steers per acre appears to be consistent with hay removal at peak growth periods. The August average daily gains reveal the vulnerability of the program to excessive heat and drought with no appreciable bermudagrass regrowth available.

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Relationship of Steer Daily Gains on Bermudagrass to Rate of Forage Digestion

M. Cannon, R. L. Hintz, G.W. Horn and W. E. McMurphy

Story in Brief

Relationships of daily gain of steers grazed on bermudagrass and extent and rate of forage dry matter (DM) digestion were examined. Steer gain data were from grazing trials on Midland, Hardie, Oklan and SS-16 bermudagrass pastures during 1977 and 1978. Rate of digestion and digestibility accounted for a small part of the variation in average daily gain. After variety, month and year were considered, relationships between rate of digestion, digestibility and average daily gain were small and of little value in predicting daily gains of steers on bermudagrass.

Introduction

Identification of indices of forage quality which would be useful in predicting animal performance has been a long-standing research goal. Early studies indicated that forage intake was more closely related to extent of digestion at early time periods (i.e., 6 to 12 hours) of *in vitro* incubation than longer time periods. The objective of this study was to obtain data relative to the relationship between daily gain of steers grazed on bermudagrass and extent and rate of forage dry matter (DM) digestion.

Experimental Procedure

The steer gain data obtained during grazing trials on Midland, Hardie, Oklan and SS-16 (an unreleased experimental strain) bermudagrass pastures during 1977 and 1978 were used. The pastures, consisting of two blocks of the four bermudagrass varieties, are located at the Agronomy Research Station (Perkins, Oklahoma). Details of cattle and pasture management and results of the trials have been previously reported (Horn and McMurphy, 1979).

Hand-clipped forage samples were taken at about monthly intervals from each pasture during the 1977 and 1978 grazing trials. Each sample consisted of clippings from 14 locations within each pasture of about 3 acres. The forage samples were dried, ground, and placed in the rumen of three ruminally cannulated steers for periods of 6, 12, 24, 48, and 72 hours. Forage dry matter digestibility (percent) was calculated from dry matter losses during the ruminal incubations.

The rate of digestion was examined by two methods. The first method was to calculate the regression coefficient (slope) of the log of digestibility on time for each year, month and pasture subclass. The rate of digestion from 6 to 72 hours was estimated as the regression coefficient (slope) of the log of digestibility on time. The second method was to estimate the parameters A and k of the nonlinear function, $Y = A(1-e^{-kt})$, for each year, month and pasture subclass. In the nonlinear function, Y is the observed digestibility at time t. The rate of digestion at time t was estimated as the value of the first derivative of the nonlinear function (slope of the curve) at time t. Correlations between average daily gain and observed digestibility, rate of digestion from 6 to 72 hours (method 1), and rate of digestion at time t (method 2) were calculated.

Results and Discussion

Variety, month, year and variety by year interaction influenced ($P<.05$) the rate of digestion from 6 to 72 hours and therefore were included in the model. The partial correlation (.045) between the rate of digestion from 6 to 72 hours and average daily gain was small and not significantly different ($P>.8$) from zero.

The rate of digestion at time t was affected ($P<.05$) by variety, year, month and all interactions. However, the objective of this report was to investigate the possibility of using the observed digestibility or rate of digestion to predict average daily gain. Therefore, partial correlations between average daily gain and observed digestibility and rate of digestion at time t were calculated (Table 1). All partial correlations were small and not significantly ($P>.05$) different from zero. A reason for the low correlations may be that variety, month and year explained the majority of the variation (i.e., 92-98 percent) in observed digestibility and rate of digestion at time t (Table 2). Variety, month and year explained 81 and 86 percent of the variation in average daily gain and rate of digestion from 6 to 72 hours, respectively. The amount of variation in average daily gain explained by rate of digestion from 6 to 72 hours, rate of digestion at time t or observed digestibility along with variety, month and year was 81 percent

Table 1. Partial correlation coefficients[a,b]

Correlation of average daily gain with	Time period				
	6 hr	12 hr	24 hr	48 hr	72 hr
Observed digestibility	−.11	−.15	−.02	−.31	−.01
Rate of digestion at time t	−.19	−.17	.004	.09	.14

[a]Variety, month, year and all interactions were included in the model for average daily gain, observed digestibility and rate of digestion at time t.
[b]None of the correlations were significantly ($P > .05$) different from zero.

Table 2. Percent of variation in observed digestibility and rate of digestion at time t explained by variety, month and year

Trait	Time period				
	6 hr	12 hr	24 hr	48 hr	72 hr
Observed digestibility	94	98	96	96	97
Rate of digestion at time t	98	97	92	93	93

except with observed digestibility at 48 hours (82.5 percent). Therefore, rate of digestion from 6 to 72 hours, rate of digestion at time t or observed digestibility explains very little of the variation in average daily gain after month, variety and year are considered. Whether or not rate of digestion from 6 to 72 hours, rate of digestion at time t, or observed digestibility are included with variety, month and year in the model to predict average daily gain, the standard error on the overall mean daily gain (1.78 lb) ranged from .043 to .045 lb.

