AMMONIATION AND(OR) SUPPLEMENTATION OF TALL FESCUE STRAW FOR BEEF CATTLE PRODUCTION

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ABSTRACT

Seventy-two Hereford cross weaner steers were stratified by weight (avg wt = 414 lbs) and allotted randomly within stratification to three replications of the following treatments: 1) meadow hay plus supplemental alfalfa; 2) fall fescue straw plus supplemental alfalfa; 3) ammoniated tall fescue straw and 4) ammoniated tall fescue straw plus supplemental alfalfa. The basal diet of hay or straw was fed ad libitum and sun cured alfalfa pellets were fed at .45% body weight (2 lbs per head per day). Basal forage dry matter (DM) intake of ammoniated straw was 5 and 13% lower ($P<.10$) than supplemented straw and supplemented meadow hay treatments, respectively. Total DM intake of steers consuming only ammoniated straw was 17, 21 and 26% lower ($P<.05$) than steers consuming supplemented ammoniated straw, supplemented straw and supplemented meadow hay, respectively. Average daily gains were highest for steers consuming supplemented meadow hay, intermediate for supplemented straw and supplemented ammoniated straw, and lowest for steers receiving only ammoniated straw (1.04, .72, .84 and .38 lbs, respectively). Results from this study suggest that tall fescue straw is an adequate winter feed resource, however, urea based ammoniation did not effectively increase straw nutritive value.

(**Key words:** Beef Cattle, Straw, Supplementation, Ammoniation, Intake)

INTRODUCTION

Beef cow/calf and grass seed production are important Oregon Agricultural Industries. In the United States, Oregon ranked first in grass seed production in 1988 generating 228.4 million dollars (Oregon Agric. Stat., 1989). Likewise, beef cow/calf production is the top Oregon agricultural commodity generating 335 million dollars in 1988, up 16 percent over 1987 (Oregon Agric. Stat., 1989). While these industries are certainly important to Oregon's economy, they are currently faced with problems which threaten their economic prosperity.

In the grass seed industry, air pollution concerns dictate a search for alternative methods of sanitation of grass fields and disposal of straw residue. Propane burners provide an available method of sanitation without much smoke pollution. The problem exists with developing methods to remove residual vegetation from the plants thereby exposing the crown for propane sanitation. If the grass seed residues can be shown to be an economically viable feedstuff for beef cattle production, harvesting of the residues will eliminate concerns over air pollution as well as be cost effective for the grass seed producer.

Likewise, in the beef cattle industry, large amounts of capital as well as meadow acreages are devoted to the production of hays for feeding cattle during the winter months. For Oregon's beef cattle industry, this is a competitive disadvantage in that many areas of the United States do not have to extensively rely on hay feeding during the winter months. In addition, concern over the use of public rangelands may force the beef cattle industry to rely more solely on private rangelands and hay meadows in the near future. Therefore, finding alternatives winter feeds will decrease the reliance on extensive hay production, free up meadows for grazing livestock and may be a more energy efficient (sustainable) form of beef production.

The increased use of grass seed residues as a livestock feed resource may provide solutions to problems plaguing two of Oregon's most important agricultural industries. The major problem, however, is finding efficient, economical methods to utilize grass seed residues as a feed resource. Grass seed residues are a high fiber, low protein feed and, as a result, low intake and digestibility limit there value as a feed resource. Numerous approaches have been taken to improve the nutritive value of high fiber, low quality roughages. Chemical modification such as ammoniation has been shown to increase the nutritive value of low quality roughages. Most of the successes, however, are limited to treatment with anhydrous ammonia, a technique not readily available in many areas of the pacific northwest. Likewise, supplementation of protein has been shown to increase the intake and use of low quality forages. Few studies, however, have directly related supplementation to ammoniation as strategies to improve the nutritive value of low quality roughages. The objectives of this research, therefore, was to evaluate the influence of urea-ammoniation versus supplementation on the intake, utilization and subsequent performance of beef cattle consuming tall fescue straw.
Three separate studies were conducted to address these objectives (see progress reports section for related research). The following study directly relates to feeding straw to growing animals during the winter feeding period.

