

Cattle Management and Supplementation Strategies to Improve Reproduction of Cattle on Fescue

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The ergot and loline alkaloids toxins produced by endophyte-infected (E+) tall fescue reduce milk production and reproductive efficiency in cattle. Pregnancy rates of cows grazing E+ fescue are decreased by 15% to 40% compared to cows grazing low endophyte or endophyte-free (E-) pastures. Several studies indicate that grazing E+ fescue decreased milk production by 25 % (Peters et al., 1992; Brown et al., 1996). All of the negative effects on reproduction become worse in hot weather. Effects on reproduction are direct and indirect. Direct effects include gamete damage, early embryonic death, and decreased ovarian/luteal function (See Dr. Schrick's Cattlemen's College paper). Indirect effects are impacts of reduced forage intake and overall reduction in nutrients which causes weight loss or diminished weight gain. In the "Fescue Belt", cow-calf producers need to adopt cost effective strategies to reduce the impact of E+ fescue on cow reproduction.

Principal management strategies to improve reproduction include supplementing nutrients, mitigating the effects of the E+ fescue toxins, and reducing exposure to the toxins. Below is a brief list of management strategies that fall under the three broad categories.

Supplementing nutrients

- Energy
- Protein
- Minerals

Mitigating effects of toxins

- Blocking physiological actions
- Changing calving season

Reducing Exposure

- Grazing other forages
- Dilution of fescue with other forages or feeds
- Feeding adsorbents or detoxifying agents

Supplementing nutrients

Reduced feed intake in cattle grazing E+ fescue is a result of increased body temperature, decreased gut motility, and perhaps suppression of appetite. The overall impact in the breeding female is a decrease in nutrient intake coincident with the time of highest nutrient demand. Cows that calve in poor body condition or lose weight from calving through breeding have lower pregnancy rates than cows that are in good condition regardless of the forage they graze. Therefore, in addition to the direct effects of E+ toxins on reproduction, the indirect effects of poor nutritional status also compromise reproduction in cows grazing E+ fescue.

Supplementation of nutrients to cows grazing E+ fescue from pre-calving to breeding is a short term management option for reducing the impact of E+ fescue on reproduction. For producers

that are unable to alter calving seasons or the forage base, supplementation may be the only option available. Supplementation actually both increases nutrients available to the cow and decreases or dilutes the amount of E+ toxins consumed.

Energy and Protein. Energy is the most limiting nutrient in cows grazing fescue in mid-summer. However, protein may also be deficient. Many studies examined supplements combining protein and energy. Research from Missouri indicates that supplementing corn or soyhulls along with by-pass protein to cows on fescue may increase weight gains during the summer. However, the amount of by-pass protein supplemented affected gains. High levels of by-pass protein increased gains in corn supplemented cows whereas low levels of by-pass protein increased gains in soyhull supplemented cows.

By-product supplements such as soyhulls, corn gluten feed, wheat midds etc. are preferred supplements because they do not interfere with digestion of forage. High starch supplements (corn, small grains) impair forage digestion. However, at supplementation rates of < 1.0% of body weight, we have not observed any differences in average daily gains or pregnancy rate of heifers developed and bred while grazing E+ fescue (Table 1.).

Table 1. Initial and final body weights and trial average daily gain for heifers fed different types of energy supplements during the late development and artificial insemination periods.^a

Supplement	Initial Weight, lbs (SE = 15 lbs)	Final Weight, lbs (SE = 18 lbs)	Average Daily Gain, lbs/d (SE = 0.11 lb/d)
Year 1			
Soyhull	678.2	822.2	1.85
Cottonseed	675.6	815.2	1.79
Corn/soybean meal	652.2	804.6	1.96
Year 2			
Soyhull	729.4	851.1	1.61
Cottonseed	725.9	846.0	1.59
Corn/soybean meal	727.2	845.2	1.59

