Cow/Calf Session III

Moderator— Jim Furman

Fescue Toxicity / Problems and Possible Solutions

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Introduction and History

Tall fescue as a major forage source in the United States is a post-World War II phenomenon. An adapted cultivar, selected from an eastern Kentucky farm in 1931, was tested at the University of Kentucky and released in 1943 as the KY-31 variety. This cool-season perennial proved superior to other available forages for persistence, productivity, length of growing season, and erosion control.

Acreage was greatly expanded during the soil bank era of the 1950s and 60s. The area of U.S. land on which tall fescue is the predominant grass has been estimated at 35 million acres for at least the past 20 years. The fescue belt is centered in the Upper South of eastern United States. This region is home to about 25 percent of the U.S. beef cow population.

Tall fescue responds well to nitrogen fertilization and has a nutrient composition similar to other cool-season grasses. Performance of cattle consuming tall fescue as pasture, hay or ensilage has historically been inconsistent and generally below predictions based on forage analyses.

Bacon *et al.*, in 1977 reported the presence of an endophytic fungus in tall fescue. The endophyte *(Acremonium coenophialum)* adversely affects neither growth nor outward appearance of the grass. It is never manifested exterior to the infected plant. Transmission is via the seed to the next generation of fescue.

An extensive list of potential toxicants extracted from endophyte-infected tall fescue has been compiled. Ergopeptine alkaloids, principally ergovaline, are believed responsible for the majority of fescue's adverse effects on cattle and other livestock.

Effects on Cattle

Fescue toxicity in cattle includes three distance entities; fescue foot, fat necrosis and fescue toxicosis. Fescue foot is primarily related to overgrown fescue grazed during cold damp weather. It is a gangrenous condition resulting from vasoconstriction in the extremities; the tail switch, the rear feet, and perhaps the tips of the ears. Although debilitating to affected animals and devastating to cattlemen when fescue foot is a herd problem, the impact of fescue foot to the industry is not huge.

Fat necrosis results in hard masses in the abdominal cavity, sometimes interfering with parturition. This syndrome has traditionally been associated with beef cows grazing tall fescue heavily fertilized with broiler litter. It has since been demonstrated that cows grazing tall fescue fertilized with inorganic nitrogen may also succumb to this syndrome.

The syndrome referred to as fescue toxicosis accounts for most of the economic loss (perhaps approaching a billion dollars) attributed to the presence of the endophyte in tall fescue. Cattle consuming endophyte-infected tall fescue have shown the following responses: (1) lower feed intake, (2) lower weight gain, (3) lower milk production, (4) higher respiration rate, (5) higher body temperature, (6) harsh hair coat, (7) more time in shade, (8) less time grazing, (9) reduced serum prolactin, (10) reduced reproductively and (11) increased nervousness. Signs are exacerbated during hot, humid weather.

Feedlot gains following the grazing of tall fescue are usually satisfactory and sometimes compensatory. Cattle moved directly from fescue to a feedlot during

very hot weather, and subjected to additional stresses, have resulted in high mortality. Such wrecks have caused buyers to be overly cautious. The unthrifty appearance of cattle after grazing tall fescue, when history is incomplete, may result in a substantially discounted price.

Potential Solutions

The decade following discovery of the endophyte-animal performance relationship was devoted largely to developing endophyte-free varieties of tall fescue. Many such varieties were released, based on superior forage yield and animal performance for a particular physiographic area. Kentucky's principal contribution was 'Johnstone', a tall fescue-ryegrass hybrid. By the time seed production of the new varieties had increased to the level of demand it was generally recognized that tall fescue plants benefited from presence of the endophyte. Endophyte-free varieties are more susceptible to insect damage, are harder to establish, less persistent and less drought resistant. A mutualistic relationship between the endophyte and the plant contributes both to the positive attributes of tall fescue and to its negative effect on animal performance.

Endophyte-free tall fescue must for now be viewed as having a potential for increasing animal productivity only under specified management and under particular growing conditions. Plant breeders are searching for competitive endophyte-infected fescue plants with low ergopeptine alkaloid content. It may be possible to incorporate alkaloid-deficient endophytes into adapted tall fescue cultivars. Cultivars might also be selected and bred that limit the endophyte's capacity to produce ergopeptine alkaloids.

The most viable current options for cattlemen already utilizing endophyte-infected fescue involve managing the existing sward. A high priority should be given to providing alternative forages during the cattle breeding season and immediately before shipping cattle during hot weather. Tall fescue should be clipped to prevent seedhead formation (the most toxic portion of the plant). Legumes growing in combination with tall fescue at the same time provide an alternative feed source and provide nitrogen to boost growth of the fescue.

Numerous feed treatments, animal treatments and dietary additives have been investigated for their ability to ameliorate the adverse effects of endophytic toxins on cattle. Ensiled fall-accumulated endophyte-infected tall fescue retained its toxicity. Results of studies in which ammoniated fescue hay was fed to steers or sheep indicate anhydrous ammonia may detoxify compounds responsible for at least some of the signs of fescue toxicosis. Thiamine supplementation at one gram per cow daily prevented the reduction in feed intake associated with increased ambient temperature and extended grazing time. Hydrated sodium calcium aluminosilicate fed to sheep with fescue hay showed no beneficial effects and reduced absorption of essential minerals.

Copper, selenium or zinc supplementation have demonstrated no compensation for detrimental effects of endophyte-infected fescue diets. Supplementation with grain resulted in similar pregnancy rates for cows wintered on high or low endophyte fescue hay.

Phenothiazine and thiabendazole have demonstrated no consistent beneficial effects aside from their anthelmintic properties. Studies with ivermectin and fenbendazole have had equivocal results. Anabolic implants have improved rate of gain of steers grazing tall fescue and in some studies have appeared to compensate for some depressions of gain associated with the endophyte.

The administration of dopamine antagonists to cattle on an endophyte-infected fescue diet increased prolactin secretion. Steers treated with metaclopramide by injection or orally spent more time grazing and gained faster than untreated controls.

Steers passively immunized by infusion of a mouse monoclonal antibody specific for ergot alkaloids responded with increased serum prolactin. This initial success along with corroborating evidence from *in vitro* studies, suggests that cattle could potentially be immunized against ergopeptine alkaloids.

Summary

The estimated average of predominantly tall fescue in the fescue belt of the U.S. has not changed in over 20 years. The population of cattle in the same region has increased during that time. The source of the detrimental effects of tall fescue on animals (the endophyte, *Acremonium coenophialum*) was discovered. The major toxins produced by or in response to the endophyte (ergopeptine alkaloids, especially ergovaline) have been incriminated. Many tall fescue cultivars free of the endophyte have been released. Without the symbiotic endophyte, tall fescue loses many of its desirable agronomic characteristics. Endophyte-infected fescue, and cattle dependent upon it for a major feed source, can be managed in ways to continue a profitable relationship. Both pharmacological treatment and immunological protection of cattle to the toxicological effects of endophyte-infected tall fescue show promise.

Author's Note: For a more comprehensive review with extensive references, the reader is referred to STUEDEMANN, J.A. AND F.N. THOMPSON, 1993. Management strategies and potential opportunities to reduce the effects of endophyte-infested tall fescue on animal performance. pp. 103-114. *In: Proc.* 2nd Int. Symp. on *Acremonium*/Grass Interactions. Palmerston North, New Zealand, February 3-6, 1993.