

The Value of Enzyme Preparations Added to Beef Cattle Rations (Project 5-662).¹

D. Richardson, F. W. Boren, E. F. Smith and B. A. Koch

This was our second test to determine the value of various enzyme preparations added to beef cattle rations. The first involved amylase and a combination of amylase and protease. Amylase apparently depressed the appetite or feed consumption, which resulted in decreased rate of gain. The combination of amylase and protease appeared to increase rate of gain at the beginning of the test; however, gains decreased as the test progressed and ended with the average daily gain being less than for control animals. This test involved a combination of amylase and protease and also this combination plus cellulase in the wintering phase. One lot received protease only in the fattening phase.

Feed is stored nutrients. Enzymes are organic catalysts whose primary function is to break proteins, fats and carbohydrates in the feed down to constituent parts, such as amino acids, fatty acids, and simple sugars for absorption into the body. Amylase acts on carbohydrates other than crude fiber; protease on proteins; and cellulase on cellulose (fiber).

Experimental Procedure

Forty-four Hereford steer calves averaging about 540 pounds each were divided into four lots of 11 animals each. The ration ingredients used and average daily consumption are shown in Table 3. All rations were the same except for added enzyme preparations. Lot 10 received a combination of amylase, protease, and cellulase during alternate 28-day periods during the wintering phase but only protease during the fattening phase.

Results and Discussion

Results of this test are shown in Table 3. All lots receiving enzyme preparations tended to consume less silage, and gains were slightly, but not significantly, less during the wintering phase. The combination of enzymes during alternate 28-day periods was of no value. Lot 8, which received the combination of amylase and protease, gained significantly faster (P .10) during the fattening phase. Although Lot 10, which received protease during the fattening phase, was not the fastest gaining group, marbling and carcass grades of its steers were significantly higher (P .05). Cellulase was apparently of no value in the wintering or fattening phases.

Theoretically, adding enzymes or enzyme preparations should be of value; however, results have not been consistent in various tests conducted here and elsewhere. It is apparent that any practical value from the use of these products must yet be determined by further research on such things as kind and amount of enzyme to use, when and how to administer it, etc.

¹ Appreciation is expressed to Rohm & Haas Company, Philadelphia, Pa., for partial support of this project and enzyme preparations used in the test.

Table 3

Added enzyme preparations in beef cattle rations.

Wintering, December 9, 1960, to March 31, 1961—112 days.

Lot number	7	8	9	10
Added enzyme preparation	None	F-3C Amylase protease	F-4D Amylase protease cellulase	Same as 9, fed on alternate 28- day periods
No. animals per lot	11	11	11	11
Av. initial wt., lbs.	541	540	542	541
Av. final wt., lbs.	752	746	743	736
Av. daily gain per steer, lbs. . .	1.89	1.84	1.80	1.74

(6)

Table 3 (Continued)

Av. daily ration, lbs.:				
Sorghum silage	34.7	34.0	33.9	32.0
Alfalfa hay	1.0	1.0	1.0	1.0
Soybean oil meal	1.0	1.0	1.0	1.0
Sorghum grain	5.0	5.0	5.0	5.0
Enzyme preparation, grams	....	3.4	3.4	3.4
Av. feed per cwt. gain, lbs.:				
Sorghum silage	1780	1848	1887	1841
Alfalfa hay	53	54.3	55.6	57.6
Soybean oil meal	53	54.3	55.6	57.6
Sorghum grain	265	271	278	288
Feed cost per cwt. gain (Does not include cost of enzymes)	\$12.26	12.61	12.92	13.04
Fattening, March 31 to August 18, 1961—140 days.				

