Soy Hulls: More Than Just a Feed Supplement

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Introduction

There is approximately 35 million acres of tall fescue in the USA, with most of this acreage being utilized in hay meadows and grazed pastures in a region between the temperate northeast and subtropical southeast and commonly referred to as the Fescue Belt. Popularity of the grass is due to its productivity, persistence, and low cost of management. Unfortunately, a fungal endophyte that infects most plants of tall fescue produces ergot alkaloid toxins that cause a toxicosis in cattle and other grazing livestock. Fescue toxicosis may reduce reproductive performance of cow herds and weaning weights, and reduce post-weaning weight gain and overall thriftiness. Cattle inflicted with toxicosis have elevated body temperatures, maintain rough hair coats during the summer, and have reduced blood concentrations of prolactin (hormone required for milk production, and growth and development processes). Consequently, fescue toxicosis is estimated to cost the U.S. beef industry approximately 1 billion dollars each year.

Co-product feeds, such as dried and wet distillers grains, cottonseed hulls, and soybean hulls have increased in demand to overcome high and fluctuating grain concentration markets. Research done by USDA-Agricultural Research Service's Forage-Animal Production Research Unit (FAPRU) has shown soybean hulls (SBH) to have potential to cost effectively increasing cattle performance and relieve the adverse effects of fescue toxicosis. This paper will discuss results of a grazing experiment that demonstrated how feeding SBH to steers grazing toxic tall fescue can substantially improve weight gain and reduce the severity of fescue toxicosis.

Procedures

A two-year grazing experiment with steers grazed on toxic tall fescue pastures evaluated the effects of ear implantation with Synovex-S (200 mg progesterone, 20 mg estradiol; Fort Dodge Animal Health, Fort Dodge, IA) and feeding SBH (5 lb/steer/day) on average daily weight gain, hair coat ratings, and serum prolactin concentrations. The experiment was conducted from April 19 to July 5 in 2007 and from April 29 to July 24 in 2008 at the University of Kentucky's C. Orin Little Animal Research Center in Woodford County. There were four treatments: 1) no implant or SBH feeding (control), 2) Implant only, 3) SBH feeding only, and 4) with implant and SBH feeding. Steers weighed an average of 640 lb in both years and were weighed at the initial and final days of grazing. On the final day of grazing, hair coats were rated as being sleek, transitional (some shedding), or rough (no shedding), and jugular blood was collected for measuring prolactin in blood serum.

Results and Discussion

Ear implants and feeding SBH each had similar effects on steer average daily weight gain (ADG; Figure 1), but there also was strong additive effect of combining the two treatments. Ear implants and feeding SBH increased ADG by 30 and 38%, respectively, but combining the two treatments increased ADG by 81%. Although the two treatments individually generated greater weight gain efficiency, combining the treatments increased ADG over implantation without SBH by 52% and over SBH without implantation by 30%.

Besides improved weight gain performance, the SBH treatment was indicated to decrease the severity of toxicosis while the implantation treatment had no effect. There was greater than a 2-fold increase in concentrations of prolactin in serum (Figure 2) of steers on the SBH treatments. Prolactin has always been used as an indicator of toxicosis because it is consistently lower in cattle that graze toxic tall fescue. Prolactin has been linked in recent years with having physiological roles in growth and development, but our primary concern with low prolactin in fescue cattle is that the hormone is required for udder development and milk production. Reduced milk yields of cows nursing calves on toxic fescue pasture has been linked with low prolactin. It also was interesting that steers on the SBH treatments also had a lower percentage of rough hair coat ratings and higher percentage of sleek hair coats than those not on the SBH treatments.

These results indicated that SBH, but not ear implants, relieved the severity of fescue toxicosis. The nutritive value of SBH is comparable to a moderate quality hay; therefore, it is doubtful that the increase in ADG and relief of toxicosis from feeding SBH was related to any improved nutrition. There likely was some a dilution ergot alkaloids in the diet, but the steers were still consuming ergot alkaloids.

Soybean hulls contain isoflavones, which are a class of compounds with similar chemical structures as estradiol, the common ingredient in steroid implants. Besides functioning as a growth promotant, estradiol has been demonstrated to open certain blood vessels and, because of this activity, has been used to treat hot flashes in post-menopausal women. Scientists at the USDA-ARS Animal Metabolism and Agricultural Chemical Reseerch Unit found isoflavones in SBH, but were 4-fold less than has been reported for soybean meal. The group also analyzed estrogenic activity (behaves similarly as estrogen) in serum collected from steers in the earlier discussed grazing experiment. Estrogenic activity was higher with the implant treatment than with the SBH treatment, but there was a tendency of added activity by combining the implant and SBH treatments.

