

Adapting Roughages Varying in Quality and Curing Processes to the Nutrition of Beef Cattle: Urea vs Soybean Meal in Wintering and Finishing Rations for Beef Steers. (Project 370)

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It is generally recognized that a readily available source of energy (preferably grain) must be in the ration of ruminants for efficient synthesis of protein from nonprotein nitrogen. Therefore, nonprotein nitrogen has been used primarily in finishing (high grain) rations. Although urea is used rather extensively, there is practically no information on the minimum amount of readily available energy (grain) needed for efficient utilization. This test was designed to compare soybean meal (natural protein) and urea (nonprotein nitrogen) on an equivalent nitrogen basis in wintering and finishing rations of beef steer calves. During the wintering phase, they were fed sorghum silage (made from sorghum that produced 85 bu. grain per acre), 2 lbs. of average quality alfalfa hay, supplement and 0, 3 or 6 lbs. of added grain. In the finishing phase, 2 pounds prairie hay per head daily replaced the sorghum silage. The alfalfa hay was continued and all animals received a full feed of sorghum grain.

#### Results and Observations

Results are shown in Table 1. In the wintering phase, the calves receiving the urea supplement without added grain (lot 14) gained significantly less ( $p < .05$ ) than any other lot. When 3 or 6 pounds of grain was added per head daily to urea supplemented calves (lots 16 and 17), gains were significantly greater than by calves on soybean meal without grain (lot 13) but not greater than by calves getting grain and soybean meal (lot 15).

During the finishing phase, steers receiving soybean meal (lots 13 and 15) continued to gain significantly faster ( $p < .05$ ) than those receiving urea. They had significantly heavier carcasses and fat covering over the 12th rib. The additional fat resulted in significantly lower carcass yield grades. Carcass grades were significantly lower in lot 14, which received the urea supplement without grain during the wintering phase. Combined wintering and finishing gains were significantly higher for steers receiving the soybean meal (lots 13 and 15). There were no significant differences in ribeye areas. Thus, it is indicated that animals fed urea received enough protein for normal muscle development even though they did not gain so rapidly as those receiving soybean meal.

The results show that urea can be used as the only source of added protein nitrogen, but that gains may be lower than with natural protein. The animals receiving urea without added grain (lot 14) obtained approximately 3 pounds of grain per head daily in the silage. Since they made satisfactory gains, it is indicated that urea is partially utilized with as little as 3 pounds of grain per head daily. However, adding grain greatly improved gains (approximately 0.5 lb. daily).

Table 1  
Urea Compared with Soybean Meal  
Wintering phase with varying levels of grain  
December 17, 1965 to April 3, 1966 - 112 days

Lot	13	14	15	16	17
No. steers per lot	14	14	14	14	14
Av. initial wt., lb.	519	525	520	518	519
Av. final wt., lb.	689	665	703	710	730
Av. daily gain, lb.	1.52	1.24	1.63	1.72	1.88
Av. daily ration, lb.					
Sorghum silage	24.8	24.1	21.1	20.7	17.1
Alfalfa hay	2.0	2.0	2.0	2.0	2.0
Soybean meal	1.0	---	1.0	---	---
Grain-Urea supplement <sup>1</sup>	---	1.0	---	1.0	1.0
Sorghum grain	---	---	3.0	3.0	6.0
Feed per cwt. gain, lb.					
Sorghum silage	1634	1939	1291	1205	910
Alfalfa hay	132	161	123	117	106
Soybean meal	66	--	61	--	--
Grain-Urea supplement	--	80	--	58	53
Sorghum grain	--	--	184	175	319
Feed cost per cwt. gain	\$11.16	\$12.17	\$13.13	\$11.52	\$12.94

