Table 2. Regression coefficients of regressions of daily gain on initial body weight of steers grazed on wheat pasture

Year	Regression coefficient[a]	Probability level[b]
1	−.22	.001
2	.002	.98
3	−.13	.10
4	−.15	.06
All 4 years	−.14	.001

[a]Change in daily gain (lb) for each 100-pounds increase in initial steer body weight.
[b]Probability that regression coefficient is significantly different from zero.

The data used in this study were from fall-weaned steer calves that were placed on wheat pasture. The results do not apply to the question or differences in gain of calves versus yearlings. Also, the extent to which differences in fleshiness of the steers may have influenced the results is not known.

The results indicate that daily gains of lightweight steers (e.g., 300 lb) on wheat pasture will be greater than those of heavier steers (e.g., 500 lb). Since a given acreage of wheat pasture can be stocked with more lightweight than heavy steers, total gains per acre would be greater for lightweight steers.

Effect of Feeding Wheat Straw or Sorghum-Sudan Hay on Gains and Wheat Forage Utilization of Stocker Cattle

T.L. Mader, G.W. Horn and W.E. Phillips

Story in Brief

Grazing and metabolism trials were conducted during the 1979-80 wheat pasture grazing season to determine the effect which feeding wheat straw (WS) or sorghum-sudan hay (SS) to wheat pasture stockers had on gains and wheat forage intake and utilization. Live and carcass daily weight gains were not significantly altered by feeding either WS or SS. A single pulse dose of Ytterbium-labeled wheat forage was used as a particulate phase marker to measure total gastrointestinal tract (GIT) dry matter (DM) turnover rates of wheat forage (percent/hr) and fecal outputs. Wheat forage intakes were calculated by dividing estimates of fecal outputs (corrected for the undigested portion of WS or SS in feces) by wheat forage indigestibility (one minus estimated *in vivo* digestibility). In the grazing trial, steers were grazed on a single wheat pasture and fed nothing (control) or WS or SS. Wheat forage intakes were significantly ($P<.05$) greater for steers fed SS; however, GIT DM turnover rates of wheat forage were not significantly ($P>.05$) different among treatments. In a metabolism stall trial, steers were fed 90 percent *ad libitum* of harvested wheat forage (control) or harvested wheat forage plus SS. Differences in wheat forage intake and digestibility and total GIT turnover rates were not significant ($P>.05$). The data indicate that feeding WS or SS to wheat pasture stockers does not alter wheat forage utilization or significantly decrease wheat forage intake.

In cooperation with USDA, Science and Education Administration, Southern Region.

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) heat (e.g., to increase the heat of ruminal fermentation), and 4) reduction of the incidence of bloat.

During the fall of 1978 a 3-year project was initiated to obtain information relative to the effect of feeding low-quality roughages to wheat pasture stockers. Measured were:

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 have previously been reported (Mader *et al.*, 1979 and 1980). Results of the second year of the project are reported herein. Research relative to the above objectives has been partitioned into an extensive phase (Objectives 1 and 3) and an intensive phase (Objectives 2, 4 and 5). Data relative to Objective 5 was not obtained in the second year of this study; however, total gastrointestinal tract dry matter turnover rate of wheat forage was determined.

Experimental Procedure

Extensive phase

Fifty-seven (57) fall-weaned Hereford steer calves that weighed 365 lb were randomly assigned to five groups. Two groups of steers grazed clean-tilled wheat pasture for 147 days (November 27 to April 21) and two groups of steers grazed wheat pasture and were fed *ad libitum* sorghum-sudan hay. Due to a shortage of wheat pasture, only one group of 12 steers was grazed on wheat pasture and fed wheat straw *ad libitum*.

Straw and hay intakes for the respective steer groups were measured every two weeks. Straw and hay were added to feeders and sampled at 2-week intervals for dry matter, *in vitro* dry matter digestibility determinations, and other chemical analyses. A mineral mixture that consisted of two-thirds salt and one-third ground limestone was fed free-choice in "whirlwind" type mineral feeders. No additional salt was fed to the steers. All steers were observed twice daily throughout the trial and assigned a bloat score of 0 to 3.[1]

Initial, intermittent and final shrunk live weights (overnight stand without feed or water) were measured. Three intermittent weights were taken (January 9, February 22 and March 19) so as to bracket major changes in climatic growing conditions for wheat, and, therefore, major changes in wheat forage quality and /or maturity. In the previous year, steers were removed from wheat pasture in March, however, as of the March weigh date, no bloat had been observed for any of the steers on trial. Therefore, an additonal grazing period of 34 days was utilized in an effort to acquire additional data relative to the incidence of bloat.

Samples of available wheat forage in all pastures were taken by hand-clipping at 2- to 4-week intervals throughout the trial. Carcass weight gains were calculated from the mean dressing percentage of an initial slaughter group of four steers, and the mean dressing percentages of final slaughter groups of three steers randomly selected from each of the three treatment groups.

[1]0 - No visible signs of bloat; 1 - Slight distention of left side; 2 - Marked distention of left side; 3 - Left and right sides distended.

