Wheat Forage Intake and Utilization of Wheat Pasture Stockers Fed Low-Quality Roughages

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Story in Brief

Grazing and metabolism trials were conducted to determine the effect of feeding low-quality roughages (LQR) to wheat pasture stockers on wheat forage intake and utilization. A single pulse dose of ytterbium-labeled wheat forage was used as a particulate phase marker to measure total gastrointestinal tract (GIT) and ruminal dry matter (DM) turnover rates (percent/hr) and fecal outputs. Wheat forage intakes were calculated by dividing estimates of fecal outputs (corrected for the undigested portion of LQR in feces) by wheat forage indigestibility (1-IVDMD). In the grazing trial, steers were grazed on a single wheat pasture and fed nothing (control) or wheat straw (WS) or sorghum-sudan hay (SS) *ad libitum* during a 2-hour period each morning. Wheat forage intake and total GIT DM turnover rate were not significantly different ($P>.05$) among treatments. In the metabolism stall trial, steers were fed 90 percent of *ad libitum* of harvested wheat forage (control) or harvested wheat forage plus SS. Differences in wheat forage digestibility, total GIT and ruminal DM and liquid turnover rates were not significant ($P>.05$), although each was decreased in steers fed SS. Data to date indicate that feeding LQR to wheat pasture stockers does not improve wheat forage utilization or significantly decrease wheat forage intake.

Introduction

Low-quality roughages such as wheat straw are commonly fed *ad libitum* to stocker cattle on wheat pasture. Reasons cited by producers for feeding low-quality roughages on wheat pasture include the following: 1) extension of wheat pasture, 2) a means of slowing rate of passage and thereby increasing the efficiency of utilization of "washy" wheat forage, 3) for heat (e.g., to increase the heat of ruminal fermentation and reduce maintenance energy requirements), and 4) to reduce the incidence of bloat.

A 3-year project was initiated during the fall of 1978 to obtain information relative to the effect of feeding low-quality roughages to wheat pasture stockers on:

1. Live and carcass weight gains
2. Wheat forage intake
3. Incidence of bloat
4. Wheat forage dry matter digestibility
5. Total ruminal dry matter turnover rate

Results obtained during the first year of the project, relative to objectives 1 and 3, have previously been reported (Mader *et al.*, 1979). Results of studies conducted during the first year, relative to objectives 2, 4 and 5, are reported herein.

Experimental Procedure

Grazing trial

Nine Hereford x Angus steer calves that weighed 498 lb were used in three 3 x 3 latin square designs with period on wheat pasture and treatment as factors. During each period all steers grazed a single wheat pasture for 8 hr each day. The steers were removed from wheat pasture overnight, placed in individual feeding stalls on each of the following mornings, and fed: 1) nothing, 2) wheat straw or 3) sorghum-sudan hay *ad libitum* for 2 hr prior to being returned to wheat pasture. Each period consisted of 11- and 5-day preliminary and collection phases, respectively. At the beginning of each collection phase, all steers were fed a single pulse dosage of wheat forage (.284 lb dry matter basis) labeled with ytterbium chloride (9.74 g Yb/steer), a particulate phase marker. Fecal samples were then obtained from the rectum of each steer at 0800 and 1600 hr daily during the collection phase. Daily fecal output and total gastrointestinal tract (GIT) dry matter (DM) turnover rate were estimated using the single dose marker technique described by Faichney (1975) and Ellis *et al.*, 1977. Total GIT DM turnover rate was determined from the slope of the linear portion of the graph of the natural logarithm of fecal Yb concentration *vs* time (hr). Daily fecal output was determined by multiplying GIT pool size of undigested DM by daily GIT DM turnover rate (negative slope x 24). Undigested GIT DM pool size equals grams (g) Yb fed divided by the initial concentration of Yb (g/g feces), determined from the line estimating slope extrapolated back to the time (Tau) Yb first appeared in the feces. Tau was determined from the equation of the entire excretion curve (i.e., Yb concentration *vs* time) utilizing non-linear regression procedures. Wheat forage intakes were calculated by dividing estimates of fecal output [corrected for the undigested portion of low-quality roughage in feces, as determined by *in vitro* dry matter digestibility (IVDMD) procedures] by wheat forage indigestibility. Wheat forage indigestibility was calculated by substracting IVDMD of hand-clipped wheat forage samples from one.

