RELATIONSHIPS AMONG FECAL NITROGEN, DIET NITROGEN, AND DAILY GAIN OF STEERS GRAZING TALLGRASS PRAIRIE

F.T. McCollum[1]

Story in Brief

Methods of indirectly monitoring plane of nutrition and performance of grazing livestock would be useful for livestock managers. The relationship between dietary nitrogen and fecal nitrogen in beef steers grazing tallgrass prairie was monitored over a four year period. Regression analysis developed a relationship, Y=.79X-.17 with a coefficient of determination of .74, where Y is diet nitrogen and X is fecal nitrogen (both variables were adjusted to an organic matter basis). In addition, the relationship between average daily gain and fecal nitrogen in grazing steers was monitored in two of four years. Regression analysis produced a relationship, Y=1.23X-1.06 where Y is average daily gain (lb/head) and X is fecal nitrogen (percent organic matter basis) with a coefficient of determination of .78.

(Key Words: Fecal Nitrogen, Cattle, Range, Diet Composition, Gain.)

Introduction

The development of indirect methods of monitoring nutrition and performance of grazing livestock could potentially increase the efficiency of supplemental feeding programs, improve marketing decisions, and as a result, improve ranch profitability. Body condition scoring is an example of monitoring cow and ewe performance and has been widely adapted by producers. However, body condition at a given time is the result of previous plane of nutrition and therefore may not be an expedient means of determining nutritional needs. Forage testing may be utilized to monitor plane of nutrition but also has its limitations for short-term management decisions. Fecal nitrogen (N) may provide a useful means for monitoring immediate plane of nutrition as well as performance.

---

[1]Associate Professor

The studies described in the following report were conducted to determine if useful relationships among diet N, steer performance and fecal N could be developed.

Materials and Methods

All of the trials in this study were conducted at the Downey Range Research area located southwest of Stillwater, OK. The vegetation on the study pastures is typical of the tallgrass prairie and is dominated by big bluestem, little bluestem and indiangrass. Stocking rates during the trials were similar to stocking rates recommended for moderate utilization.

Relationships among diet N and fecal N were studied with data collected during four summer grazing seasons. Sampling periods were spread at approximately equal time intervals from mid-May to early October. Diet samples were collected four or five times during the summer grazing season using esophageally fistulated beef steers. During each sampling period, a group of intact beef steers were grazed in conjunction with the fistulated steers. Fecal samples were collected from this group at the same time masticate samples were collected from the fistulated steers. All diet and fecal samples were analyzed for dry matter, ash, and N content. Nitrogen content was adjusted to an organic matter basis. Means from each sampling period were used in regression analysis resulting in a total of 20 diet N:fecal N couples.

Relationships among average daily gain and fecal N were studied during two summer grazing seasons. Data were obtained by weighing beef steers every 21 to 28 days through the summer grazing season (May to October) and collecting fecal samples from each steer each time they were weighed. Twenty-three steers were monitored in the first year and 30 steers were monitored in the second year. The fecal samples were analyzed for dry matter, ash, and N. Fecal N was adjusted to an organic matter basis. A mean fecal N was then determined for each weigh date. Average daily gains on the dates of fecal collection were estimated by taking the first derivative of weight accumulation curves for each steer during the grazing season. The derivative equation was then solved with respect to the date of each fecal collection. A mean average daily gain was then determined for each weigh date. A total of 34 average daily gain:fecal N couples were then analyzed using regression procedures.

Results and Discussion

Results of the diet N:fecal N analysis are illustrated in Figure 1. Diet N varied from about 1% to 2.2% during the trial, therefore application of this

