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Changes In Growth Performance Of Steers And Nutritive Value Of Wheat Pasture From Fall/Winter Grazing To Graze-Out

R.R. Reuter and G.W. Horn

Story in Brief

Twenty-four fall-weaned steer calves grazed wheat pasture from November 20, 1998, to May 13, 1999, to determine changes in live weight and nutritive value of wheat forage during the 174-d grazing period. Weight of the steers increased in a linear manner over the grazing period, and daily gain averaged 2.62 lb. However, observed weight on d 20 was almost 25 lb less than what would be expected from the value predicted by the other weights. This is suggestive of an initial, very transient adaptation period to wheat pasture. Wheat forage dry matter, crude protein, and in vitro organic matter disappearance values changed in a cubic manner over the grazing period. The Level I model of the 1996 Beef Cattle NRC indicated that metabolizable energy intake is first-limiting with respect to growth performance of stocker cattle on wheat pasture. Supplementation with readily available carbohydrate would provide additional energy, and may result in more efficient capture of excess ruminal degradable nitrogen.

Key Words: Growing Steers, Wheat Pasture, Nutritive Value

Introduction

Relative to other forages, performance of cattle is typically high when grazing cool-season annual grasses. These grasses are some of the highest quality forages available to cattle producers in the southern Great Plains. Significant research has been conducted relative to their use and supplementation. However, some aspects of these grasses have not been thoroughly investigated. For example, cattle performance may be limited by initial low dry matter content and(or) changes in nutrient content as the grazing season progresses. This trial was conducted to quantify changes in growth performance of steers and changes in composition of wheat forage from fall/winter through the graze-out period.

Materials and Methods

Two pastures of hard red winter wheat (Pioneer 2163) were established at the Wheat Pasture Research Area near Stillwater, OK, during the first week of September, 1998. Approximately 100 lb/ac of actual nitrogen was applied as anhydrous ammonia immediately before planting. Twenty four fall-weaned Hereford x Angus steer calves (initial wt 519±49 lb) from the same cow herd were weighed and assigned randomly to the pastures on November 20. The steers had been weaned on October 13, vaccinated for respiratory diseases and with a 7-way Clostridial vaccine, and treated for internal and external parasites. The steers grazed an old world bluestem pasture and were fed 2 lb/d of a soybean meal/cottonseed meal-based supplement that contained 40% protein and 54 mg decoquinate/lb between weaning and placement on wheat pasture. The steers were then gathered at approximately 8:00 a.m., shrunk in drylot without feed and water for 5 h, and weighed on d 20, 29, 46, 62, 83, 97, 125, 139, 153 and 174 of the trial. No supplement was fed during the wheat pasture grazing period except that the steers had free-choice access to a commercial mineral mixture that contained 20% salt, 16% calcium, 4% phosphorus, 5.5% magnesium and 150,000 IU vitamin A/lb. Consumption of the mineral was measured weekly and ranged from less than .10 during the early part of the trial to .60 lb/steer/day toward the end. Mean ± std. dev. intake of mineral was .17±.13 (pasture 1) and .22±.20

lb/steer/day for the second pasture.

Four samples of wheat forage were clipped from each pasture 7 d before grazing began, and on each day the cattle were weighed. The collector attempted to simulate cattle diet selection when clipping the samples. Samples were composited within pasture by date of collection for analysis. Standing dry matter (DM), organic matter (OM), nitrogen and sulfur (S) concentrations, and *in vitro* organic matter digestibility (IVOMD) were determined. Crude protein (CP) was partitioned into degradable intake protein (DIP) and undegradable intake protein (UIP) by measuring nitrogen disappearance during a 48-h *in vitro* incubation in a borate-phosphate buffer containing protease type XIV from *Streptomyces griseus*.

The Level I model of the 1996 Nutrient Requirements of Beef Cattle (NRC, 1996) was used to evaluate nutrient balances of the steers during the wheat pasture grazing period. *In vitro* organic matter digestibility (DM-basis, as a measure of TDN), CP, and DIP were inserted into the feed library for each sampling period. Animal parameters selected were: 8-mo old, Angus x Hereford steers with no implant and 13% microbial efficiency. Dry matter intake was estimated by the model, and that estimated intake was used for nutrient balance modeling. The software predicts ADG allowed by either metabolizable energy (ME) or metabolizable protein (MP) intake, as well as DIP and MP balance.

A non-cumulative ADG was calculated for each steer on each weigh day as the weight on that day minus the weight on the previous weigh day, divided by the number of days between the two weigh days. Regression analysis was used to analyze the relationship of weight, ADG, and forage characteristics to days on pasture. Further, regression was used to determine the relationship of DIP and S to CP in the forage.

Results and Discussion

Weight increased linearly in response to increasing days on pasture (Figure 1), and the residuals or differences between observed and predicted weights of steers at various days on pasture ranged from -24.8 to 11.7 (Table 1). The value of -24.8 at d 20 was the only residual that was significantly different ($P<.05$) from zero. These results suggest some initial adaptation of the steers to wheat pasture during which weight gains were decreased.

