QUALITY OF DIET CONSUMED BY CATTLE IN THE TEXAS HILL COUNTRY: MEASUREMENTS USING NEAR INFRARED SPECTROSCOPY COMBINED WITH NUTRITIONAL BALANCE ANALYZER SOFTWARE

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Introduction

Two primary factors must be known in order for a nutritional management program for cattle to be successful. First, the amount of available forage at a given range site must be known. Second, the quality of diet selected must be determined. Knowledge of these two factors offers a valuable tool to the cattle producer. While this area of research has received much attention, a comprehensive look at free-ranging cattle in the Texas Hill Country, particularly Edwards Aquifer region, has not been undertaken. Results gleaned will serve as a model for producers in the immediate area and throughout the Texas Hill Country.

One of the largest costs to cattle producers is that associated with supplemental feeding. During some years additional feeds are necessary, while in others their use could be decreased or avoided by having the correct information available when making grazing management decisions. Most often, all producers have to rely on is forage availability data. While it is important to know the availability of forage on a range site, this information is incomplete without knowing the quality of diet selected by cattle. When both forage availability and diet quality are considered, cattle producers have an additional tool with which to make grazing decisions. During some years it will still be necessary to supply supplemental feeds to cattle, but at other times the answer may be as simple as adjusting stocking rate to meet not only forage availability, but also quality of diet selected by cattle.

Purpose and Objectives

The purpose of this study was to determine the quality of diet selected by cattle grazing the Southwest Texas State University (SWT) JH Freeman Ranch. Specific objectives were: 1) To use Near Infrared Spectroscopy (NIRS) fecal analysis to estimate forage diet quality on a monthly basis for two years to establish a forage quality profile; 2) To use NIRS forage quality estimates with animal and environmental information in the Nutritional Balance Analyzer (NutBal) computer program to estimate animal nutritional status; and 3) To use NutBal estimates of nutritional status to evaluate feeding and management strategies for potential improvement in efficiency.

Materials and Methods

Cooperators. This study was undertaken with the cooperative support of Texas A&M University. Dr. Bob Lyons, Range Extension Specialist, Uvalde, Texas and the Grazingland Animal Nutrition Laboratory (GANLAB), College Station, Texas served as Texas A&M cooperators. Dr. Lew K. Hunnicutt, Assistant Professor, Department of Agriculture and Mr. Bryan Davis, Manager, JH Freeman Ranch served as cooperators from SWT.

Study Animals. Under the present management scheme at the Freeman Ranch, there are two herds of cattle. One herd is bred to calve in the spring of the year, the other in the fall of the year. Both herds were utilized for this study to obtain baseline nutritional status values for each herd throughout the year.

Sample Collection and Handling. Fresh fecal samples (10 from each herd) were collected monthly on pasture. Collections began on July 15, 1997 and all subsequent sampling was conducted on the 15th (± 2 days) of each month. Samples were combined and sealed together in a plastic bag and shipped to the GANLAB for NIRS analysis. Other data collected each month was body condition score [BCS; Scale: 1 (emaciated) to 9 (obese)] of the same 10 cows each month and environmental conditions were monitored. This data, along with the NIRS data, allowed computer analysis of nutritional status of each herd via the NutBal software program. This software package uses values determined from NIRS fecal analysis and, using a series of mathematical equations, extrapolates the values for crude protein (CP) content and digestibility of the forage consumed.

Results and Discussion

The first year of data collection for this two-year study is reported here. Two basic measures of forage quality have been monitored. The first is the percent crude protein content of the forage (Figure 1). Crude protein content of forage at the beginning of the study was in the 6% percent range for both herds of cattle. This was lower than expected but at the time we were undergoing very dry conditions at the ranch. The 6% CP values fall at the lower end of the CP requirement range for nonlactating beef cows (range = 6 to 8%CP). More importantly it does not fall within the CP requirement range for lactating beef cows (range = 10 to 12%) which would indicate a need for supplementation at that time. There were no differences ($P>0.05$) in CP content selected by cattle in the two herds. From January through April there was a sharp increase in protein content in forages selected by both herds. This was most likely due to the amount of winter grasses present across the ranch. This time period can truly be considered, it would seem, an excellent portion of the grazing season during which supplementation should not be required. Crude protein values declined in May and June and again approached the 6% range where they had been in July of the previous year.

The second measure of forage quality was percent digestibility (Figure 2). In July, digestibility of forage consumed by both herds approached 60%. Because of the dry period we were undergoing, the high digestibility values were unexpected. Later values followed seasonal trends as expected. From August through January digestibility decreased slightly. There was a "zigzag" type pattern in forage digestibility from September through December. One reason for this could simply be the ability of cattle to select different diets. Another reason could be that during October and December the ranch received small amounts of moisture that led to slight regrowth of grasses and other forages that should have had somewhat higher digestibility and palatability. As expected, January was the month with the lowest forage digestibility values. This period represents the middle of the dormant season for many grasses which leads to decreased digestibility. Forage values for both herds were still very high (55%, spring herd; 56%, fall herd). This indicates that the cattle were able to select a more varied diet consisting of growing forbs and browse species during the dormant season of the grass species. January through April saw the largest increase in forage digestibility. This very closely followed the rise in percent CP as shown earlier. Again, this can be attributed to the winter grass grazing season as well as the warm season grass species entering the early growth phase during early to mid Spring. From April

through June forage digestibility steadily decreased and again approached the 60% level where it had been in July of the previous year. There were no differences ($P>0.05$) in digestibility of forage selected by cattle in the two herds throughout the year.