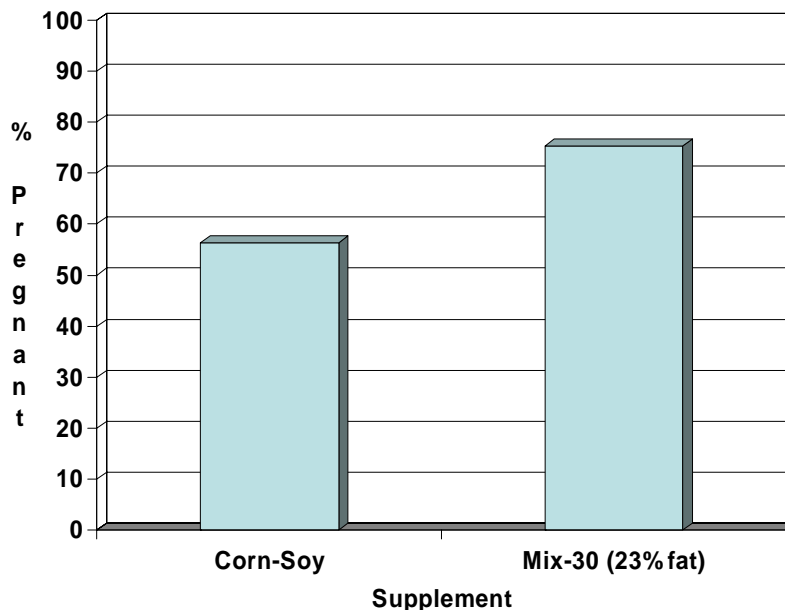
^a Means between years for all growth measures were different ($P < 0.03$); No effect of treatment ($P > 0.3$)

In addition, we did not observe an effect of type of supplement on pregnancy rates in these heifers (Table 2). Both years of the experiment were drought years with high ambient temperatures beginning in early May. Even though heifers were supplemented, the additional nutrition could not fully overcome the interaction of E+ fescue and high temperatures.

Table 2. Pregnancy rate (proportion) of heifers fed different supplements during late development and artificial insemination period.

Supplement	Pregnancy rate to AI	Overall pregnancy rate
Soyhull	45.8 % (11/24)	79.2 % (19/24)
Cottonseed	45.8 % (11/24)	75.0 % (18/24)
Corn/soybean meal	54.1 % (13/24)	83.3 % (20/24)

In contrast, Kentucky researchers reported that a high fat supplement increased pregnancy rates in cows grazing E+ fescue by 19 % compared to a corn-soy supplement (Figure 1). These supplements were fed at a rate of approximately 2.2 lbs per day from 30 days before the breeding season through the breeding season.



Adapted from Myers et al., 2004

Figure 1. Impact of fat content of supplement on pregnancy rates in cows grazing E+ fescue.

Overall, feeding of 2 to 5 lbs (dry matter basis) of an energy-protein supplement from pre-calving through the breeding season appears to be beneficial. Supplementation increases cow body condition, calf weaning weights, and pregnancy rates in cows. Ranchers should seek the most cost effective supplement available which will usually be a by-product based feed. However, some consideration should be given to supplements that provide added fat.

Minerals. The reduced forage intake caused by E+ toxins also affects mineral status of the animal. Most of the impact is due to decreased overall mineral intake as a result of decreased forage intake. Some research indicates that ruminates cannot absorb phosphorus from KY – 31 E+ fescue as easily as they can from other grasses. Therefore, inclusion of phosphorus in summer mineral for cows grazing E+ fescue may be warranted, but the effects of a low phosphorus mineral on pregnancy rates in cows grazing E+ versus E- fescue have not been tested.

The primary minerals of concern are the trace minerals especially those that impact immune function. Immune function appears to be compromised in cattle grazing highly infected E+ fescue. Our current recommendations to producers are mineral mixes should include the maximum allowable amount of Se (56 ppm) as well as 1500 ppm Cu, 3600 ppm Mn, and 3600 ppm Zinc. Concentrations of iron and sulfur should be low to zero in most cases. Extension professionals in Tennessee are recommending Cu levels in the 2500 ppm range. Because of the

high variability of soil/forage mineral content across the region, beef producers should refer to their state Cooperative Extension Service for mineral recommendations.

Other feed additives. Ionophores and antibiotics may have beneficial effects on growth and health of cattle grazing E+ fescue, but little information is available on their impacts on reproduction in cows. Some information on these additives is summarized in Table 3.