Metabolism stall trial

Six ruminally-cannulated steers that weighed 830 lb were utilized in a completely randomized design and were fed harvested wheat forage (control) or harvested wheat forage plus sorghum-sudan hay. Wheat forage was harvested using a John Deere flail harvester. After harvesting, the forage was placed in large plastic bags (approximately 40 lb/bag), excess air was removed by vacuum and the bags were tied off with string. At the time of harvesting, wheat forage samples were obtained and frozen for analysis at a later date. The bagged forage was stored at 2°C and fed as needed during the trial. Samples of wheat forage fed to steers were taken daily during the fecal collection phase of the trial (day 11 to day 16 of storage) and frozen for later analysis for soluble protein and non-protein nitrogen.

The trial included a 7-day preliminary period in which wheat forage intake was adjusted to achieve *ad libitum* intake, and 5- and 3-day fecal collection and ruminal sampling periods, respectively, in which wheat forage was fed at 90 percent *ad libitum*. Wheat forage dry matter digestibility was measured from wheat forage intakes and total collections of fecal output. Total feces of sorghum-sudan hay fed steers was adjusted for the amount of hay dry matter appearing in the feces, which was determined by multiplying the amount of hay fed by the indigestible portion (1-IVDMD) of sorghum-sudan hay. The single dose marker technique was also used to estimate fecal output (which was compared to that measured by total collection), total GIT DM turnover rate and ruminal solids and liquid turnover rates. Ytterbium labeled wheat forage and cobalt-EDTA, respectively, were used as solid and liquid phase markers.

Results and Discussion

Grazing trial

Roughage and wheat forage intakes and total tract DM turnover rates are shown in Table 1. Daily intakes of wheat straw were similar (.23 *vs* .25 lb DM/head/day) to straw intakes reported by Mader *et al.* 1979, for steers having free-choice access to wheat straw on wheat pasture. Intakes of sorghum-sudan hay, however, were slightly greater (.96 *vs* .57 DM/head/day) in this study.

Wheat forage intakes for the control, wheat straw- and sorghum-sudan hay-fed were, respectively, 6.96, 7.49 and 5.95 lb DM/head/day and were not significantly different (P>.05). Total tract turnover rate of DM (percent/hr) was also not significantly different (P>.05) among treatments.

Metabolism stall trial

Chemical composition of fresh-cut *vs* wheat forage stored in the cooler is shown in Table 2. While the percentage of soluble nitrogen (expressed as a percent of total nitrogen) increased during storage, soluble protein nitrogen decreased from 8.78 to 2.33 percent. Soluble non-protein nitrogen increased from 32.05 to 54.44 percent. The storage conditions, therefore, did not prevent the degradation of some of the wheat forage soluble protein. Some of the bags of stored wheat forage removed from the cooler during the last few days of the trial smelled as if some fermentation had occurred. These bags were discarded and were not fed to the steers.

Sorghum-sudan hay intake, wheat forage intake and digestibility, total GIT and ruminal dry matter turnover rate, and fecal output of steers fed wheat forage in metabolism stalls are shown in Table 3. The sorghum-sudan hay intake appears to be high (1.55 lb DM/head/day). However, when expressed as a percent of metabolic body weight, they were only slightly greater (.82 *vs* .74 percent) than those observed during the grazing trial. Wheat forage intake of steers fed sorghum-sudan hay was decreased about 32 percent, although the reduction was not significant (P>.05). A decline in daily wheat forage intake of 26 percent for a control steer and 8 and 58 percent for two sorghum-sudan steers were observed during the fecal collection period of this trial. The decline in wheat forage intake may be attributed to the changes in wheat forage

Table 1. Roughage and wheat forage intake and total gastrointestinal tract (GIT) DM turnover rate of steers.