Intensive phase

GRAZING TRIAL—Nine Hereford x Angus steer calves that weighed 765 lb were used in three 3 x 3 Latin square designs with periods on wheat pasture and treatment as factors. During each period all steers grazed a single wheat pasture for 9 hr each day. The steers were removed from wheat pasture, placed in individual feeding stalls, fed 1) nothing, 2) wheat straw or 3) sorghum-sudan hay *ad libitum* overnight and returned to wheat pasture the following morning. 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 (.124 lb dry matter basis) labeled with Ytterbium chloride (1.46 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 dry matter turnover rate were estimated using the single dose marker technique described by Faichney (1975) and Ellis *et al.* (1977). Details of the marker technique have previously been discussed (Mader and Horn. 1980). 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) prodedures) by wheat forage indigestibility. Wheat forage indigestibility was calculated by subtracting *in vivo* digestibility of hand-clipped wheat forage samples from one. *In vivo* digestibility was estimated from the average IVDMD of the wheat forage samples.

METABOLISM STALL TRIAL—Ten Hereford steers that weighed 634 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 every 2 or 3 days using a small flail harvester. After harvesting, the forage was placed in large plastic bags (approximately 40 lb/bag), excess air was removed and the bags were tied off with string. The bagged forage was stored at 2°C and usually fed within 1 to 3 days after harvesting. Samples of wheat forage fed to steers were taken daily during the fecal collection phase of the trial and frozen for later analysis.

The trial included a 7-day preliminary period, in which wheat forage intake was adjusted to achieve *ad libitum* intake, and a 5-day fecal collection period, 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 steers fed sorghum-sudan hay 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 (one minus estimated *in vivo* digestibility) of sorghum-sudan hay. The single dose marker technique, using ytterbium-labeled wheat forage, was used to estimate fecal output and total GIT DM turnover rate. Fecal outputs estimated by the marker technique were compared to those from total collection.

Results and Discussion

Extensive phase

Roughage consumption (lb DM/head/day) and average daily gains of the steers are shown in Table 1. Roughage intake was greatest in Period 2 and decreased thereafter. Over the 113-day period (11-27-79 to 3-18-80), steers consumed .20 lb of wheat straw per head per day and .52 lb of sorghum-sudan hay per head per day.

Live weight gains were lowest in Period 1, averaging 1.31 lb/head/day and tended to increase over the grazing season, averaging 2.49 lb/head/day in Period 4. Daily gains tended to be greater for the control steers during Periods 1 and 2 but lower for the control steers during the remaining periods. Only in Period 3 were gains significantly

different ($P<.05$) between the control and roughage-fed steers. Over the entire 147-day grazing season, carcass daily gains of 1.42, 1.40 and 1.47 lb/head/day, respectively, for the control steers and those fed wheat straw and sorghum-sudan hay were not significantly different ($P>.05$). Although steers were observed for bloat twice daily during the trial, no incidence of bloat was noted for any steers among the treatment groups.

Intensive phase

GRAZING TRIAL—Roughage and wheat forage intakes and total GIT DM turnover rates are shown in Table 2. Intakes (expressed as percentage of metabolic

Table 1. Roughage intake and daily gains of wheat pasture stockers fed low-quality roughages[a]

Item	Control	Wheat straw[b]	Sorghum-sudan hay[b]
Roughage consumption, lb DM/head/day			
Period 1 (11-27-79 to 1-8-80)	—	.21	.32
Period 2 (1-9-80 to 2-21-80)	—	.22	.74
Period 3 (2-22-80 to 3-18-80)	—	.13	.49
Period 4 (3-19-80 to 4-21-80)	—	.07	.16
Periods 1-3 (113 days)	—	.20	.52
% metabolic body weight	—	.15	.40
Average daily live gains, lb			
Period 1 (11-27-79 to 1-8-80)	1.43[c]	1.27[c]	1.24[c]
Period 2 (1-9-80 to 2-21-80)	2.08[c]	1.88[c]	1.98[c]
Period 3 (2-22-80 to 3-18-80)	2.06[c]	2.14[d]	2.23[e]
Period 4 (3-19-80 to 4-21-80)	2.25[c]	2.98[c]	2.25[c]
Periods 1-4 (147 days)	1.92[c]	2.00[c]	1.87[c]
Average daily carcass gains, lb			
Periods 1-4 (147 days)	1.42[c]	1.40[c]	1.47[c]

[a]Mean values represent two groups of 11 or 12 steers per group for the control and sorghum-sudan hay treatment and one group of 12 steers for the wheat straw treatment.
[b]Mean crude protein and estimated TDN contents were 3.44 ± .11 and 37.24 ± 1.70 for the wheat straw and 8.24 ± .27 and 52.66 ± .67 for the sorghum-sudan hay, respectively.
[cde]Means with a common lettered superscript are not significantly different ($P>.05$)

Table 2. Roughage and wheat forage intake and total gastrointestinal tract (GIT) DM turnover rate of steers grazed on wheat pasture

Item	Control	Wheat straw[a]	Sorghum-sudan hay[a]
Roughage intake			
lb DM/day	—	.73	1.63
% of metabolic body weight	—	.41	.96
Wheat forage intake			
lb DM/day	11.05[b]	11.19[b]	13.52[c]
Total GIT DM (wheat forage) turnover rate, %/hr	4.46[b]	4.36[b]	4.75[b]

[a]Estimated *in vivo* digestibilities are equal to 36.87 and 54.29% for wheat straw and sorghum-sudan hay, respectively.
[bc]Means in a row with a common-lettered superscript are not different ($P>.05$).

