

# HIGH-STARCH AND HIGH-FIBER ENERGY SUPPLEMENTS IMPROVE PERFORMANCE OF STOCKER CATTLE GRAZING WHEAT PASTURE<sup>1</sup>

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## Story in Brief

Studies were conducted during three years to compare high-starch versus high-fiber energy supplements for fall-weaned steer calves grazing wheat pasture. Steers were hand-fed, 6 days/week, either 1) no supplement other than access to a commercial mineral, 2) a high-starch corn-based energy supplement, or 3) a high-fiber, soybean hull and wheat middling-based energy supplement at a target level of .75% of mean body weight. Both supplements were fed as a 3/16-inch pellet and contained about 40 mg of monensin/lb. Stocking rate was increased by about one-third where supplements were fed. Daily gains were increased .33 lb by supplementation but were not influenced by type of supplement. Mean supplement consumption was .66% of body weight. Supplement conversions [lb (as-fed)/lb increased gain/acre] were 5.04 and 5.02 for high-starch and high-fiber supplemented cattle, respectively. This supplementation strategy increased daily gains when stocking rate was increased by about one-third.

(Key Words: Energy Supplementation, Growing Cattle, Wheat Pasture.)

## Introduction

Weight gains by stocker cattle grazing wheat pasture are potentially excellent because of its high quality. However, gains are frequently decreased

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because of inadequate amounts of available forage. Feeding moderate amounts of an energy supplement to growing cattle on wheat pasture is a way of increasing stability of the enterprise, improving predictability of cattle performance and increasing stocking density. Because of the seasonality of stocker/feeder cattle prices and effects of length of ownership and total weight gains on profitability of stocker cattle programs, increasing stocking density during the fall/winter grazing period is particularly important during years in which the government farm program favors graze-out of wheat. During the 1989/90, 1990/91 and 1991/92 wheat pasture years, we conducted studies to compare moderate amounts of high-starch and high-fiber energy supplements for stocker cattle grazing wheat pasture. Details of the studies of the first two years were reported previously by Horn et al. (1991 and 1992). A summary of the 3-year study is reported herein.

## Materials and Methods

The fall-weaned steer calves that were used each year were British and exotic crossbred (year 1) and Brangus x Hereford or Brangus x Hereford /Angus crossbred calves (years 2 and 3). Mean initial weight on wheat pasture was 464, 473 and 537 lb in years 1 to 3, respectively. Each year the steers were processed on arrival and were fed bermudagrass hay (free-choice) and 2 lb/head/day of a soybean meal-based, high-protein supplement for about 28 days prior to being placed on wheat pasture. The steers were treated for internal and external parasites and vaccinated (IBR, PI<sub>3</sub>, BVD, BRSV and a 5-way Clostridial vaccine) during processing. Steers were implanted with Synovex-S immediately prior to placement on wheat pasture. The cattle were weighed after periods of 14 to 16 hours without feed and water.

The cattle grazed clean-tilled wheat pastures (variety 2157) each year at the Marshall Wheat Pasture Research Unit. Weather prior to and(or) during the fall/winter grazing period was very different each year. Twelve, sixteen and seven, 18- to 24-acre pastures were available for grazing during each of the years. The number of steers per pasture varied from 11 to 13 to achieve stocking densities of 1.38 to 2.00 acres/head. During years 1 and 3, stocking density was increased from 2 to 1.5 acres/head where supplements were feed. During the second year, cattle of each treatment grazed wheat pasture at stocking densities of 2, 1.64 and 1.38 acres/head. Steers received no supplement other than free choice access to a commercial mineral mixture or were hand-fed 6 days/week a corn-based energy supplement (high-starch, 67% starch DM basis) or a high-fiber energy supplement (18% starch) that contained about 47% soybean hulls and 46% wheat middlings (as-fed basis). Both energy supplements were pelleted (3/16-inch), contained monensin (40 mg/lb) and were fed in amounts attempting to achieve a target level of

consumption of .75% of mean body weight. Detailed composition of the supplements was reported by Horn et al. (1992). Steers were removed from wheat pasture at jointing time each year. Total grazing days and number of days that supplement was fed were: 115 and 96 (1989/90), 107 and 100 (1990/91) and 89 and 69 (1991/92).

Residual forage in each pasture was estimated 2 to 3 times each year by hand clipping forage to ground level inside 0.5 square meter quadrats along paced transects. Residual forage ranged from about 830 to 1925 lb/acre. Stocking rates ranged from about 58 to 191 steer days/ton of forage DM.

