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Abstract

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Keywords

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New Developments in Feeding Wheat to Cattle

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Summary

At least for the varieties we studied, hard red winter wheat was superior to soft red winter wheat in beef cattle rations. That contradicts the perception that feed wheats should be soft. The net energy values of Larned hard wheat and Hart soft wheat were 102% and 99% that of corn, respectively. Adding Rumensin® to wheat rations improved performance, probably by reducing acidosis instead of increasing ration net energy value. There was a positive associative effect when wheat and milo were fed together but not when wheat and corn or corn and milo were combined. Steer performance was improved by adding 3% fat to rations; that improvement was proportional to the amount of wheat in the rations and was probably due to the fat's added energy. Steers that were fed fat graded better and gained more uniformly. When 100% wheat was fed, overall performance was satisfactory only when fat was included.

Introduction

Depressed export markets have emphasized the need for alternate ways to use surplus wheat. Because wheat is the state's leading grain crop, and about 15 % of the national wheat crop was fed last year, it is important to improve the management of wheat in cattle rations. This project is a joint effort of scientists of the Department of Animal Sciences and Industry and the Fort Hays and Garden City Branch Experiment Stations. The experiments reported here were conducted at Hays.

Experimental Procedures

Four feeding trials were conducted with mostly Angus X Hereford yearling steers that initially weighed about 800 pounds. Cattle were fed in groups of 17 to 25 head. Since implanting experiments were superimposed on the feeding trials, most cattle were implanted. All cattle were followed through a packing plant and carcass data were obtained. Final live weights were adjusted to a constant 62 dressing percentage.

Both milo and wheat were finely rolled. Forage sorghum silage and prairie hay was used as roughage. Milo and soft wheat rations were supplemented with soybean meal and urea but no supplemental protein was needed when hard wheat was fed. Rumensin® and Tylan® were fed unless otherwise indicated. A premix was used containing vitamin A, niacin, zinc methionine, and trace minerals. Rations also contained ammonium sulfate and ground limestone.

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Experiment 1: One objective was to identify properties that might differentiate a good feed wheat from a good milling wheat, so we compared a typical Kansas hard red winter wheat (Larned) with a soft red winter wheat (Hart). Soft wheats have less protein than hard wheats, but we added enough supplemental protein to the soft wheat rations to eliminate this factor in the comparisons.

Three other treatments included the addition of 3% fat (a mixture of beef tallow and soybean oil) to the milo, hard wheat, and soft wheat rations.

Experiment 2: We have recommended limiting wheat and mixing it with another grain to avoid depressed performance and possible lower carcass grade of high wheat rations. This experiment was conducted to determine if there are associative effects from combining 2 grains. An associative effect means that a combination of certain grains performs differently than would be expected from the individual characteristics of the grains. Ration combinations included milo-wheat, corn-wheat, and milo-corn, as well as each grain fed by itself.

Experiment 3: This study measured the effect of Rumensin® on soft and hard wheat diets. We wanted to know if different wheats respond differently to Rumensin®, thus affecting our interpretations of the experiments. Tylan® was fed in all rations.

Experiment 4: This test included milo, milo-wheat, and wheat rations, with or without added fat. It let us examine more closely the effect of level of wheat on the response to added fat, as well as confirm the complementary effect of combining wheat with milo.

Results and Discussion

Experiment 1: Larned hard wheat performed slightly better than Hart soft wheat (Table 17.1). Feed intake was only 3% less for the hard wheat than the soft wheat, so wheat gluten does not seem to explain the depressed intake when high levels of wheat are fed. NEg values averaged 3.3% higher ($P<.01$) for hard than for soft wheat. The average value for the soft wheat (1.47 Mcal/kg) was slightly less than that for corn (1.48); the value for the hard wheat (1.52) was 2.5% more. It was not necessary to add protein to rations that contained hard wheat. Since kernel softness, per se, had no advantage, at least in the varieties we studied, those wheats with superior milling quality may also be best for feeding. That may be fortunate for Kansas agriculture. The logistics of keeping hard and soft wheat separate in the marketing system seem nearly impossible. Producers should also benefit from not being forced to decide at planting time whether to grow a feed or a milling wheat.

When wheat was the only grain fed, feed intake was 13% less and gain was 16% less than when milo was fed. But when fat was added to the wheat rations, performance and carcass grade were almost equal to the milo fed cattle (Table 17.1). There was little response when fat was added to the milo rations. Adding fat did not affect grain net energy estimates, so responses to fat probably resulted from increased energy consumption.

Experiment 2: If there is an associative effect from combining two grains, performance should exceed the average of the two grains fed separately. As shown at the bottom of Table 17.2, that occurred only when wheat and milo were combined, and supports the idea that, if grains are to be combined in cattle finishing rations, one grain should be slowly digested (milo) and the other rapidly digested (wheat). There were no associative effects when the combinations included corn.