Materials and Methods

Seventy-two Hereford cross weaner steers were stratified by weight and allotted randomly to three replications of four treatments (6 head/pen). Treatments consisted of: 1) meadow hay plus supplemental alfalfa; 2) tall fescue straw plus supplemental alfalfa; 3) ammoniated tall fescue straw and 4) ammoniated tall fescue straw plus supplemental alfalfa. The basal diet of straw or meadow hay was fed ad libitum and sun cured alfalfa pellets were fed to supplemental treatments at .45% body weight (BW; 2 lbs/head/day). Pens of steers were fed chopped roughage once daily and refused feed was weighed and sampled on a weekly basis. Steer weights were obtained on a 28 day basis following a shrink (held off feed and water for 16 hours).

The tall fescue straw (Hounddog turf-type variety) was baled and placed into truck hauling units July 30 through August 2, 1990. Approximately, half of the grass seed

residue was treated with a water/urea solution (50% urea, weight to volume basis) just prior to baling. Treated and control straw (untreated) were selected on an alternate windrow basis. The urea/water solution was applied at a rate of 6 lbs of solution per 100 lbs of forage (3% urea concentration). Likewise, moisture content of the treated straw was strictly maintained at 15 to 30 percent. This was necessary to insure the proper conditions to facilitate the urea conversion to ammonia. In addition, an extract of whole soybeans was added to the solution to provide a source of urease to facilitate the breakdown of urea to ammonia. Some slight equipment modifications were incurred due the viscous nature of the water/urea solution and subsequent affects on balers.

The untreated tall fescue straw was analyzed to contain 6.5% crude protein (CP) and 42.8% acid detergent fiber (ADF). After treatment, the straw was found to contain 12.2% CP and 39.8% ADF. In addition, in vitro (test tube) digestibility was improved by 15% with treated straw. From this data, we are confident that the treatment of the straw was effective in producing the physical changes of the forage needed to potentially improve its subsequent nutritive value.

In addition, due to the present concerns over endophyte-infected tall fescue, straw utilized in these studies were analyzed for endophyte produced ergopeptides. In summary, no measurable level of ergopeptides (less than 50 parts per billion) were detected and, thus, had no influence on the results of these studies.

RESULTS AND DISCUSSION

One of the "classical theories" of ruminant nutrition is that as you increase the digestibility of low quality roughage, intake will increase proportionately. Given the apparent chemical changes in the treated tall fescue (in vitro digestibility, CP and ADF), increases in forage intake should occur. However, the intake of the treated tall fescue forage was 5% less ($P<.10$) than the untreated straw (Figure 1). Intake of straw and untreated straw was 8% and 15% lower ($P<.10$) than steers receiving meadow hay as a basal forage. Total DM intake of steers consuming only ammoniated straw was 17, 21 and 26% lower ($P<.05$) than steers consuming supplemented ammoniated straw, supplemented straw and supplemented meadow hay, respectively.

Average daily gain (ADG) reflected intake in that steers receiving meadow hay displayed the highest level of gain, with supplemented straw and supplemented ammoniated straw treatments showing intermediate ADG and unsupplemented ammoniated straw steers displaying the lowest ADG (Figure 2). Although steers receiving straw plus alfalfa pellets consumed more total feed than steers fed ammoniated straw plus alfalfa, ADG tended to be higher for the latter group. The observation suggest that the treated straw is somewhat more digestible and, as a result, more efficiently utilized. Feed efficiency estimates (feed per pound of gain),

however, did not differ (P>.10) among supplemented straw and supplemented ammoniated straw.

Based on results from this study, the use of urea-ammoniation techniques to improve the nutritive value of grass seed residues does not appear cost effective. Intakes of the treated straw were relatively low compared to untreated straw and meadow hay treatments. This observation suggests that the urea based ammoniation process causes some palatability problems with the basal forage. In addition, the ammoniation process is designed to render supplementation unnecessary. However, our performance data indicate that urea-ammoniated forage promoted a 50% reduction in ADG relative to supplemented straw and supplemented meadow hay feeding strategies. Therefore, considering the added cost associated with urea-ammoniation (6 to 10$ per ton), no cost effective benefits are realized.

Although, the urea-ammoniation procedure used in this study does not offer much promise as a tool to increase the nutritive value of grass straw, there are some promising aspects to this study. Supplemented straw appears to be an adequate feed resources for beef cattle production. Steers fed straw plus supplemental alfalfa gained over .7 pounds per day. In addition, straw represented over 80% of the diet and, therefore, represents a potentially cost effective alternative to tradition hay feeding practices.