The slope of the line relating weight to days on pasture (ADG) was 2.62, with an R^2 of .99 (Figure 1). This would indicate that much of the variation observed in ADG (Table 1) may be due to factors, such as differences in fill, that would prevent measurement of an accurate weight, and therefore ADG, over these relatively short weighing periods.

Nutritive value of wheat pasture was largely a function of sampling date, as shown by the cubic responses of DM, IVOMD, and CP to day of grazing (Figures 2, 3, and 4). These graphs depict a scenario of high initial quality, which decreased during winter, followed by an increase during the late-winter, early spring growth period, and a subsequent decrease during the graze-out period. Wheat forage DM content ranged from a low of 17.5% on day –7 (November 13) to a high of 40.6% on January 21.

Relatively little variation was observed in DIP over the trial, and was 76.9±2.4% of CP (Table 1). DIP was not linearly related to CP ($R^2<.01$). Sulfur content of the forage declined at the rate of .001%/d, and was linearly related to CP ($R^2=.86$).

The Level I model indicated that ME intake was first limiting for gain, as ME-allowed ADG was lower than MP-allowed ADG (Table 2). The high positive DIP balance was due to the high concentration of CP and DIP in relation to the energy content of wheat pasture.

Implications

These results suggest that while there may be an initial, very transient adaptation period where growth of cattle is reduced, metabolizable energy intake is most often first-limiting with respect to growth performance of stocker cattle on wheat pasture. Supplementation with readily available carbohydrate would provide additional energy, and may result in more efficient capture of excess ruminal degradable nitrogen.

Literature Cited

NRC. 1996. Nutrient Requirements of Beef Cattle (7th Ed.). National Academy Press, Washington, DC.

Table 1. Nutritive value of wheat pasture and weight gain of steers.

Day[a]	Date	DM[b]	OM %DM	IVOMD %OM	CP %DM	DIP %CP	S DM	ADG[c]	WT[d]	Residuals[e]
-7	11/12/98	17.5	88.0	90.9	30.6	77.2	.454	--	--	--
0	11/20/98	--	--	--	--	--	--	--	519	11.7
20	12/9/98	19.2	91.9	90.6	29.5	78.0	.387	.81	535	-24.8
29	12/18/98	18.8	88.8	87.7	26.9	76.8	.318	4.97	580	-3.4
46	1/4/99	37.5	89.4	84.7	27.4	75.3	.320	3.33	636	8.5
62	1/20/99	40.7	89.0	87.1	24.1	76.6	.276	2.66	679	9.1
83	2/10/99	26.7	87.5	88.6	27.2	75.7	.323	2.12	723	-1.5
97	2/24/99	28.1	89.2	89.2	22.9	79.2	.283	3.14	767	5.8
125	3/24/99	24.8	90.1	90.7	24.9	77.5	.290	2.40	834	-.6
139	4/7/99	22.3	90.7	88.8	23.6	75.0	.269	2.08	863	-8.3
153	4/21/99	25.6	91.7	82.4	16.9	79.3	.208	3.75	916	8.0
174	5/13/99	26.2	90.9	79.7	13.6	75.8	.176	2.04	959	-4.6
	n=	2	2	2	2	2	2	2	2	
	SD	7.17	1.67	3.60	5.10	2.36	.0763	1.14	149	
	SE	.57	.87	.57	.96	1.83	.016	.25	5.5	

[a]Day of grazing period.

[b]Dry matter percentage of standing forage.

[c]Non-cumulative ADG of steers for period ending on the day for which the value is reported.

[d]Cumulative weight of steers.

[e]Differences between observed and predicted weights of steers.

Table 2. Predicted intake and nutrient balances of steers grazing wheat pasture.

Day of grazing	Wt, lb	DMI[a]	ME ADG[b]	MP ADG[c]	Degradable intake protein, g Supply	Req.	Balance	Metabolizable protein, g Supply	Req.	Balance

0	518	12.4	2.84	3.44	1329	585	744	688	609	80
20	535	12.5	3.09	3.40	1305	614	691	688	645	42
29	580	13.6	2.70	3.43	1275	625	650	708	610	98
46	636	14.7	2.54	3.82	1376	656	720	781	608	173
62	679	15.4	2.72	3.61	1290	704	586	766	646	120
83	723	16.1	2.71	4.18	1504	736	768	857	658	199
97	767	16.7	2.86	3.59	1374	784	590	791	692	98
125	834	17.5	2.97	4.22	1532	843	689	896	727	168
139	863	18.1	2.91	4.55	1454	859	594	938	719	218
153	916	19.4	2.57	3.50	1180	865	315	800	681	119
174	959	20.3	2.32	3.15	998	867	132	758	653	105
AVG	728	16.1	2.75	3.72	1329	740	589	788	659	129
SD	153	2.6	.22	.43	151	110	195	82	42	54

[a]Predicted dry matter intake, lb/d.

