



# Cattle Producer's Handbook

Animal Health Section

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## Health Concerns with Feeding Grass-Seed Straw Residues

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The largest production cost facing livestock producers in the Pacific Northwest is providing supplemental winter-feed to their cattle. One potential avenue to decrease winter-feed costs involves the use of grass-seed straw. In Oregon, over 500,000 tons of grass-seed straw are produced on an annual basis and, at \$35 to \$60 per ton delivered to the ranch, this is a competitive feed resource for wintering beef cows.

One of the primary factors limiting the use of grass-seed residues is the tremendous variation in nutritive quality of the straw. This variation can be because of grass species, grass variety, fertilization, harvesting technique, and/or weather conditions during harvesting. Although there is limited information available, the species of grass-seed straw that appear to have the most potential as a livestock feed (in terms of nutritive quality and quantity available) include bluegrass, tall fescue, perennial ryegrass, and bentgrass.

Some grass-seed residues, however, have anti-quality factors associated with them that are important for livestock producers to be aware of when planning to use a grass-seed residue as an alternative feed source. The information presented will help cattle producers make sound nutritional decisions concerning the use of grass-seed residues as a winter-feed resource.

### Endophyte and Grass-Seed Straw

The endophytes that affect grass-seed straw are fungi that live in symbiotic relationship with the grass plant. The grass plant is a “host” for the fungus that provides it with the necessary nutrients to survive while the fungus allows the grass plant to be more disease and insect resistant and more tolerant of grazing and drought.

The problem with the fungi arises from the alkaloids that they produce. The two primary grass-seed straws that can contain significant levels of these alkaloids are tall fescue and perennial ryegrass. The fungus that is found

in tall fescue is called *Neotyphodium coenophialum*, and the fungus found in perennial ryegrass is called *Neotyphodium lolii*. The primary alkaloids produced by these fungi are ergovaline and lolitrem B for *Neotyphodium coenophialum* and *Neotyphodium lolii*, respectively.

The presence of these endophytes and their respective alkaloids in pasture and harvested grass-seed straw presents a problem to cattle, sheep, and horses ingesting them. It should be noted that perennial ryegrass can also contain elevated levels of ergovaline, therefore, perennial ryegrass has the potential to cause problems associated with both ergovaline and lolitrem B.

### Type and Variety of Grass-Seed Residue

The type of grass-seed residue can affect the alkaloid concentration. The most common types of grass-seed residues are straw and seed screenings. These can be economical feed resources for the cattle producer. However, seed screenings have a much greater probability of containing high levels of alkaloids than straw. This is because alkaloids are concentrated in the reproductive parts of the grass plant, especially the seedheads.

Contrary to some opinions, endophyte toxicity is not reduced by pelleting. Therefore, livestock producers should not feed seed screenings unless these grass-seed residues have been tested for alkaloids and/or are guaranteed to be endophyte free.

The variety of a grass-seed residue can also affect alkaloid concentration. In general, the turf varieties have a much higher alkaloid concentration than the forage varieties. The turf varieties are developed to have high endophyte concentrations so that the plants have increased growth, increased drought tolerance, and increased resistance to certain insects—qualities for which turf plant breeders select.



**Fig. 1. A cow that is sloughing her hooves after consuming endophyte infected tall fescue during a period of cold weather in eastern Oregon.**



**Fig. 2. A cow that has sloughed her hooves after consuming endophyte infected tall fescue during a period of cold weather in eastern Oregon.**

Turf varieties are used for planting golf courses, lawns, etc. The forage varieties are developed for forage production and use by livestock. Consequently, forage varieties normally have lower endophyte concentrations.

## **Alkaloid Effects on Cattle**

### **Ergovaline**

Cattle ingesting endophyte-infected tall fescue develop a condition called “fescue toxicosis,” which is characterized by poor growth and increased sensitivity to heat stress. Ergovaline causes vasoconstriction in the extremities of the body (decreased blood flow to the skin, feet, etc.), which makes it difficult for affected animals in hot climates to regulate their body temperatures. This often leads to hyperthermia (elevated body temperatures) and is commonly termed “summer syndrome.”