Finishing phase, April 8 to October 13, 1966 - 188 days

Av. final wt., lb.	1186.7	1103.9	1177.5	1132.1	1126.4
Av. daily gain, lb.	2.61	2.34	2.53	2.25	2.11
Av. daily ration, lb.					
Sorghum grain	17.8	15.8	17.6	16.9	15.4
Soybean meal	1.0	--	1.0	--	--
Urea supplement <sup>1</sup>	--	1.0	--	1.0	1.0
Alfalfa hay	2.0	2.0	2.0	2.0	2.0
Prairie hay	2.0	2.0	2.0	2.0	2.0
Feed per cwt. gain, lb.					
Sorghum grain	680	678	698	751	729
Soybean meal	38	--	40	--	--
Urea supplement	--	43	--	45	47
Alfalfa hay	77	86	79	89	95
Prairie hay	77	86	79	89	95
Feed cost per cwt., \$	17.04	16.79	17.54	18.37	18.13
Shrinkage to Market, %	2.35	3.01	2.37	2.21	0.95
Av. hot carcass wt., lb.	714.1	655.1	718.6	674.6	686.9
Av. dressing % feedlot wt.	60.18	59.35	61.03	59.58	60.98
Av. dressing % market wt.	61.67	61.19	62.51	60.93	61.56
Av. fat thickness, 12th rib, in.	0.63	0.49	0.65	0.49	0.47
Est. % Kidney Knob	2.46	2.40	2.57	2.54	2.39
Av. size ribeye, sq. in.	12.50	12.54	12.48	12.87	12.83
Av. degree marbling <sup>2</sup>	6.25	6.78	6.29	6.43	6.43
Av. yield grade	3.17	2.86	3.36	2.86	2.57
Carcass grades:					
Top choice	--	--	3	1	--
Av. choice	10	5	7	8	10
Low choice	2	7	4	4	4
Top good	--	2	--	1	--

Summary Wintering and Finishing-300 Days

Av. winter gain, lb.	170	139	183	192	211
Av. finishing gain, lb.	491	439	475	422	396
A.D.G. (300 days), lb.	2.20	1.93	2.19	2.05	2.02
Feed cost/cwt. gain (300 days) \$	15.66	15.72	16.37	16.01	16.40

1. 86% sorghum grain, 14% urea.

2. 4 = slightly abundant, 5 = moderate, 6 = modest, 7 = small 8 = slight, 9 = trace.

Nutritive Value of Forages as Affected by  
Soil and Climatic Differences. (Project 430)

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1. Colby Station
2. Garden City Station
3. Mound Valley Station

Opinions differ as to how livestock perform in various parts of Kansas due to location, soil, climate, rainfall and/or local feed, however, no valid information has been available to confirm the opinions.

This project was designed to measure as accurately as possible the performance of beef steers at Colby, Garden City, Manhattan and Mound Valley Experiment Stations. Similar sheds and lots were constructed at each location. Sorghum silage (FSIA), second cutting alfalfa and sorghum grain produced at each location was used. Through the cooperation of Warner's Hereford Ranch, steer calves of the same breeding have been used throughout the series of tests. Two lots of six animals each have been used at each location. The calves were fed a growing ration of alfalfa hay and silage for 112 days. Then grain was added to the ration and gradually increased until it was supplied free choice. The silage was gradually decreased and removed from the ration. The steers continued to receive five pounds of alfalfa hay per head daily. The finishing period lasted approximately 200 days. All animals were delivered to Wichita where they were sold, and slaughtered and carcass information was obtained.

Results of the first three years' tests have been reported individually in the 51st, 52nd and 53rd Livestock Feeder's Day Reports. The following observations were obtained from an analysis of the three years' results:

1. Satisfactory and economical gains were produced at all four locations every year.
2. Wintering gains were higher at Mound Valley than for the other locations two of the three years. Analysis of variance showed that, in general, greater wintering gains may be expected at Mound Valley than at the other locations.
3. Finishing gains were significantly different two of the three years. Pooled data analysis indicated significantly lower gains at Mound Valley than other locations. Gains at Garden City and Colby were significantly higher than those at Manhattan.
4. In total gains, there were no significant differences on a yearly basis, however, the pooled data indicated significantly higher total gains at Garden City over Manhattan and Mound Valley, but not Colby. In general, total gains are indicated to rank in the order of Garden City, Colby, Manhattan and Mound Valley.
5. Back fat thickness was significantly lower at Mound Valley than at other locations. Other carcass characteristics did not differ significantly among locations.

6. Feedstuff analyses revealed significant differences in protein content of sorghum grain and carotene content of alfalfa hay and sorghum silage, however, these differences did not account for differences in animal performance. Therefore, it is suggested that if any differences in nutrients are involved in animal performance, they were not detected by proximate feedstuff analysis.
7. Correlation of growth data with local rainfall, humidity and temperature suggested that only 5.6% of variability in rate of gain could be explained by the significant correlation of temperature with average daily gain. This showed little indication that differences among locations were due to climatological factors of rainfall, humidity and temperature.
8. The results of the first three tests indicate differences in animal performance at the four locations, but they do not give any explanation for the differences.