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

Item	Control	Sorghum-sudan hay[a]
Roughage intake		
lb DM/day	—	1.42
% of metabolic body weight	—	.93
Wheat forage intake, lb DM/day	12.22[b]	12.23[b]
Wheat forage digestibility, %	75.25[b]	74.70[b]
Total GIT DM (wheat forage) turnover rate, %/hr	9.13[b]	10.38[b]
Daily fecal output of undigested wheat forage, lb DM/day		
Measured by total collection	3.02[b]	3.08[b]
Estimated by pulse dose of Ytterbium	2.88[b]	3.14[b]

[a]Estimated *in vivo* digestibility is equal to 58.24%.
[b]Means in a row with a common-lettered superscript are not different (P>.05).

body wt) of wheat straw and sorghum-sudan hay were greater than those observed in the extensive phase. Wheat forage intakes compared to control steers were slightly greater (11.05 vs. 11.19 lb/head/day) for steers fed wheat straw and significantly (P<.05) greater (11.05 vs.13.52 lb/head/day) for steers fed sorghum-sudan hay. This would indicate that low-quality roughage fed at these levels tended to either maintain or stimulate wheat forage intake rather than decrease it. Total GIT DM turnover rate of wheat forage was not different (P>.05) among treatments. However, steers fed sorghum-sudan hay had the fastest GIT DM turnover rate (4.75 percent /hr), which may be due to the increased wheat forage intake.

METABOLISM STALL TRIAL—Sorghum-sudan hay intake, wheat forage intake and digestibility, total GIT 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 of 1.42 lb DM/head/day, when expressed as a percent of metabolic body weight was similiar (.93 vs. .96 percent) to that observed during the grazing trial. Wheat forage intakes were very similiar (12.22 vs. 12.23 lb/head/day) for both the control steers and those fed sorghum-sudan hay. Although total GIT DM turnover rate of wheat forage was not significantly different (P>.05), the average turnover rate of steers fed sorghum-sudan hay was higher (10.38 vs. 9.13 percent /hr) than that of control steers. The greater turnover rate may be attributed to the intake of sorghum-sudan hay since wheat forage intake was similiar, An explanation for the large difference in GIT DM turnover rate of wheat forage between steers of the grazing and metabolism stall trials is not apparent.

Regardless of the differences in wheat forage turnover rate, wheat forage digestibility was not changed (P>.05) by feeding sorghum-sudan hay. Estimated vs. measured daily fecal outputs of undigested wheat forage were similiar for both steer groups. Fecal output of undigested wheat forage, averaged across both groups, was 3.06 lb/head/day whereas fecal output estimated from the pulse dose marker technique was 3.01 lb/head/day. The data indicate that intake is not decreased and that utilization of wheat forage (digestibility and rate of passage through the gastrointestinal tract) is not significantly altered by feeding wheat straw or sorghum-sudan hay to wheat pasture stockers. Daily gains over the entire grazing season were similiar for steers of all treatments.

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Yeast Culture in a Free-Choice Mineral Supplement for Stocker Cattle Grazing Wheat Pasture

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Story in Brief

Steer and heifer calves were grazed on wheat pasture from December to mid-March. Two groups were allowed access to a commercial mineral supplement, and two groups received the same supplement with added cultured yeast. The addition of 50-percent cultured yeast in the mineral mixture increased daily mineral consumption threefold from 0.08 to 0.24 lb per head.

The increased mineral consumption did not significantly ($P>.05$) affect the average daily gain of the cattle. However, limited available wheat herbage in one pasture replicate may have influenced these results. There was no difference in the calcium or magnesium status of blood or hair among the animals fed mineral alone or mineral with cultured yeast, but both appeared to be considerably below reported levels. Phosphorus levels were considered to be adequate. Herbage sodium was found to vary with pasture, and the sodium content of the hair but not serum of animals varied accordingly. Little treatment differences were found in herbage, serum or hair concentrations of potassium, iron, copper and zinc. Future studies with blood and hair samplings should involve a greater number of animals for a more sensitive statistical analysis.

Introduction

Early wheat pasture studies with grazing stocker cattle in the panhandle of Oklahoma indicated that there was a possible deficiency of calcium and magnesium (McMillen and Langham, 1942). Consumption of mineral supplements by cattle grazing wheat pasture has generally been relatively low. Mader *et al.* (1979) reported that steers grazing wheat pasture consumed only 0.26 lb per head daily of a 2:1 mixure of salt and limestone. A technique is needed to increase mineral consumption to meet calcium and magnesium requirements.

Ruf *et al.* (1953) showed that the inclusion of 5-percent live yeast in the diet of lambs increased feed consumption by 0.6 lb and daily gains by 0.16 lb. Feeding yeast

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