Table 3. Effects of some feed additives on cattle grazing E+ fescue

Feed Additive	Action	Observed Effect	Reference
Aureomycin	Antibiotic	No effect on pregnancy rate; increased calf weights, reduced pinkeye	Gay et al., 1988
<i>Aspergillus oryzae</i> extract	Digestibility enhancer	None	Humphry et al. JAS 80:225
Laidlomycin propionate	Ionophore	None	Humphry et al. JAS 80:225
Rumensin	Ionophore	Increased calf gains depending on forage and supplement availability	Various

Mitigating the effects of toxins

Blocking actions of toxins. One of the principal effects of E+ toxins is to reduce the release of hormones from the brain, such as prolactin, that are important to lactation and reproduction. Domperidone, metoclopramide, and similar drugs can block the effects of E+ toxins in the brains of cattle resulting increased milk production and increased levels of the pregnancy hormone, progesterone (Jones et al., 2006). While these drugs are an important research tool, they are too expensive for use at the ranch.

Producers often hear of other non-pharmacological or “natural” compounds that are purported to decrease the physical effects of E+ fescue on cattle. One such compound that has received considerable attention is TASCO™, a seaweed based product. Stocker calves fed TASCO while grazing E+ fescue had enhanced immune function upon entering the feedlot compared to calves that did not receive TASCO (Allen et al., 2001). Several reports indicated that TASCO caused a decrease in body temperature in heat stressed cattle exposed to E+ toxins. However, the effect appears not to be permanent and the actual decrease in body temperature was 0.2 to 0.5 ° F. Whether such small changes in body temperature are biologically significant in heat stressed cattle is not known.

Only three controlled studies on the effects of TASCO on reproduction in cattle have been conducted (Best et al, 2003; Patterson and Davis, 2005; Stegner et al., 2006). We conducted the largest study (1060 cows) in 2005 (Stegner et al., 2006). Cows were fed mineral with and without TASCO for 30 days before the breeding season through the end of the breeding season. Both treatments were on every farm. At the level of TASCO included in the mineral mix, supplementation was unable to counter act the negative effects of E+ fescue. Pregnancy rates

were similar for TASCO and control mineral cows (Figure 2.). These results agree with smaller studies conducted in Missouri and Mississippi.

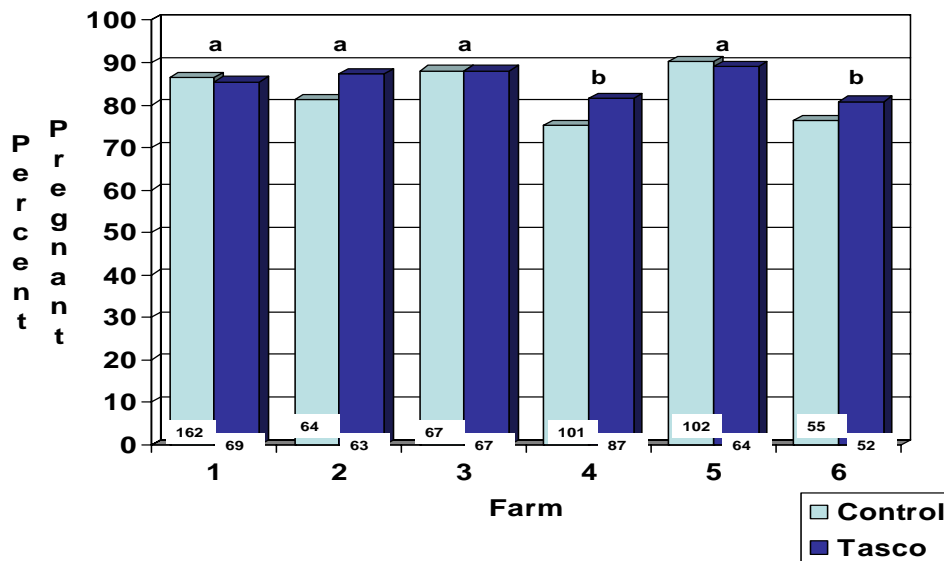


Figure 2. Effect of minerals with or without TASCO on the percentage of cows pregnant during the breeding season. a,b Effect of farm $P < 0.03$

Cows fed TASCO mineral had similar body condition scores at the end of the study. Calves from herds receiving TASCO mineral were 8 lbs. heavier at weaning, but this was not statistically different from calves in control mineral herds. Herds receiving TASCO mineral consumed more mineral (if allowed) than control herds. Increased mineral consumption or availability of organically bound minerals in seaweed may improve mineral status of animals grazing E+ fescue.

