 to 35% as moderate, and they consider levels above 50 or 60% as high. Replacing toxic tall fescue with a nontoxic forage is the best way to ensure the toxic alkaloids are no longer present. It is also the best way to avoid annual input costs and time commitments that are necessary when a toxic cultivar is retained as the pasture. When toxic tall fescue is eradicated, it is often replaced with a different forage; however, it can be replaced with a tall fescue cultivar that is either endophyte-free or contains a beneficial endophyte. Before replacing toxic tall fescue with a non-toxic cultivar, the following criteria should be considered:

1. *Level of toxic endophyte*. If endophyte infection level is low, replacing it with a new cultivar is not usually economically feasible.
2. *Land ownership*. The replacement process may not be economical for short term rental arrangements.
3. *Landscape*. Replanting into terrain with steep slopes may not be practical.
4. *Livestock class*. Pastures that support high value horse breeding programs and grass dairies are strong candidates for replacement with non-toxic tall fescue. Beneficial endophytes improve performance in beef stocker and heifer replacement operations as well, but replacement is more critical with higher-performance animals.
5. *Grazing management*. If the pasture is to be grazed close to the ground, continuously, and with the same low level of management as used for toxic varieties, it may be better to keep the old tall fescue. All replacement grasses will require at least some minimal level of grazing management.
6. *Seed production*. Some new cultivars that contain beneficial endophytes may not legally be harvested for seed, so additional income from seed production may not be expected.

Converting Toxic Endophyte Infected Fescue to Non-Toxic Grasses

Replacement of toxic tall fescue with a non-toxic grass commonly employs a process called spray-smother-spray. According to this process, the old tall fescue is sprayed with a systemic, non-selective herbicide (such as glyphosate). The field is then quickly no-till drilled into an annual smother crop that is grazed or cut for hay, and then the field is sprayed again prior to planting the new cool-season grass (Fig. 5).

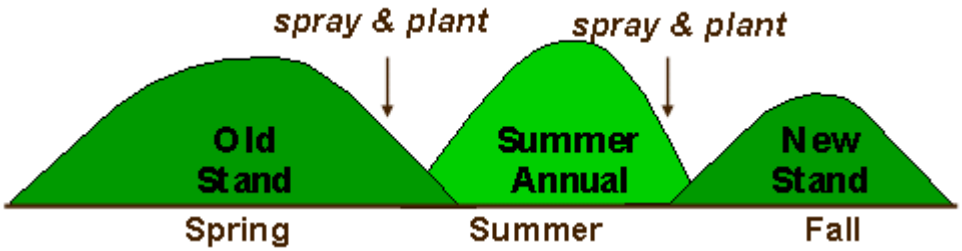

Fig. 5. The spray-smother-spray method of replacing toxic tall fescue in a pasture with another cool-season grass.

The reason for such an involved process is that old stands of well-established tall fescue are not easily eradicated. While a single spray coupled with cultivation may kill most of the existing plants, it does not kill them all. Within a year, escape tillers and viable seed

from the seed bank can reestablish the toxic field. The smother crop is used to form a shade canopy over the ground; this prevents aggressive reestablishment of the old crop while providing a source of forage until the new crop is ready to plant. After the smother crop is removed, any escape tillers and volunteer seedlings of toxic tall fescue can be killed by the second spray. The new crop can then be no-till drilled into the stubble. If the new crop is a cool-season grass, and if it forms a healthy canopy, the field will not be re-infected unless the stand thins. This is because only seed or residual surviving plants can spread the endophyte. Tillage is discouraged to reduce exposing more seed at or near the surface allowing the toxic fescue to reestablish.