Performance of cattle fed milo, corn, or wheat alone were typical of those seen in previous experiments. Gain and carcass grade of cattle fed milo were similar to those fed corn but feed efficiency was 5% poorer with milo. Steers fed the all wheat ration consumed much less feed which depressed daily gain and final weight, thereby reducing dressing percent and carcass grade.

Experiment 3: Adding Rumensin® to either finely rolled soft or hard wheat rations improved feed efficiency only 3% and did not affect net energy values for wheat (Table 17.3). Rumen acidosis and liver abscesses were less prevalent, and gains were more uniform when Rumensin® was fed. Consequently, wheat rations benefited from Rumensin®, but probably from reducing of acidosis rather than modification of the volatile fatty acid profile. Even though the tests with soft and hard wheat were concurrent, we do not feel this experiment was a valid comparison of soft and hard wheat. However, note that acidosis was more frequent when soft wheat was fed.

Experiment 4: This study confirmed many of the observations made in the three previous experiments. Adding 3% fat increased gain 2.5% in the milo ration, 8.9% in milo-wheat ration, and 11.7% in the wheat ration (Table 17.4). That response was directly related to the proportion of wheat in the ration. Likewise, there was evidence of an associative effect from combining milo and wheat because gains and feed efficiency were better than the average results from feeding milo and wheat individually.

The net energy values of milo and wheat computed from this trial are listed at the bottom of Table 17.4. The best way to determine if wheat should be fed is to use least cost computer ration formulation, but that requires accurate nutritional coefficients such as those generated by this research. Least cost formulation also takes into account the value of the extra protein in wheat.

There seemed to be several advantages to the half milo - half wheat ration. This combination eliminated the need for supplemental protein and exploited the possible associative effects of wheat and milo. There appeared to be more response from adding fat to this ration than when milo was fed alone. Finally, daily gain, dressing percent, and carcass grade were similar to rations containing no wheat.

In conclusion, this research has contributed new knowledge on how to manage wheat in cattle rations. Because of the economic multiplier effects of livestock and meat packing, feeding Kansas wheat to Kansas cattle may have a greater impact on the state's economy than exporting wheat.

Table 17.1. Soft or Hard Wheat, with or without Fat, for Finishing Steers.
Rep 1: May 18 to September 16, 1984, 122 days
Rep 2: June 18 to October 14, 1984, 119 days.

Item	Milo		Soft Wheat (Hart)		Hard Wheat (Larned)	
	No Fat	Fat	No Fat	Fat	No Fat	Fat
No. of Head	38	40	41	41	41	40
Initial Weight, lb	786.4	781.6	783.4	784.0	781.4	785.0
Final Weight, lb	1191.2	1195.6	1123.4	1179.6	1130.8	1176.0
Gain, lb	404.8	414.0	340.0	395.6	349.4	391.0
Daily Gain, lb	3.36	3.44	2.82	3.28	2.90	3.24
Avg. Daily Ration, lb (as fed):						
Sorghum Silage	12.44	12.43	11.99	12.10	12.00	11.96
Rolled Milo	20.67	20.36	—	—	—	—
Rolled Wheat	—	—	17.42	17.65	16.98	17.03
Fat	—	.54	—	.54	—	.54
Soybean Meal	.32	.32	.52	.52	.22	.22
Urea	.05	.05	.08	.08	.03	.03
Rumensin-Tylan® Premix	.55	.55	.55	.55	.55	.55
Dry Matter Total	22.62	22.87	19.88	20.67	19.48	20.02
Lb DM/100 lb Gain	672.3	665.8	709.2	620.9	678.2	621.1
Percent Response	—	+1.0%	-5.2%	+8.3%	-0.9%	+8.2%
Carcass Data:						
Dressing Percent	63.07	63.68	61.90	63.45	61.38	62.43
Marbling Score	4.89	4.97	4.69	4.82	4.48	4.80
Percent Choice	76%	78%	66%	75%	41%	73%
Backfat, in	.51	.58	.44	.50	.42	.50
NE gain of Grain, mcal/kg	1.40	1.37	1.47	1.47	1.51	1.52

Table 17.2. Milo, Corn, and Wheat - Compared Alone or in Combination, July 16 to November 11, 1984, 119 days