Conclusions

The high ADG of steers that were implanted and fed SBH could have been through enhanced growth promotion from a combination of estradiol from the implant and isoflavones from the SBH. The estradiol from the implant was indicated to not have an effect on prolactin concentrations or hair coat ratings; however, increased prolactin and higher percentages of steers with sleek hair coats could be associated with a dilution effect on dietary ergot alkaloids

that allowed the concentration of isoflavones in blood circulation to be at a level that could offset the negative effects of ergot alkaloids on prolactin and hair coat shedding. Recent research conducted by FAPRU scientists demonstrated that constricted blood flow in goats exposed to ergot alkaloids was relieved after they were treated with biochanin A, an isoflavone produced by clovers and other legumes. Isoflavones have potential as natural occurring growth promoters and treatment for relief from fescue toxicosis.

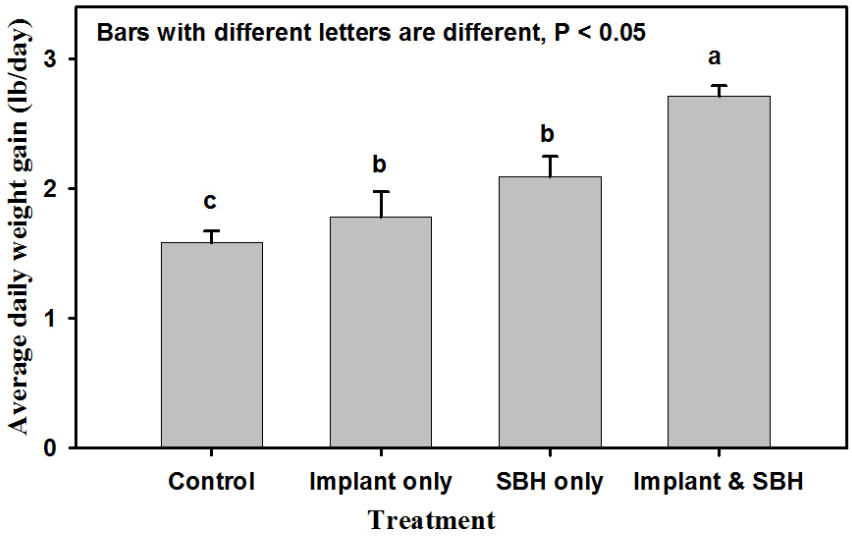

Figure 1. Average daily gain averaged over a 2-yr grazing experiments with toxic tall fescue to evaluate the combined effects of ear implantation with estridial and progesterone and feeding soybean hulls (SBH).

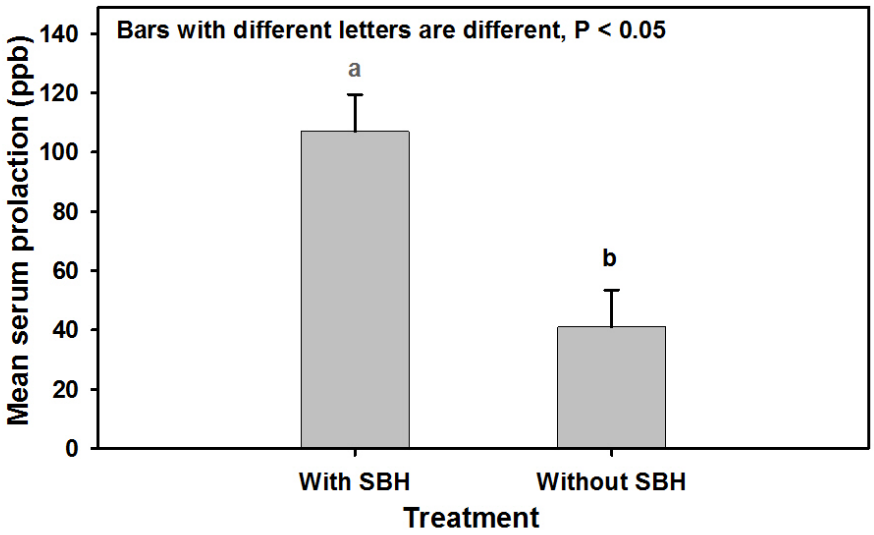

Figure 2. Mean serum prolactin with and without feeding soybean hulls (SBH) averaged over a 2-yr grazing experiment with toxic tall fescue.