This spray-smother-spray technique can be employed with spring or fall plantings. With fall plantings, the toxic pasture should be sprayed in the spring and a dense smother crop of pearl millet (*Pennisetum americanum*), sorghum-sudangrass (*Sorghum bicolor*), sudangrass *(Sorghum bicolor)* or corn *(Zea mays)* no-till drilled in late spring. Producers should manage the smother crop as they would normally, carefully monitoring nitrate or prussic acid build-up in the annual grasses. After the smother crop is grazed or harvested for hay or silage, the escape tillers and volunteer seedlings of the old fescue and smother crop are sprayed, and the new cultivar is no-till drilled according to the fall planting recommendations for a particular region. If the spray-smother-spray process is used for spring plantings, the smother crop must be wheat (*Triticum aestivum*), rye (*Secale cereale*), or triticale *(Triticale hexaploide)*.

Successful establishment of a new non-toxic grass can be expedited with other management methods. Clipping seedheads of the old tall fescue before the seed matures and before spraying prevents a build-up of seed in the seed bank that could reinfect the new stand. Use caution when seeding a companion legume with the new stand. Legumes such as red clover (*Trifolium pratense*) are aggressive and can form a canopy over the newly-seeded replacement grass. Aggressive legumes should not be seeded until the grass is well established. In addition, seeding legumes at the time of establishment limits the use of broadleaf herbicides. Many legumes are easy to interseed into existing tall fescue sods. Legumes with poor seedling vigor, such as birdsfoot trefoil (*Lotus corniculatus*), could be seeded at time of grass establishment.

Fall Seedings of a Cool-Season Grass

For fall seedings of a cool season grass the initial spray must be in late May. The optimum dates are between May 15 and May 21, which is about 1 week before a summer annual crop would be planted. Glyphosate should be applied at a rate of at least 2 lbs per acre, or 2 quarts per acre of a 4 lb/gallon glyphosate formulation plus 6 to 7 ounces of nonionic surfactant in 10 to 20 gallons of water per acre. The smother crop is no-till drilled on or near June 1, and must be pearl millet, sorghum - sudangrass, sudangrass or corn. The smother crop will be grazed or harvested for hay or silage during the summer and sprayed with a second application of glyphosate in late August—between August 15 and August 21—about 1 week before the new non-toxic cool-season grass is planted. The smother crop will not be harvested for grain or seed. The new grass could be a novel or friendly endophyte tall fescue, another cool-season grass, or a mixture of novel endophyte fescue and another cool-season grass. Use the Missouri NRCS Forage and Biomass Planting Standard (512) and the Vegetation Establishment, Herbaceous Seeding Specification (723) for planting the new cool season grass.

Spring Seedings of a Warm-Season Grass

For spring seedings of a warm-season grass, the process starts the spring before. Mow, clip or severely graze the fescue in early May to prevent the fescue from going to seed. Graze any regrowth through August. Heavy grazing pressure will weaken the tall fescue plants. A prescribed burn could be used in July or early August to eliminate the duff and any old growth as well as weaken the fescue plants. Defer grazing in mid to late August and allow the fescue to regrow to a height of 6 to 8 inches tall. This should occur by late September or early October. Apply 1 to 2 quarts per acre of a 4 lb/gallon glyphosate formulation plus 6 to 7 ounces of non-ionic surfactant in 10 to 20 gallons of water per acre. Spraying should be done when the temperature is above 60 degrees and the fescue is actively growing. Plant a smother crop of a cool season cereal grain (rye, wheat, or triticale). The smother crop may be grazed through the winter or harvested as hay or silage. The smother crop will not be harvested for seed or grain. Spray with a second application of glyphosate in late winter/early spring 7 to 10 days before planting to the warm season grass. Use the Missouri NRCS Forage and Biomass Planting Standard (512) and the Vegetation Establishment, Herbaceous Seeding Specification (723) for planting the new warm season grass stand.

Adapted with written permission from:
Roberts, C., and Andrae, J. 2004. Tall fescue toxicosis and management. Online. Crop Management doi:10.1094/CM-2004-0427-01-MG.
http://www.plantmanagementnetwork.org/pub/cm/management/2004/toxicosis/

An updated hard copy is published as:
Roberts, C.A., and J.G. Andrae. 2010. Fescue toxicosis and management. ASA and CSSA, Madison, WI. https://www.crops.org/publications/book-publishing