Item	Milo	Corn	Wheat	Milo Corn	Milo Wheat	Corn Wheat
No. of Steers	28	28	28	28	28	28
Initial Weight, lb	691 .1	698 .3	686 .0	700 .9	692 .3	699 .3
Final Weight, lb	1116.1	1130.3	1033.4	1119.3	1094.1	1088.2
Total Gain, lb	425.0	432.0	347.4	418.4	401.8	388.9
Daily Gain, lb	3.57	3.63	2.92	3.52	3.38	3.27
Avg. Daily Ration, lb (as fed):						
Sorghum Silage	10.81	10.77	10.61	10.83	10.63	10.63
Rolled Milo	21.09	—	—	10.32	9.43	—
Rolled Corn	—	19.78	—	10.32	—	9.20
Rolled Wheat	—	—	16.44	—	9.43	9.20
Prairie Hay	.20	.20	.20	.20	.20	.21
Soybean Meal	.40	.40	.17	.40	.29	.29
Urea	.11	.11	.05	.11	.08	.08
Premix	.55	.55	.55	.55	.55	.55
Dry Matter Total	22.16	21.32	18.63	21.93	20.50	20.24
Lb DM/100 lb Gain	621.3	589.1	640.0	618.7	616.0	621.6
Percent Improvement Compared to Milo	—	+5.5%	-2.9%	+0.4%	+0.9%	+0.0%
Carcass Data:						
Dressing Percent	64.23	63.55	61.48	62.90	62.18	62.08
Marbling Score	5.03	5.21	4.40	5.26	4.73	4.90
Percent Choice	75%	82%	43%	86%	57%	74%
Backfat, in	.51	.53	.41	.44	.44	.43
Observed Daily Gain				3.52	3.38	3.27
Expected Gain (average of grains fed individually)				3.60	3.24	3.27
Percent Deviation				-2.2%	+4.3%	0.0%

Table 17.3. Soft or Hard Wheat - with or without Rumensin®,[1] July to October 28, 1984, 111 days.

Item	Soft Wheat (Hart)		Hard Wheat (Larned)	
	Control	Rumensin®	Control	Rumensin®
No. of Steers	17	17	18	17
Initial Weight, lb	825.0	819.0	822.3	817.3
Final Weight, lb	1078.8	1066.3	1083.8	1095.0
Total Gain, lb	253.8	247.3	261.5	277.7
Daily Gain, lb	2.29	2.23	2.36	2.50
Avg. Daily Ration, lb (as-fed):				
Sorghum Silage	10.54	11.43	11.33	11.49
Rolled Wheat	17.57	16.66	16.87	17.11
Prairie Hay	.32	.32	.30	.32
Soybean Meal	.40	.40	—	—
Urea	.17	.17	.17	.17
Premix	.44	.55	.44	.55
Dry Matter Total	19.88	19.16	19.26	19.62
Lb DM/100 lb Gain	884.8	858.2	816.5	788.8
Percent Improvement from Rumensin®	—	+3.1%	—	+3.5%
Carcass Data:				
Dressing Percent	61.12	60.66	60.59	60.25
Marbling Score	5.25	4.95	5.14	4.94
Percent Choice	100%	82%	94%	82%
Backfat, in	.47	.41	.46	.44
No. of Foundered Cattle	4	0	1	0
No. of Liver Abscesses	0	1	4	0
Net Energy of Wheat:				
NE gain, mcal/kg	1.44	1.43	1.50	1.50
NE maintenance, mcal/kg	2.19	2.19	2.32	2.32

[1] The four treatments were concurrent, however pens were assigned to measure Rumensin® response and there may have been effects that invalidate the soft versus hard wheat comparison.

Table 17.4. Adding Fat to Milo, Milo-wheat, and Wheat Rations, October 1, 1984 to January 12, 1985, 105 days.

Item	Milo		Milo-wheat		Wheat	
	No Fat	Fat	No Fat	Fat	No Fat	Fat
No. of Head	25	25	25	24	25	25
Initial Weight, lb	777.6	782.4	780.6	776.9	782.9	779.1
Final Weight, lb	1204.7	1220.7	1169.7	1201.6	1115.7	1150.7
Gain, lb	427.1	438.3	389.1	424.7	332.8	371.6
Daily Gain, lb	4.07	4.17	3.71	4.04	3.17	3.54
Avg. Daily Ration, lb (as fed):						
Sorghum Silage	11.50	11.47	11.26	11.35	10.97	11.20
Prairie Hay	.45	.52	.37	.35	.30	.30
Rolled Milo	24.57	24.18	10.91	11.02	—	—
Rolled Wheat	—	—	10.91	11.02	18.94	19.11
Fat	—	.58	—	.58	—	.58
Soybean Meal	.60	.60	.05	.05	.03	.03
Urea	.05	.05	.01	.01	—	—
Rumensin-Tylan® Premix	.55	.55	.55	.55	.55	.55
Dry Matter Total	25.14	25.45	22.67	23.45	20.45	21.24
Lb DM/100 lb Gain	618.0	609.6	611.7	579.6	645.0	600.1
Percent of Milo Control	—	+1.4%	+1.0%	+6.6%	-4.2%	+3.0%
Carcass Data:						
Dressing Percent	62.05	61.81	60.88	61.62	60.49	61.09
Marbling Score	4.82	5.21	5.05	4.99	4.54	4.88
Percent Choice	80%	84%	88%	83%	52%	80%
Backfat, in	.46	.52	.41	.44	.37	.41
Net energy of Grain:	milo	milo	wheat	wheat	wheat	wheat
NE gain, mcal/kg	1.40	1.39	1.53	1.50	1.48	1.49
NE maintenance, mcal/kg	2.12	2.10	2.40	2.33	2.29	2.31