#### Fourth Test 1965 - 1966

The fourth test was completed under the same experimental design as the three previous ones. Feedstuff analyses are given in Table 2, and feedlot results of the wintering and finishing phases in Table 3. These results agree with the three previous tests in that Garden City again was first in total performance. Results at the other locations are quite similar.

Results of Shorthorn and Shorthorn-Hereford cross at Colby and Charolais-Hereford cross at Garden City are shown in Table 4. These animals were managed and fed in the same manner as those reported in Table 3.

#### Future Tests

Since we have observed differences in beef steer performance at the four locations, our big problem is to try to determine why. It is hoped that future tests can be designed to explain the differences.

At present, all locations are using feed produced at Garden City. Sorghum silage was dehydrated and pelleted. Thus, steers from the same herd are being fed the same ration ingredients at all locations.

Table 2  
Feedstuff Analyses, 1965-66

	% Moisture	% Dry matter	% Protein	% Ash	% Ether extract	% Crude fiber	% N.F.E.	Carotene mgs. per lb.
Colby:								
Sorghum silage	69.50	30.50	1.43	2.57	0.81	6.97	18.72	1.0
Alfalfa hay	5.59	94.41	12.80	9.04	1.92	34.12	36.53	25.0
Sorghum grain	9.51	90.49	6.68	1.64	2.15	2.05	77.97	----
Garden City:								
Sorghum silage	68.80	31.20	1.23	3.29	0.86	7.39	18.43	1.5
Alfalfa hay	12.13	87.87	14.45	9.92	1.99	29.74	31.77	26.9
Sorghum grain	12.89	87.11	7.13	1.44	3.07	2.33	73.14	----
Manhattan:								
Sorghum silage	62.10	37.90	1.78	2.86	1.02	7.99	24.25	1.8
Alfalfa hay	11.95	88.05	11.61	7.66	1.48	26.37	40.93	21.7
Sorghum grain	14.02	85.98	7.09	1.61	1.93	2.47	72.88	----
Mound Valley:								
Sorghum silage	50.90	49.10	1.60	3.39	0.97	12.30	30.84	2.0
Alfalfa hay	6.79	93.21	16.08	7.43	1.58	32.03	36.09	18.0
Sorghum grain	13.95	86.05	6.03	1.45	2.50	2.48	73.60	----



Table 3  
Feedlot results  
Wintering phase  
November 19, 1965 to March 11, 1966 - 112 days

Location	COLBY		GARDEN CITY		MANHATTAN		MOUND VALLEY	
Lot no.	1	2	1	2	1	2	1	2
No. steers per lot	6	6	6	6	6	6	6	6
Av. initial wt., lb.	458.3	457.5	458.3	459.2	464.2	452.5	466.7	451.7
Av. final wt., lb.	600.7	606.8	610.5	628.2	595.0	580.8	604.8	581.2
Av. daily gain, lb.	1.27	1.33	1.36	1.51	1.17	1.15	1.23	1.16
Av. daily ration, lb:								
Sorghum silage	27.7	27.1	25.2	26.4	19.2	19.2	16.9	16.6
Alfalfa hay	3.9	4.6	5.0	5.0	4.7	4.6	4.9	4.6
Feed per cwt. gain, lb:								
Sorghum silage	2177	2035	1854	1752	1648	1676	1366	1438
Alfalfa hay	308	344	368	331	403	402	396	402
Total dry matter per cwt. gain, lb.	955	946	901	838	980	989	1040	1081
Feed cost per cwt. gain <sup>1</sup> , \$	12.56	12.52	12.02	11.14	11.63	11.73	10.41	10.78
Finishing Phase, March 11 to October 1, 1966 - 204 days								
Av. final wt., lb.	1003.0	1032.0	1089.0	1123.0	1040.0	1018.0	1032.0	996.0
Av. daily gain, lb.	1.98	2.09	2.35	2.43	2.18	2.14	2.09	2.03
Av. daily ration, lb.:								
Alfalfa hay	4.4	4.6	4.8	4.9	4.1	4.0	4.9	4.8
Sorghum grain	15.1	16.8	15.9	16.7	15.4	15.3	16.6	15.7
Feed per cwt. gain:								
Alfalfa hay	225	219	206	204	190	187	234	237
Sorghum grain	783	805	677	687	707	713	794	771
Feed cost per cwt. gain <sup>1</sup> , \$	16.90	17.23	14.77	14.92	15.11	15.17	17.22	16.84
Shrink to market, %	-3.08	-2.49	-3.60	-3.56	+2.24	+4.41	-2.34	-1.79
Av. hot carcass wt., lb.	629.0	649.8	671.2	697.2	644.3	633.7	652.2	608.7
Dressing %, feedlot wt.	62.73	62.95	61.62	62.06	61.96	62.28	60.60	61.10
Dressing %, market wt.	64.73	64.55	63.92	64.35	61.81	62.02	62.05	62.21
Av. fat thickness 12th rib	.93	.93	1.17	1.10	1.00	.93	.98	.92
Estimate % Kidney Knob	3.20	3.50	3.83	3.66	3.33	2.83	3.25	3.17
Av. size rib eye sq. in.	10.33	10.55	10.55	11.55	10.51	10.47	10.84	10.58
Av. degree Marbling <sup>2</sup>	7.83	6.66	6.83	6.83	7.50	7.50	6.67	7.83
Av. yield grade	3.33	3.50	4.33	4.00	3.50	3.66	3.50	3.33
Carcass grades:								
Low prime	-	-	1	-	-	-	-	-
Top choice	-	-	-	-	-	-	1	-
Av. choice	-	2	-	1	-	-	1	-
Low choice	2	3	2	3	4	4	1	3
Top good	-	-	-	-	-	-	1	-
Av. good	1	1	1	2	1	-	-	1
Low good	3	-	2	-	1	2	2	2