Changing calving seasons. The physiological effects of the E+ toxins such as reduced forage intake, increased body temperature, and impaired reproduction are exacerbated by high environmental temperatures. An effective strategy used throughout the fescue region is to shift to fall calving. Calves are born September through November with the breeding season from late November to early February. Cows were dry during the “summer slump”, but they are calving and beginning lactation during the fall flush of forage growth. As a result, cows enter the breeding season in better body condition than spring calving cows. In Virginia, fall calving cows calve in body condition score (BCS) 6 or 7 compared to BCS 4 or 5 for spring calving cows. In addition, moving the breeding season to early winter allows cows to be bred without experiencing heat stress. Overall pregnancy rates due to better body condition and reduced heat stress are increase by 5 to 15%.

In order for fall calving to be successful and profitable producers must be willing to make other management changes. To keep winter feed costs in check, producers need to extend the grazing season by stockpiling fescue for late fall and early winter grazing. Calves will need to be marketed in early summer to take advantage of the spring forage and offset reduced calf gains

during the winter. A common practice in our area is to wean fall calves in late May or early June and background them on grass with supplement for sale in July.

Winter calving avoids the effects of heat stress during the breeding season. However, cow feed costs are greatly increased in this system. Calving during the worst weather of the year in the region is also less than desirable.

Shifting calving seasons is not an easy choice for some operations. However, few cow/calf producers in our region regret moving to fall calving.

Reducing Exposure

Dr. Ball's presentation on "Forage Management and Grazing Strategies to Minimize the Effects of Fescue" will cover alternative/companion forage and grazing strategies, so this section will concentrate adsorbents or detoxifying agents.

Absorbents and detoxifying agents. An amazing assortment of substance that are know to absorb toxins have been fed to cattle in an attempt to prevent uptake of E+ toxins from the bovine digestive tract. Most of these additives have proven to be ineffective (Table 4). However, a yeast derived glucomannan (FEB-200, MTB-100; Alltech, Inc., Nicholasville, KY) appears promising.

Table 4. Some absorbent used to reduce exposure to toxins produced by endophyte-infected fescue.

Feed Additive	Proposed Action	Observed Effect	Reference
Hydrated sodium calcium aluminosilicate (HSCA)	Absorbent	None	Chestnut et al., 1992
Bentonite	Absorbent	None	Parrish et al., 2003
Diatomaceous earth	Absorbent	None	Various
Glucomannan (FEB-200® , MTB-100®)	Absorbent	Increased excretion of alkaloids	Akay et al., 2004

Research from the University of Kentucky indicates that cows fed supplements containing FEB-200 had increased weight gains and improved body condition scores compared to cows fed supplement without FEB-200 (Ely et al., 2006). The effect was most pronounced during July, August, and early September. In addition, weaning weights of calves from FEB-200 groups were 15 to 22 lbs heavier at weaning than calves from no-supplement and corn supplement groups.

At this point it is unclear if FEB-200 will enhance pregnancy rates in cows. Certainly, increasing body weight is compatible with improved reproduction, but these effects were not observed during early to mid breeding season. Additional research is needed to understand the effect of this yeast derivative on reproduction.

Summary

Various management options exist to improve reproduction in cattle grazing E+ fescue. Changing to fall calving or altering forage composition are the most powerful tools to positively impact reproduction in the cow-calf operation. However, these options are not always practical or possible for all producers. Supplementation of a high energy supplement containing 15 to 20% CP at a rate of 0.25 to 0.5 % of body weight appears to improve reproduction in cows grazing E+ fescue. In addition, complete mineral mixes with high levels of trace minerals is recommended. Recent data on commercially modified glucomannan appear promising, but additional studies on its impact on reproduction are needed. Other feed additives appear to have limited to no effects on reproduction in cows grazing E+ fescue.

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