Statistical methods involved regression analysis similar to that described by Bransby et al. (1988). Experimental units were pastures and sampling units were steers. The data were adjusted for year effects so that prediction equations for average daily gain could be developed, from a pooled analysis, without having to include year in the models. Orthogonal contrasts included supplementation vs no supplementation and type of supplement (i.e., high-starch vs high-fiber). Variables of interest were average daily gain (lb/head), beef gain (lb/acre) and supplement conversion (lb supplement (as-fed basis)/lb increased gain/acre).

## Results and Discussion

Effects of the energy supplementation strategy on daily gains during the three year study are summarized in Table 1. Supplementation increased gains in each of the three years, with a mean improvement in gains of .33 lb. The high-fiber supplemented cattle had higher ( $P < .03$ ) daily gains in year 1 and year 3 ( $P < .05$ ) than high-starch supplemented cattle. However, type of supplement did not influence ( $P > .80$ ) daily gains of steers in year 2. Consumption of the high-starch supplement in year 3 was only .37% of body weight; therefore, these data (2 pastures) were deleted from the pooled analysis (Figure 1). Mean supplement consumption across the remaining pastures was .66% of mean body weight. Derived prediction equations for average daily gain on wheat are illustrated in Figure 1. Prediction equations ( $R^2 = .65$ ,  $S_{y.x} = .13$ ) for average daily gain were as follows:

**Controls (no supplement):**  $ADG = 2.3515 - .00324$  (steer days/ton of forage)

**Supplemented cattle:**  $ADG = 2.6805 - .00324$  (steer days/ton of forage)

Conversion of supplement, calculated as lb of supplement per lb of increased gain per acre, is shown in Table 2. Supplement conversions from the pooled analysis were 5.04 for high-starch and 5.02 for high-fiber supplemented steers and did not differ ( $P > .85$ ). These conversions are substantially less than

**Table 1. Effect of energy supplement and type of energy supplement on daily gains of steers grazing wheat pasture.**

Year	Treatment	Supplement consumption, % of body wt	ADG, lb $\pm$ SE <sup>a</sup>	Contrast			
				Supplementation vs control		High-fiber vs high-starch	
				Response, lb	OSL <sup>b</sup>	Response, lb	OSL <sup>b</sup>
1989-90	Control <sup>c</sup>	----	2.14 $\pm$ .04	.14	P<.02	.15	P<.03
	High-starch	.71	2.20 $\pm$ .04				
	High-fiber	.72	2.35 $\pm$ .04				
1990-91	Control	----	1.96 $\pm$ .06	.36	P<.001	-.02	P>.80
	High-starch	.63	2.33 $\pm$ .06				
	High-fiber	.67	2.31 $\pm$ .07				
1991-92	Control	----	2.19 $\pm$ .01	.32	P<.002	.11	P<.05
	High-starch	.37	2.45 $\pm$ .08				
	High-fiber	.57	2.56 $\pm$ .07				
	Mean:	.66 <sup>d</sup>		.27		.08	

<sup>a</sup> Standard error of the mean.

<sup>b</sup> Observed significance level.

<sup>c</sup> Control steers had free-choice access to a commercial mineral mix that contained 20% salt, 16% calcium, 4% phosphorus, 5.5% magnesium and 150,000 I.U. vitamin A per pound.

<sup>d</sup> Does not include high-starch treatment of 1991-92.

