Fescue Toxicity Syndrome

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Tall fescue is the predominant cool-season grass in a large section of the United States bounded approximately by a line south from Topeka, KS to Tyler, TX, east to Macon, GA, northeast to Philadelphia and west to Topeka. Most of the estimated 35 million acres of tall fescue in that area is the Kentucky 31 (KY 31) cultivar. It is a persistent grass, adapted to a wide range of soil and climatic conditions. Tall fescue is a near perfect plant for soil conservation. It yields a lot of forage and responds well to nitrogen application. The chemical composition compares favorably to orchardgrass, timothy and bromegrass.

Performance of animals grazing fescue has been inconsistent, and generally below predictions based on forage analysis. Some of this deficit has been related to reduced intake attributed to poor palatability. However, this has never provided a fully acceptable explanation. Because of the several superior agronomic characteristics of tall fescue, there has been a continuing interest in solving the problems associated with animal response.

Fescue toxicity in cattle includes three distinct entities; fescue foot, fat necrosis and summer syndrome. Fescue foot is primarily associated with heavy stands of overgrown fescue grazed in cold damp weather. Its predominant feature is vasoconstriction, manifested by lameness and sloughing of extremities, rear claws or feet, tail switch and tips of ears. Fat necrosis occurs almost exclusively in cattle pastured on fescue fertilized with poultry manure. Indurated fatty tumors develop, mostly in the abdomen, and can usually be palpated rectally. Summer syndrome denotes poor animal performance by cattle grazing tall fescue, especially notable during hot, humid weather. Symptoms of summer syndrome include reduced feed intake, decreased rate of gain and/or milk production, rough hair coat, rapid breathing, increased body temperature and general unthriftiness.

History of Tall Fescue

Historically, tall fescue was found growing on a steep hillside on the W.M. Suiter farm in Menifee County, Kentucky, in 1931. Hence, the variety name Kentucky 31 (KY 31). Seed for the Suiter cultivar is thought to have been bought from a Virginia seedsman prior to 1887. Tall Fescue was probably introduced to the United States from Europe.

Dr. E.N. Fergus of the University of Kentucky tested the Menifee County material from 1932 to 1939. KY 31 fescue seed was released in 1942 and included in the Kentucky seed certification program in 1945. KY 31 fescue gradually replaced a lot of broomsedge, sawbriars and other unproductive, erosion-prone swards. It became popular as a permanent pasture seeding and was used extensively in the Soil Bank program.

Productivity and toxicity of tall fescue have been studied for years at the University of Kentucky, in laboratories and in grazing and feeding trials. Attention was focused on differences in alkaloid content; e.g., lolines and perlolines. Fescue cultivars were developed with high or low content of specific alkaloids. There were notable differences in animal response to these varieties.

The Fescue Endophyte

Dr. Joe Robbins, a USDA animal scientist in Georgia, is credited with directing attention to what is now recognized as the pathogen responsible for Summer Syndrome of cattle. In June, 1973, Dr. Robbins visited the farm of Mr. A.E. Hays, Mansfield, GA. Mr. Hays had two herds of Angus cattle which had been maintained on separate stands of fescue for 10 years and behaved quite differently year after year. Dr. Robbins and his coworkers suspected a toxic fungus was responsible. They concentrated their efforts on fungi found on the plant surface until they learned of an internal fungus (endophyte) infecting fescue in New Zealand, reported by J.C. Neil in 1941.

The fungus, *Acremonium coenophialum,* is apparently a parasite of many grasses. Symptoms of choke disease are caused by *A. coenophialum* in bent grass, prairie wedge grass and orchardgrass. Intercellular, systemic infections without symptoms occur in tall fescue and perennial ryegrass. In New Zealand, the endophyte in perennial ryegrass has been reported to cause ryegrass staggers in sheep.

One field on the Hays farm was found to be 100% infected with *A. coenophialum* whereas the other field was only 10% infected. Surveys of fescue stands in Kentucky, Maryland, Missouri, Virginia, and Alabama revealed a very high rate of infection by the endophyte. Testing revealed presence of the endophyte in fescue from the Suiter farm, from Poland (13 ecotypes) and from France (4 ecotypes). A majority of fescue toxicity research since this discovery has been directed toward the endophyte.