	Control	Wheat straw[a]	Sorghum-sudan hay[a]
Roughage intake			
lb DM/day	—	.23	.96
% of metabolic body weight	—	.18	.74
Wheat forage intake			
lb DM/day	6.96[b]	7.49[b]	5.95[b]
Total GIT DM			
Turnover rate, %/hr	5.22[b]	5.30[b]	5.47[b]

[a]IVDMD = 27.42 and 48.08% for wheat straw and sorghum-sudan hay, respectively.
[b]Means in a row with a common-lettered superscript are not different (P>.05).

Table 2. Chemical composition of harvested wheat forage.

	Fresh-cut[a]	Stored in cooler[b]
Number of samples	2	6
Dry matter (DM), %	17.95	18.59
Crude protein, %	26.31	25.38
Nitrogen (N), %	4.21	4.06
Soluble N		
% of DM	1.72	2.30
% of total N	40.83	56.77
Soluble protein N		
% of DM	.37	.10
% of total N	8.78	2.33
Soluble non-protein N		
% of DM	1.35	2.20
% of total N	32.05	54.44

[a]Frozen until time of analysis.
[b]Stored at 2°C; samples taken daily during collection period of trial (day 11 to 16 of storage). Samples then frozen until analyses were conducted.

Table 3. Wheat forage intake and digestibility, total GIT dry matter and ruminal turnover rate and fecal output of steers in metabolism stall trial.

	Control	Sorghum-sudan hay[a]
Roughage intake		
lb DM/day	—	1.55
% of metabolic body weight	—	.82
Wheat forage intake, lb DM/day	10.74[b]	7.29[b]
Wheat forage digestibility, %	74.76[b]	73.75[b]
Total GIT DM turnover rate, %/hr	3.50[b]	2.92[b]
Ruminal turnover rate, %/hr		
Dry matter	3.69[b]	3.47[b]
Liquid	10.20[b]	8.14[b]
Daily fecal output, lb DM/day		
Measured by total collection	2.69[b]	2.52[b]
Estimated by pulse dose of Ytterbium	3.12[b]	2.54[b]

[a]IVDMD = 45.77%.
[b]Means in a row with a common-lettered superscript are not different (P>.05).

composition which occurred during storage. Significant differences in wheat forage digestibility, total GIT and ruminal DM and liquid turnover rates were not observed (P>.05), although each was decreased in steers fed sorghum-sudan hay. Since poorer quality feedstuffs tend to pass out of the rumen at a slower rate, a larger decrease in solids turnover rate was expected. Also, a decrease in solids turnover rate would tend to increase wheat forage digestibility.

Total GIT and ruminal DM turnover rates of steers fed only wheat forage were similar. Ruminal DM turnover rates of steers fed wheat forage and sorghum-sudan hay were greater than DM turnover rates of the total GIT; an explanation for this discrepancy is not apparent. Estimated *vs* measured daily fecal outputs were similar for steers fed sorghum-sudan hay but greater for control steers. Accurate estimates of fecal output are prerequisite to calculations of forage intake of grazing cattle. Additional studies are needed to assess the accuracy of estimated fecal outputs in trials using pulse dosage marker techniques.

Literature Cited

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Protein-Sparing Effect of Monensin Fed to Steers Wintered on Dormant, Native Range

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Story in Brief

Ninety-six Hereford steer calves were allotted to four treatments (two levels of supplemental protein with or without monensin). The steers grazed dormant native range pastures and were group fed, 6 days per week, 2 lb of supplement/head/day that contained 13.5 or 27 percent digestible protein and 0 or 150 mg of monensin during the 120-day trial (November 30, 1978, to March 30, 1979). The data suggest that a protein supplement containing 19.4 percent digestible protein plus monensin would support equivalent steer gains (i.e., 30 lb) during the total wintering period as a protein supplement containing 28 percent digestible protein without monensin.

Introduction

While the mechanism of action of monensin is not completely understood, the improvement in feed efficiency of feedlot cattle is related to the shift affected by monensin in the production of ruminal volatile fatty acids (VFAs), increasing pro-

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