Correlations, not adjusted for variety, year and month (simple correlations), between observed digestibility and rate of digestion at time t and average daily gain were also calculated (Table 3). Simple correlations between observed digestibility and average daily gain indicate that as digestibility increases, average daily gain tends to increase. Simple correlations between rate of digestion at time t and average daily gain were very small at 24, 48 and 72 hours. The simple correlation (-.003) between average daily gain and rate of digestion from 6 to 72 hours was small and not significantly different from zero. Rate of digestion from 6 to 72 hours alone explained none of the variation (0 percent) in average daily gain. Observed digestibility or rate of digestion at 6 or 12 hours alone explained between 14 and 36 percent (Table 4) of the variation in average daily gain while rate of digestion at 24, 48 or 72 hours explains very little (0 to 3 percent). Therefore, rate of digestion from 6 to 72 hours, rate of digestion at time t or observed digestibility does not account for much of the variation in average daily gain. Using rate of digestion from 6 to 72 hours to predict average daily gain gives a standard error of .07 lb. If observed digestibility at time t is used to predict average daily gain, the standard error of the overall mean daily gain (1.78 lb) ranges from .058 to .067 lb. Rate of digestion at time t predicts average daily gain with a standard error ranging from .06 at 6 or 12 hours to .07 at 24, 48 or 72 hours. The standard error of the mean of 64 average daily gains (1.78 lb) was .071 lb (standard error calculated from the raw average daily gain data without taking into account any sources of variation).

Based on these data, digestibility or rate of digestion does not account for much of the variation in average daily gain whether or not variety, year and month are considered. Therefore, rate of digestion at time t, rate of digestion from 6 to 72 hours or

Table 3. Simple correlation coefficients[a]

Correlation of average daily gain with	Time period				
	6 hr	12 hr	24 hr	48 hr	72 hr
Observed digestibility	.37[b]	.50[b]	.57[b]	.52[b]	.60[b]
Rate of digestion at time t	.57[b]	.50[b]	−.03	−.17	−.13

[a]Simple correlation between average daily gain and rate of digestion from 6 to 72 hours (method 1) was −.003 (not significantly different from zero).
[b]Significantly different from zero ($P < .05$).

Table 4. Percent of variation in average daily gain explained by observed digestibility or rate of digestion at time t

Source of variation	Time period				
	6 hr	12 hr	24 hr	48 hr	72 hr
Observed digestibility	14	25	32	27	36
Rate of digestion at time t	32	25	0	3	2

observed digestibility does not appear useful in prediciting average daily gain. However, year and month accounted for a major proportion of the variation, and only 2 years were represented in these data. Therefore, further replications are needed to obtain more precise estimates of the relationship between rate of digestion, digestibility and average daily gain.

Literature Cited

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Effects of Reimplantation for Grazing Calves

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Story in Brief

One hundred ten steer and heifer calves were used to study the effects of Ralgro[1] implants on calves grazing native pastures. Administration of Ralgro implants increased weight gains 31 lb over a 449-day grazing period. This improved performance yielded $22.40 more profit per calf. Equal responses were noted for calves reimplanted at 90- and 180-day intervals. In yearlings, response to an implant was equal for calves implanted for the first time and calves which had received implants previously. Ralgro implants appeared most beneficial when pastures supported rapid growth.

Introduction

High interest rates, combined with increasing fertilizer and land costs have reduced the profit margins of cattle-growing operations. The use of growth-stimulating implants is one method which may be used to increase rate of gain and total profits. Ralgro implants have been shown to increase gains in pasture cattle in many trials. However, the effect of frequency and number of implants has not been thoroughly studied. The purpose of this study was to determine the weight gain response of beef calves to Ralgro implants over a period of approximately 15 months.

Materials and Methods

A total of 110 crossbred (½ Charolais, ¼ Angus and ¼ Hereford) calves (200 lb) were used in three different sequences of implantation with Ralgro.

Steer and heifer calves were randomly allotted between treatments. Calves were nursing and later grazing two different pasture types. Pasture one has deep sand and is primarily tall grass species. Pasture two has predominantly red clay soil with short grass species. Calves were born between January 1 and April 1, 1978.

The three sequences of Ralgro implantation are presented in Table 1. One set of calves was not implanted until 1 year of age. Calves on Treatments 2 and 3 received their first implants in April of 1978 when the calves were branded, dehorned and castrated. Treatment 2 calves received subsequent implants at 180-day intervals while calves in Treatment 3 were reimplanted with Ralgro approximately every 90 days. The

[1]IMC Chemical Group, Inc., Terre Haute, Indiana.
[2]Davison and Sons Cattle Company, Arnett, Oklahoma.