Infected cattle also have decreased feed intake, increased weight loss, rough hair coats, increased salivation, nervousness, lower pregnancy rates, and decreased milk production compared with cattle consuming nonendophyte-infected forage. In addition, decreased blood flow to the peripheral tissues can result in tissue death in the feet (fescue foot), tail, and ears. Severe symptoms can result in sloughing of hooves and tails. These clinical signs, though more apparent during hot weather, can occur at any time of the year.

Winters can be cold in the many areas of the western United States, with temperatures often dipping below 0°F for extended periods of time. This coincides with the time when the majority of grass-seed straw is fed to cattle. If high concentrations of alkaloids, such as ergovaline, are present in the straw, symptoms of fescue toxicosis can be more prevalent.

For example, freezing temperatures and decreased blood flow to the extremities can result in frozen feet, tails, and ears. This leads to frost bite, dry gangrene, necrosis, and sloughing of the hooves, ears, and tail. The first obvious sign of ergovaline toxicity in cold environments is normally lameness in the hind legs. Sadly, the

damage may already be done (frozen feet) at that point with no treatment possible.

Figs. 1 and 2 show cattle that developed “fescue foot” from consuming a 100 percent tall fescue straw diet that contained elevated levels of alkaloids during a period of freezing temperatures. These cattle started showing signs of lameness approximately 45 days before these photographs were taken.

### **Lolitre**

Cattle ingesting endophyte-infected perennial ryegrass straw can develop a condition called “ryegrass staggers.” In addition, perennial ryegrass can also have elevated levels of ergovaline, thereby providing the potential to develop fescue toxicosis.

The clinical symptoms of “ryegrass staggers” are manifested by muscle spasms causing a range of clinical signs from a stilted gait to complete tetany and musculoskeletal collapse. In the early stages, affected animals have difficulty flexing their legs and have an unusual gait. In severe cases, animals have difficulty walking and may fall often. Convulsions and death can occur.

In many reported cases, exercise or excitement has triggered the clinical signs in animals consuming endophyte-infected perennial ryegrass. While toxicosis caused by over-ingestion of endophyte-infected tall fescue can have life-threatening effects and/or marked economic losses, the clinical signs of perennial ryegrass intoxication are most often reversible with total removal or partial blending of the infected forage or feed.

## **Treatment of Cattle Showing Clinical Symptoms**

If cattle are observed to be showing clinical symptoms of fescue toxicosis and/or ryegrass staggers the only treatment is to remove the grass-seed residue causing the disease from the feeding regime. If the symptoms are not severe, removal of the grass-seed residue from the diet will result in disappearance of clinical signs within 10 days, with most cases taking 3 to 4 days.

If clinical signs are severe, however (necrotic tissue loss in the extremities, such as feet, tails, ears, etc.), there is no treatment. The damage is permanent and potentially life threatening. Treatment with antibiotics will not alleviate the symptoms.

If ryegrass staggers is diagnosed, animals should not be rounded up or excited in any way. Immediately remove the grass-seed residue from the diet and provide an alkaloid free feed. If possible, remove affected individuals from the herd and place in a shaded pen or barn.

Also, don't drive the affected cattle. Allow them to move to a safe pen or pasture on their own or with gentle prodding. Light, excitement, and loud noises can actually make the symptoms worse.

### Recommendations for Safe Feeding of Grass-Seed Residues

Livestock in the Pacific Northwest have become increasingly more at risk due to increasing restriction on end-of-the-season burning of the grass-seed straw residues. One alternative to field burning is to bale the residue and use it as an alternative winter-feed source for livestock. Livestock producers are purchasing these relatively low cost forages and feeding them to livestock without a knowledge of the concentration of ergovaline or lolitrem B present in them. This increases the potential for incidences of "fescue foot" and "ryegrass staggers."

Oregon State University researchers sampled numerous varieties of tall fescue and perennial ryegrass straw in 1991 and 1992 to determine the variation in ergovaline concentration. The ergovaline concentration in tall fescue straw samples ranged from 0 to 945 parts per billion (ppb) and the ergovaline concentration in perennial ryegrass straw samples ranged from 0 to 790 ppb.

Consequently, the first and most important step in feeding potentially endophyte-infected grass-seed residue is to have it tested for alkaloids. It should be noted that perennial ryegrass-seed residues should be tested for lolitrem B and ergovaline. Once the concentration of alkaloids in a grass-seed residue is known, livestock producers can carry out the proper nutritional management.