Most established fescue that has been tested is infected to some degree with *Acremonium coenophialum.* The fungus lives inside the fescue plants but does not invade the plant

cells. It overwinters in the plant crown, parallels tiller growth in the spring, infects the flower pannicle and seed. Fungal hyphae have not been detected in roots or leaf blades, but have been found in the leaf sheath. The primary method (and perhaps the only method) of transmitting the fungus is through infected seed.

A toxin produced by the fungus or by the plant in response to the fungus has not been proven. The endophyte has been associated with occurrence of pyrrolizidine alkaloids in fescue. These alkaloids have been shown to be related to the summer syndrome. Several ergo-peptide alkaloids were identified in toxic fescue by Shelly G. Yates, et al. Ergovaline was the most abundant alkaloid and no ergotamine was detected. Additional studies are needed to isolate a chemical or chemicals responsible for toxicity and to define inter-relationships between host plant/endophyte/toxin/animal/ environment.

Summer Syndrome of Cattle

University of Kentucky, University of Missouri, USDA at Beltsville and several other major experiment stations have been studying the endophyte since its recognition. Auburn University, with support from cattle producers, began extensive animal field trials. Notable differences have been demonstrated in production, rate of gain, body temperature and quality of haircoat in cattle consuming fescue with and without the endophyte. Cattle grazing toxic fescue pastures in hot weather showed an increase in body temperature of about 2° F. Steers grazing toxic fescue in cool weather (Nov.-Dec. in Kentucky) also had a significant temperature increase. Serum prolactin was extremely depressed in cattle fed toxic fescue. Cattle removed from grazing toxic and non-toxic fescue pastures and commingled in a feedlot required more than six weeks for body temperatures, respiration rate and prolactin levels to equalize.

Kentucky data from two years of grazing low-endophyte Kenhy (an improved variety) or high-endophyte KY 31 with cow-calf pairs showed a 26% difference in pregnancy rate; 89.9% and 63.8%, respectively. Grazing studies at Auburn University resulted in increases of 185 lb gain per acre and 0.83 lb average daily gain (ADG) with low-endophyte (LE) compared to high-endophyte (HE) fescue. Animals grazing HE and LE fescue in trials at the University of Kentucky gained 0.81 and 1.37 lb/day, respectively. Johnstone (a newly released LE variety) resulted in a 0.97 lb/day increase in ADG over HE KY 31. Animals grazing HE fescue showed typical "summer syndrome" symptoms while animals consuming LE fescue appeared healthy.

Studies at Auburn University and the University of Kentucky have also shown increased intake and daily gains, and lower body temperatures of steers consuming LE seed or hay when compared to HE seed or hay. Fescue toxicosis symptoms are not obvious during winter. Animal performance, however, is reduced in cattle consuming infected forage. Toxic forage fed year round may have an accumulative effect. University of Kentucky research revealed a 39% reduction in forage intake and a 37% decrease in milk production during summer in lactating dairy cows fed HE fescue. Cows fed HE fescue lost weight while cows fed LE fescue gained weight.

Control of the Endophyte

Release of new varieties of tall fescue, along with selection within currently available varieties, is providing low-endophyte seed for new plantings. Johnstone, a new tall fescue variety contains low alkaloid and low-endophyte. This variety has shown excellent results in grazing and performance trials. Other new varieties include low-endophyte Kenhy, AU Triumph, Forager, and MO-96.

Seed certification programs have been implemented which provide testing, labeling, and tagging of seed with low-endophyte content. A new variety that is simply "low-endophyte" will be of little or no value if it is not adapted, does not produce well, or is susceptible to disease or other pests. When considering a new variety, attention should be given to adaptability, agronomic performance, animal performance, persistence and pest resistance. Negative effects on animal performance associated with the endophyte and alkaloids can be diluted substantially by the presence of legumes in the animal diet. Even small amounts of birdsfoot trefoil, ladino clover or red clover in endophyte-infected fescue pastures sharply increased cattle gains in Alabama and Kentucky.

Cattle will put more grazing pressure on LE fescue than on HE fescue. Cattle will selectively graze LE fescue when both are available. Greenbugs and aphids also prefer LE fescue. In fact, when these insects were confined to LE plants they thrived, reproduced and severely damaged the plants. When confined to HE plants, the adult insects soon died. The turf industry has a preference for HE KY 31 tall fescue

The new LE varieties of tall fescue will probably require superior grazing management to persist in stands. If producers are not convinced they cannot abuse it the way they have KY 31, they may very well be disappointed.

References

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