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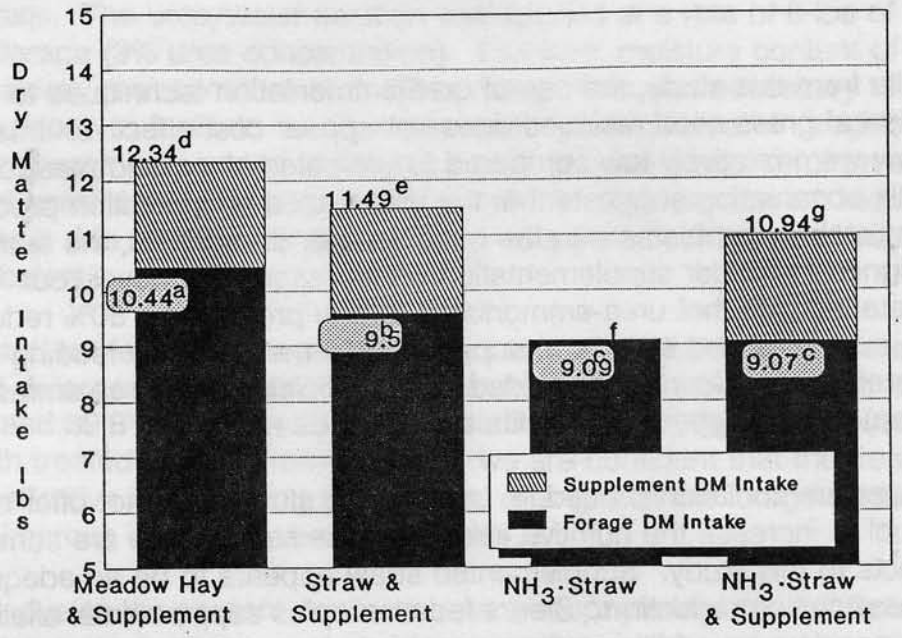
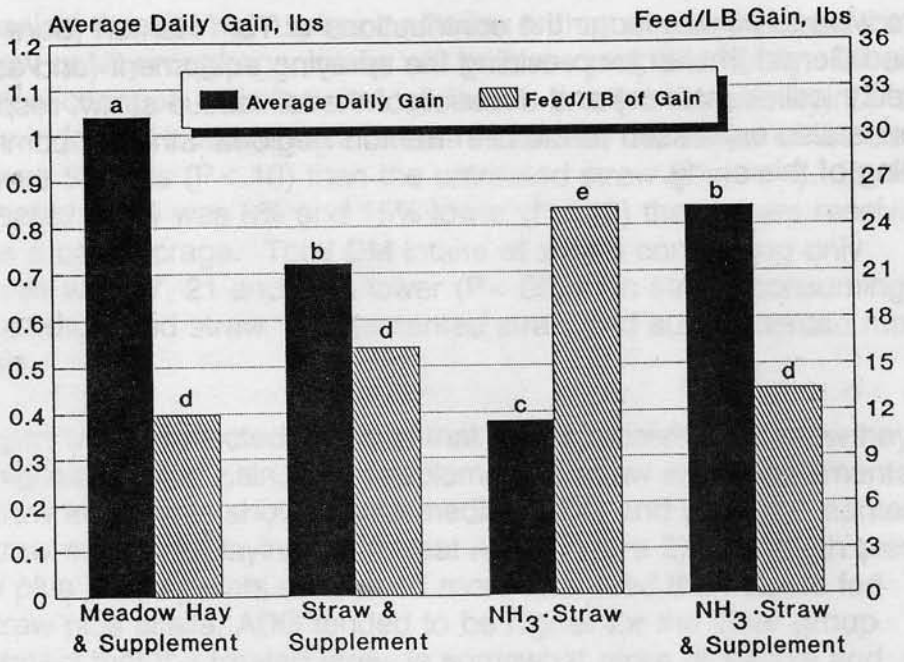
Figure 1. Forage and Dry Matter (DM) Intake of Steers During the Winter Feeding Period.



Bars with Differing Superscript Differ (P<.05) for Forage^{abc} and Total DM Intake^{defg}.

Figure 2. Average Daily Gain and Feed Efficiency of Steer During the Winter Feeding Period.



Similar Bars with Differing Superscript Differ (P<.05).