Table 1 lists the estimated threshold levels of ergovaline and lolitrem B in the diet of cattle and sheep. Cattle producers can use these values to minimize the chance of causing clinical symptoms of fescue toxicosis and ryegrass staggers when feeding endophyte-infected grass-seed residues.

The threshold levels for ergovaline may vary because environmental factors and stress also are considerations in the development of clinical disease. Specifically, the threshold levels for ergovaline decrease in colder weather. This is especially important to remember when feeding grass-seed residues during periods of severe weather (freezing temperatures and snow).

**Table 1. Estimated toxin threshold levels (parts per billion or ppb) for fescue toxicosis and perennial ryegrass staggers in cattle and sheep.**

Species	*Ergovaline	Lolitrem B
	(ppb)	(ppb)
Cattle	400 to 750	1,800 to 2000
Sheep	500 to 800	1,800 to 2000

\*Threshold level is environmentally dependent and decreases in colder weather.

Source: Adapted from Tor-Agbidye et al., 2001; Vet. Human Toxicol. 43:140-146.

Grass-seed residues that contain alkaloid (ergovaline and/or lolitrem B) concentrations above the recommended threshold levels can be effectively used as forage resources. However, this will require increased nutritional management and diligent observation of livestock consuming the residue.

The most common and effective means of feeding endophyte-infected grass-seed residue is to blend it with nonendophyte-infected forage. Generally, producers are advised to use a 50:50 mix of infected and nonendophyte-infected forage. This will normally be sufficient to eliminate, or greatly decrease, the chance of developing symptoms of alkaloid toxicity.

In addition, providing a crude protein supplement (often necessary with grass-seed residues) will also dilute the concentration of endophyte(s) in the diet. Knowledge of the grass-seed residue alkaloid concentration, and associated threshold level(s), will allow livestock producers, extension educators, and/or nutritionists to make safe decisions concerning the feeding of endophyte-infected grass-seed residues.

### Analysis of Grass-Seed Residue for Ergovaline and Lolitrem B

Analysis of grass-seed residues for ergovaline or lolitrem B can be conducted at Oregon State University for a fee (approximately \$35). It is important for producers to obtain a representative sample, following these procedures:

- Obtain core samples from at least 20 different bales randomly selected from the same lot or stack of straw.
- Seal the samples in a ziplock bag and label them with your name, phone number, sample identification, and test(s) to be conducted.
- Send the samples to the address below, and call to verify that all the necessary information is provided to properly analyze the sample.

Dr. Morrie Craig's Laboratory  
Oregon State University  
College of Veterinary Medicine  
Dryden Hall #105  
Corvallis, OR 97331  
Lab phone: (541) 737-6541

## Conclusion

Given the availability of grass-seed residue, and its ability to lower the cost of a ration, grass-seed residues have the potential to be an economical management tool for most winter-feeding programs. However, it is recommended that when purchasing grass-seed straw or seed screenings, a producer should determine if the grass-seed residue came from infected tall fescue or perennial ryegrass stands. If this is determined, it is strongly recommended that the producer have the appropriate test(s) conducted to determine the alkaloid concentration(s) of the grass-seed residue. Listed below are a series of questions and recommendations that a cattle producer should use before feeding grass-seed residues.

1. What is the species of grass-seed residue (tall fescue, perennial ryegrass, bluegrass, etc.)?
2. Does this species have the potential to contain toxic levels of alkaloids?
3. Is the grass-seed residue from a turf or forage variety?
4. If the grass-seed residue has potential to contain elevated levels of alkaloids, have it tested for ergovaline (tall fescue and perennial ryegrass varieties) and/or lolitrem B (perennial ryegrass varieties).
5. Be aware of the recommended threshold levels for ergovaline and/or lolitrem B.
6. Can I use the grass-seed residue after knowing the alkaloid concentration(s) and suggested threshold levels?
7. If the grass-seed residue is considered acceptable for use, develop a nutritional management plan to safely use the grass-seed residue (contact your county educator, extension specialist, or nutritionist for assistance).

Cattle producers can then use this nutritional management plan to minimize the potential for neurological and/or physical problems that can occur when feeding endophyte-infected grass-seed residues.

