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Endophyte

Endophyte is a seed-borne fungus that lives inside the tall fescue and perennial ryegrass plant. Although it is not harmful to the grass, endophyte produces toxins that are harmful to livestock. Since endophyte does not affect the appearance of the grass plant, its presence can only be detected by laboratory analysis.

Some grass varieties grown for turf seed have high levels of endophyte. Endophyte and the grass plant enjoy a symbiotic relationship; that is they both benefit. Infected plants have increased growth, increased drought tolerance, and resistance to certain insects, all desirable qualities for turf. Breeders of forage varieties have been selecting out infected fields since the 1970s, when the connection between endophyte and a livestock disease called fescue toxicity was discovered. A plant grown from endophyte-free seed cannot contract endophyte from another infected plant. Therefore, a stand of a non-infected variety will remain non-infected. If it is over-seeded with an infected variety, only the new plants will be infected. Infected plants cannot be cured with fungicides-the endophyte dies only when the plant dies. Therefore, to avoid endophyte only endophyte-free forage seed varieties should be used.

Different species of endophyte fungus infect tall fescue and perennial ryegrass. *Neotyphodium coenophialum* infects tall fescue and produces over 30 toxic alkaloids. The principal toxin is ergovaline. The other alkaloids affect insects primarily and mammals only to a minor extent. *Neotyphodium lolii* infects perennial ryegrass, and produces 16 alkaloids. Six lolitrem alkaloids affect livestock, while the others affect primarily insects. The principal livestock toxin is lolitrem B.

Fescue Toxicosis Symptoms

Fescue toxicosis is caused by ergovaline and other ergopeptides. These toxins, called vasoconstrictors, constrict the blood vessels and reduce circulation to the extremities. This interferes with the animal's ability to regulate body temperature, causing conditions called fescue foot in cold weather and summer slump in hot weather.

Fescue foot is characterized by dry gangrene (tissue death) in the extremities. Animals with this condition show lameness and swelling of the legs, followed 2 or more weeks later by loss of the tips of the tail or ears and sloughing of the hooves. A 10 to 20 day period of feeding on endophyte-infected tall fescue is required before clinical symptoms appear.

Summer slump is characterized by hyperthermia (elevated body temperature). Animals spend less time grazing and more time standing in water or shade in order to cool off. Other clinical signs of fescue toxicosis include reduced feed intake and poor weight gain, lower pregnancy rates, and decreased milk production. Poor livestock performance is more pronounced when temperatures exceed 87°F. The reduction in weight gain and hyperthermia in cattle may last up to 6 weeks after they are removed from an endophyte-infected pasture.

Horses are especially prone to developing serious reproductive abnormalities from ergovaline, including failure to come into heat, early-term abortions, prolonged pregnancies, difficult births, retained placentas, poor udder development with lttle or no milk production, and poor foal survival. Pregnant mares that are removed from endophyte-infected pasture 1 month before foaling usually have normal foals, but milk production may be decreased.

With more than 35 million acres of mostly endophyte infected tall fescue pasture in the southeastern states, fescue toxicosis caused by endophyte is the number one large animal toxicity problem in the United States. Livestock losses are estimated by the USDA at nearly one billion dollars per year.

Ryegrass staggers is caused by lolitrem B and other lolitrem alkaloids. These toxins, called tremorgens, cause muscle weakness, tremors, and spasms. Most affected animals show no clinical signs unless they are excited. Then they try to run, they experience problems ranging from trembling to severe incoordination and falling down. A 7 to 14 day exposure is required for symptoms to develop. The signs usually disappear 2 to 3 days after animals are removed from the endophyte-infected feed, but sometimes can last as long as 2 weeks.

Safe Levels

Research conducted at Oregon State University College of Veterinary Medicine and elsewhere have determined threshold levels of ergovaline and lolitrem B in the diet:

	---Endophyte Threshold (ppb)---	
	Ergovaline	Lolitrem B
Horses*	300-500	1,800-2,000
Cattle	400-750	1,800-2,000
Sheep	500-800	1,800-2,000

* Except for mares in the last 60 to 90 days of pregnancy, when the threshold is zero.

Clinical disease is not seen the threshold levels. It is important to note that these are toxin levels in the total diet, not in individual ration components. Forages with higher levels may be fed safely, as long as they are diluted with non-infected feedstuffs.

It was once thought that ergovaline was present only in tall fescue. However, ergovaline is now known to be one of the alkaloids produced by *Neotyphodium lolii* in perennial ryegrass.

A study at Oregon State University in 2001 found that, on the average, the ratio of lolitrem B to ergovaline in perennial ryegrass is 10:1. For example, a perennial ryegrass with 2,000 ppb lolitrem B would have only about 200 ppb ergovaline. In this example, the ergovaline would not be a problem except for mares in the last trimester of pregnancy. For this reason, animals fed endophyte-infected perennial ryegrass almost always show ryegrass staggers before symptoms of fescue toxicosis.