Body condition of the cattle was also monitored during the study. Body condition scoring was used as the indicator of energy (fat) stores maintained by an animal. Using the 1 (emaciated) to 9 (obese) scale, a BCS of 4.5 would be an "average" cow. "Average" can vary depending on many factors such as age, breed, frame size, etc., so that 4.5 may not always be the "average" of a particular herd. As shown in Figure 3, the spring herd (BCS = 4.1) began the study period in lower body condition than the fall herd (BCS = 5.2). It must be noted, however, that the spring herd in the middle of their lactation phase while the fall herd was two months into its post-weaning period. Although not significantly different ($P>0.05$), through the majority of the year the fall herd remained in slightly better body condition than did the spring herd.

Throughout the first year of this study BCS of both herds stayed within the range of the "average" value of 4.5. The cattle at the ranch are a commercial herd with an approximate 3/8 Brahman influence. They are large framed cattle with an average weight of 1100 pounds. This type of animal has typically evolved away from excess fat storage. At the BCS shown in Figure 3, these cattle have successfully conceived and calved, and they have also weaned healthy calves that have done well when marketed. Because of this I believe "average" for our cattle may indeed be within a close range of the BCS of 4.5.

Conclusions

Data collected has been invaluable for use in developing a nutritional management program at the Freeman Ranch by offering an indication of existing forage conditions.

Collecting fecal samples for analysis has allowed us to "follow" cattle without having to trail them 24 hours a day. Using NIRS analysis of fecal samples coupled with NutBal Software analysis to extrapolate intake values for CP and digestibility has given us what I consider to be a very accurate indicator of the quality of forage used by cattle at the JH Freeman Ranch. Data collection will continue through June of 1999. Once the second year of date collection is complete, comparisons of years can be made. A supplemental feeding program can then be developed which best suites the needs of cattle throughout the year. It is hoped that use of supplements can be minimized to just those times deemed critical to the cattle. This should help to offset supplemental feed costs incurred by the ranch each year.

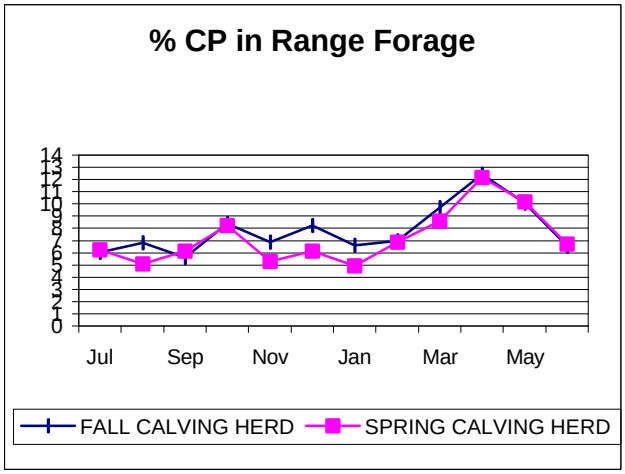

FIGURE 1. Crude protein (CP) Cintent of forage consumed by cattle

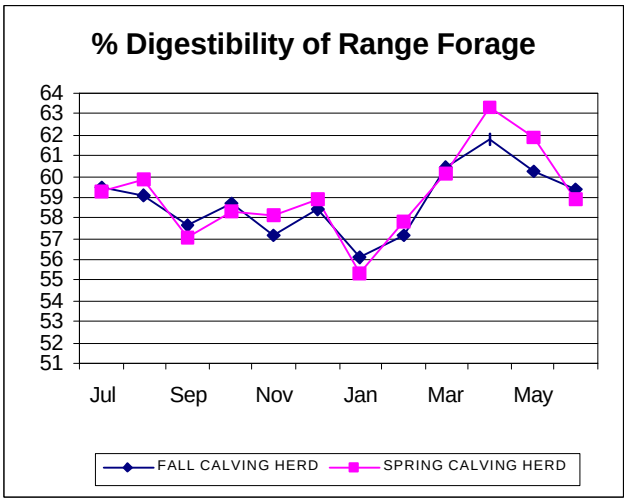

FIGURE 2. Digestibility of forage consumed by cattle

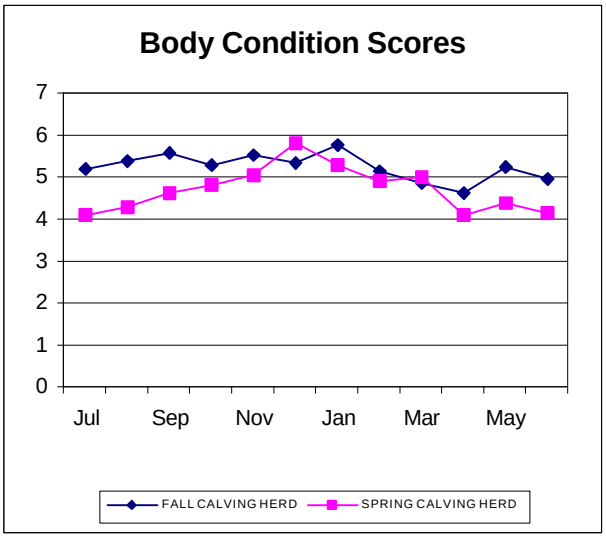

FIGURE 3. Body condition scores (BCS) of cattle