[b]Predicted average daily gain allowed by metabolizable energy intake, lb.

[c]Predicted average daily gain allowed by metabolizable protein intake. lb.

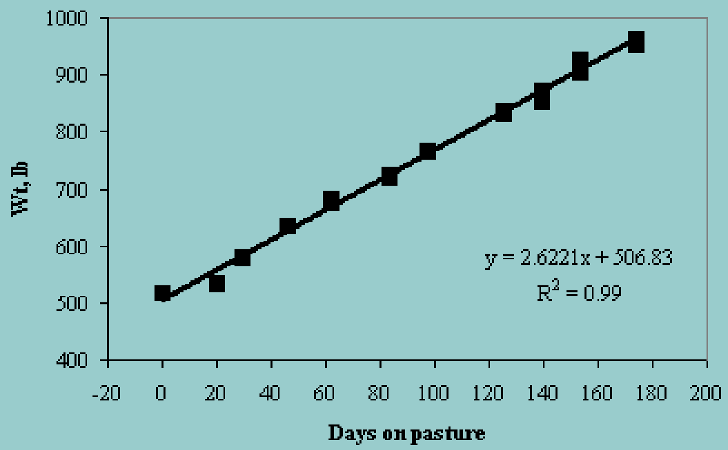

Figure 1. Live weight of steers *versus* days on wheat pasture.

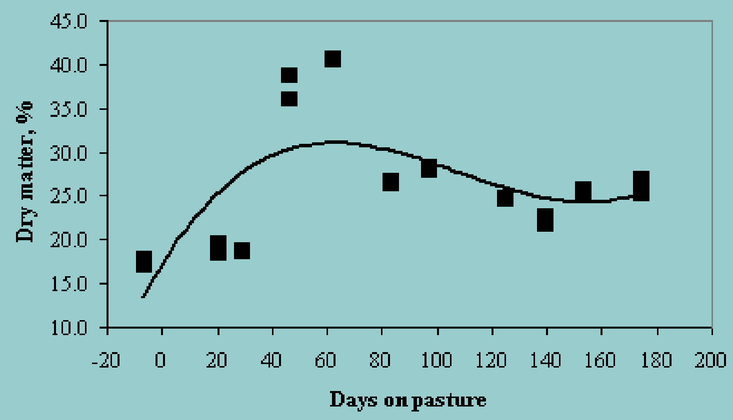

Figure 2. Dry matter content of wheat pasture across the grazing period.

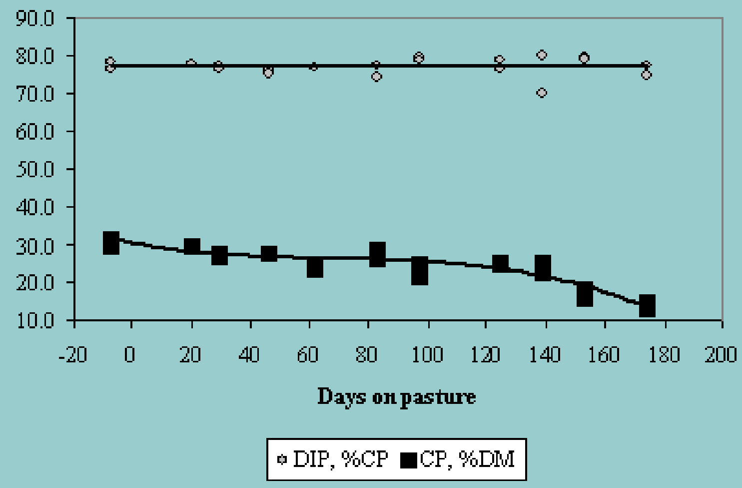

Figure 3. *In vitro* organic matter digestibility of wheat pasture across the grazing period.

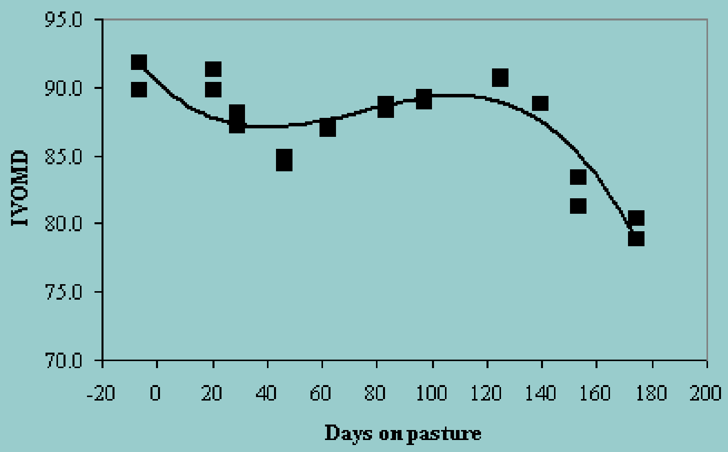

Figure 4. Degradable intake protein and crude protein of wheat pasture across the grazing period.

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