1. Sorghum silage \$8 per ton, Alfalfa hay \$25 per ton, sorghum grain \$1.80 per cwt.
2. 4 = Slightly abundant, 5 = moderate, 6 = modest, 7 = small, 8 = slight, 9 = trace.

Table 4  
Feedlot results  
Wintering phase  
November 19, 1965, to March 11, 1966 - 112 days

Location	COLBY		GARDEN CITY	
Lot no.	3	4	3	4
Animals, steers	Shorthorn	Shorthorn X Hereford	Charolais X Hereford	Charolais X Hereford
No. animals per lot	6	6	6	6
Av. initial wt., lb.	478.2	464.3	454.2	458.3
Av. final wt., lb.	614.7	589.8	696.3	689.8
Av. daily gain, lb.	1.22	1.12	2.16	2.07
Av. daily ration, lb:				
Sorghum silage	31.6	29.3	34.7	34.8
Alfalfa hay	4.0	4.3	5.0	5.0
Alfalfa pellets	----	----	----	----
Feed per cwt. gain, lbs.:				
Sorghum silage	2596	2616	1607	1684
Alfalfa hay	328	379	231	---
Alfalfa pellets	---	---	---	242
Total dry matter/cwt. gain, lb.	1102	1156	704	738
Feed cost/cwt. gain <sup>1</sup> , \$	14.48	15.20	9.32	9.77
Finishing phase, March 11 to October 1, 1966 - 204 days				
Av. final wt., lb.	1054.0	1045.0	1265.0	1293.0
Av. daily gain, lb.	2.15	2.23	2.79	2.95
Av. daily ration, lb.:				
Alfalfa hay	4.8	4.8	4.4	5.0
Sorghum grain	18.0	17.0	17.9	20.6
Feed per cwt. gain, lb.:				
Alfalfa hay	221	215	157	169
Sorghum grain	837	762	642	698
Feed cost per cwt. gain <sup>1</sup> , \$	17.83	16.41	13.52	14.67
Shrink to market, %	-3.05	-3.13	-3.78	-3.42
Av. hot carcass wt., lb.	643.8	636.2	776.5	794.0
Dressing %, feedlot wt.	61.09	60.87	61.41	61.43
Dressing %, market wt.	63.02	62.83	63.82	63.60
Av. fat thickness 12th rib, in.	.82	.85	.87	1.01
Estimate % Kidney Knob	3.66	3.42	3.08	3.33
Av. size rib eye, sq. in.	10.15	10.04	12.35	11.65
Av. degree marbling <sup>2</sup>	7.0	6.33	7.00	6.66
Av. yield grade	3.50	3.50	2.83	3.50
Carcass grades:				
Low prime	-	-	-	-
Top choice	-	2	-	-
Av. choice	2	2	1	2
Low choice	2	1	4	3
Top good	-	-	-	-
Av. good	2	-	1	1
Low good		1	-	-

1. Sorghum silage \$8 per ton, Alfalfa hay \$25 per ton, sorghum grain \$1.80 per cwt.

2. 4 = slightly abundant, 5 = moderate, 6 = modest, 7 = small, 8 = slight, 9 = trace.