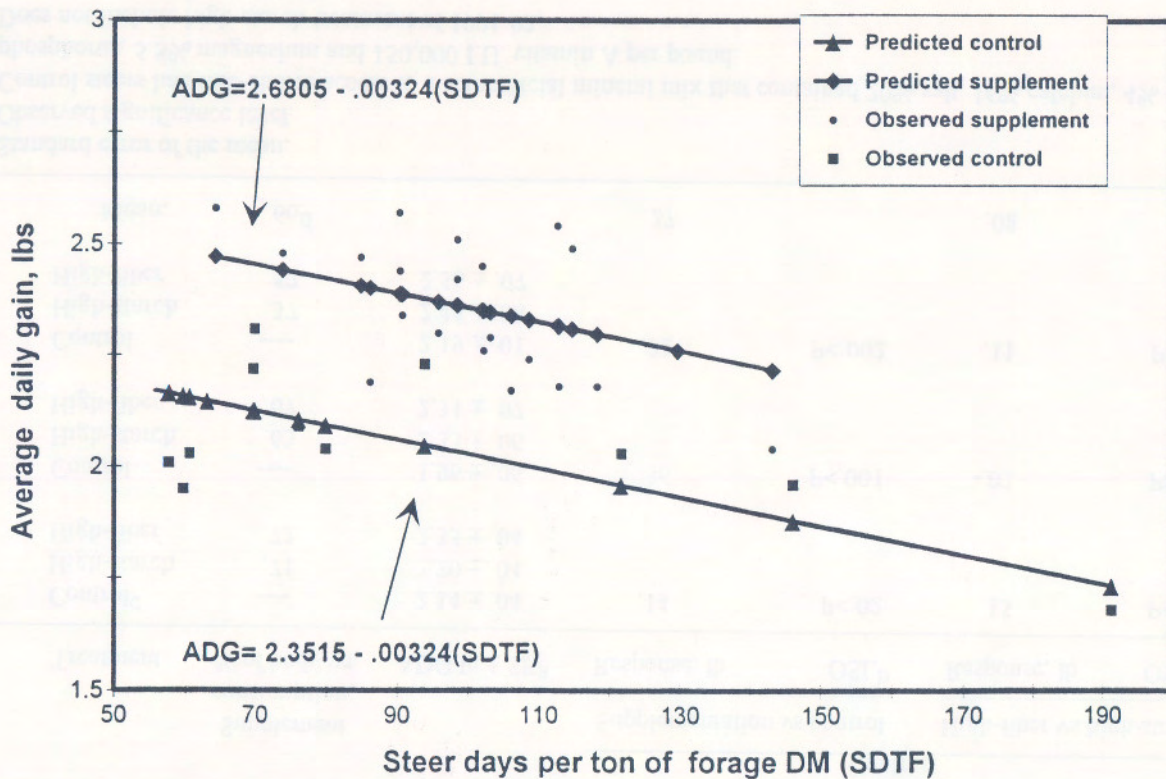


Figure 1. Influence of energy supplementation and stocking rate on average daily gain of steers grazing wheat pasture.

**Table 2. Conversion<sup>a</sup> of high-starch and high-fiber energy supplements by steers grazing wheat pasture.**

Year	Treatment	Supplement conversion $\pm$ SE <sup>b</sup>	Contrast	
			Response	OSL <sup>c</sup>
1989-90	High-starch	5.95 $\pm$ .37	-1.07	P<.09
	High-fiber	4.88 $\pm$ .37		
1990-91	High-starch	5.32 $\pm$ .91	.64	P>.65
	High-fiber	5.96 $\pm$ .91		
1991-92	High-starch	2.40 $\pm$ .21	.91	P>.05
	High-fiber	3.31 $\pm$ .17		

<sup>a</sup> Pounds of supplement (as-fed) per lb of increased gain per acre.

<sup>b</sup> Standard error of the mean.

<sup>c</sup> Observed significance level.

conversions of 9 to 10 that have traditionally been used in evaluating the economics of energy supplementation programs for wheat pasture stocker cattle.

It was apparent during this study that the cattle consumed the high-fiber supplement more readily than the high-starch supplement. Generally, the cattle consumed the high-fiber supplement in a matter of 10-30 minutes in the morning, whereas, the corn-based supplement was usually consumed over at least 2 feeding periods during the day (morning and mid-afternoon). From a feed and bunk management standpoint, this difference is important on days of inclement weather (i.e., rain, snow, etc.) and in situations of bird predation. Contamination of feed bunks by bird excreta was substantial for the high-starch supplement. In addition, the potential for lactic acid acidosis is much less for the high-fiber supplement provided the wheat middlings do not contain large amounts of fine starch.

### Literature Cited

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Year	Supplement	Gain (lb)	Feed (lb)	Cost (¢)
1989-90	High Starch	100 ± 10	1000 ± 50	100 ± 5
	High Fiber	95 ± 10	1050 ± 50	105 ± 5
1990-91	High Starch	110 ± 10	1100 ± 50	110 ± 5
	High Fiber	105 ± 10	1150 ± 50	115 ± 5
1991-92	High Starch	120 ± 10	1200 ± 50	120 ± 5
	High Fiber	115 ± 10	1250 ± 50	125 ± 5

† For each supplement, the gain per lb of gain was calculated as the ratio of gain to feed.

‡ The cost of the supplement was calculated as the ratio of supplement cost to gain.

The results of this study indicate that the high-starch supplement was more effective than the high-fiber supplement in increasing the gain of stocker cattle on wheat pasture. This was true for all years and for both sexes. The high-starch supplement also resulted in a lower feed cost per lb of gain compared to the high-fiber supplement. These results are consistent with the findings of other studies that have shown that high-starch supplements are more effective than high-fiber supplements in increasing the gain of stocker cattle on wheat pasture. The reasons for these differences are not clear, but they may be related to the higher energy density of high-starch supplements compared to high-fiber supplements. The high-starch supplement contained a higher concentration of starch, which is a more readily digestible carbohydrate than fiber. This may have resulted in a higher rate of feed intake and a higher rate of gain for the high-starch supplement group. The high-fiber supplement, on the other hand, contained a higher concentration of fiber, which is less digestible and may have resulted in a lower rate of feed intake and a lower rate of gain. These results suggest that high-starch supplements are a more effective and economical way to supplement stocker cattle on wheat pasture.

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