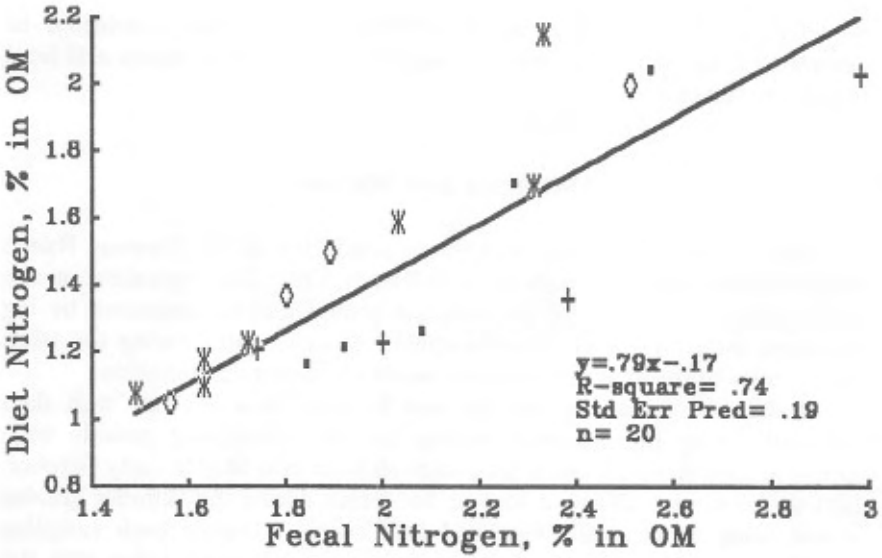

Figure 1. Association of diet nitrogen and fecal nitrogen in grazing steers.

equation should probably be restricted to this range of diet N. Overall, a very good association between the diets and feces was observed with 74% of the variation in diet N accounted for by fecal N. This coefficient is similar to other studies with similar degrees of freedom. Threshold fecal N values corresponding to 6, 8 and 10% crude protein in the diet are 1.42, 1.83, and 2.23%, respectively. Different symbols in Figure 1 represent data from different years. The relationship between feces and diet was not the same every year. If data were analyzed within years the fits are much better but the conditions under which the relationships apply are much more restricted. The variation among years indicated that these relationships are more qualitative guidelines than quantitative guidelines.

Results of the average daily gain:fecal N analysis are illustrated in Figure 2. Average daily gain varied from 1 lb/head to 2.5 lb/head during the trial. Fecal N accounted for 78% of the variation in average daily gain. Threshold fecal N values corresponding to average daily gains of 2.0, 1.5 and 1.0 lb/head are 2.5, 2.1, and 1.7%, respectively. The data points in this analysis represented various planes of nutrition that resulted from the use or nonuse of prescribed burning and protein supplementation. If these variables are removed and the data are analyzed within burning regimes or supplement regimes, the associations between gain and fecal N are much stronger (R^2=.80-.90). However, these have a restricted range of application. The composite relationship in Figure 2 would have a wider range of application.

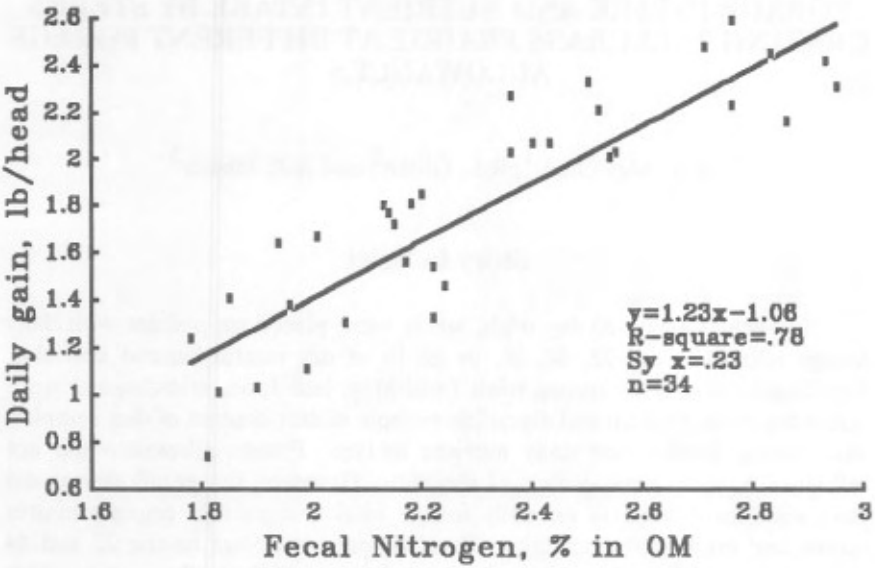

Figure 2. Associaton of average daily gain and fecal nitrogen of grazing steers.

These studies developed very acceptable mathematical relationships between diet N, average daily gain, and fecal N. Using these relationships to develop threshold fecal N values that indicate the need for supplement feeding or fecal N values that describe anticipated average daily gains can improve tactical decision making for stocker cattle producers in the tallgrass prairie regions of Oklahoma and Kansas. A missing key is a method of rapid N analysis.