Added enzyme preparation	None	F-3C Amylase protease	F-4D Amylase protease cellulase	F-1 Protease
No. of steers per lot	11	11	11	11
Av. initial wt., lbs.	752	746	743	736
Av. final wt., lbs.	1000	1032	1002	989
Av. daily gain per steer, lbs. . .	1.77	2.05 ^a	1.85	1.81
Av. daily ration, lbs.:				
Sorghum silage (1st 40 days)	23.9	22.5	22.5	21.0
Prairie hay (last 100 days)	3.0	3.0	3.0	3.0
Alfalfa hay	1.0	1.0	1.0	1.0
Dehydrated alfalfa pellets	.5	.5	.5	.5
Soybean oil meal	1.0	1.0	1.0	1.0
Sorghum grain	16.8	17.4	16.2	16.5
Enzyme preparation, grams	....	3.4	3.4	3.4
Av. feed per cwt. gain, lbs.:				
Sorghum silage	382	314	347	332
Prairie hay	169	147	163	166
Alfalfa hay	56	49	54	55
Dehydrated alfalfa pellets	28	24	27	28
Soybean oil meal	56	49	54	55
Sorghum grain	946	853	873	909
Feed cost per cwt. gain (not including enzymes and stilbestrol) ¹	\$23.41	20.92	21.79	22.53
% shrink to market	2.4	1.5	1.9	2.8
Dressing %, feedlot wt.	59.8	59.5	58.7	59.5
Dressing %, pay wt.	61.2	60.3	59.9	61.2
Av. hot carcass wt., lbs.	597.8	613.7	588.7	583.6
Av. finish:				
Thickness ²	3.3	3.2	3.7	3.5
Distribution ³	3.5	3.4	3.0	3.2
Av. degree of marbling ⁴	8.1	8.2	7.5	7.1*
Av. degree of firmness ⁵	4.1	4.4	4.5	4.0
Av. size of rib eye (est.) ⁶	4.4	4.6	4.7	4.3
Kidney knob fat (est.) lbs.	17.0	16.8	15.9	16.3

a. Significantly higher (P .10).

¹ Based on silage, \$6 per ton; prairie hay, \$14 per ton; alfalfa hay, \$17 per ton; dehydrated alfalfa pellets, \$60 per ton; soybean oil meal, \$70 per ton; sorghum grain, \$1.90 cwt.

² 2 = thick, 3 = moderate, 4 = modest.

³ 2.2 = uniform, 3 = moderately uniform, 4 = modestly uniform.

⁴ 4 = modest amount, 7 = small amount, 8 = slight amount, 9 = traces.

⁵ 2 = firm, 3 = moderately firm, 4 = modestly firm, 5 = slightly firm.

⁶ 2 = large, 3 = moderately large, 4 = modestly large, 5 = slightly small.

(7)

Table 3 (Continued)

Carcass grades: ^a				
Low choice	1	.....	3	.....
Top good	1	.....	4	.....
Av. good	1	.....	4	.....
Low good	7	.....	2	.....
Top standard	2	.....	1	.....
Av. carcass value (choice 39c, good 37c, standard 36c) ..	\$215.73	222.64	212.96	213.85
Av. live animal value at \$23.10 cwt.	\$225.55	235.00	227.21	222.18

^a Lot 10 significantly higher (P .05).

The Effects of Added Protein to Dry Rolled and Steam Rolled Sorghum Grain Fattening Rations (Project 370, 1961).

F. W. Boren, E. F. Smith, D. Richardson, R. F. Cox and D. Follis

Sorghum grain is used extensively in fattening rations for beef cattle. Its protein content reportedly varies from 6 to 12%. Wide differences in protein content result from variety, nitrogen supply in the soil, geographic location, moisture during a given year, and yield per acre.

Interest is increasing in the varying protein content of sorghum grain. The main question is whether the protein in sorghum grain can satisfy the entire ration protein for fattening cattle.

Objective of this experiment was to determine the value of adding various amounts of soybean oil meal to dry-rolled and steam-rolled sorghum grain fattening rations for yearling heifers.

Experimental Procedure

Fifty head of yearling heifers were allotted to 5 lots at random and assigned to the various treatments. The animals were brought to full feed in about 28 days. During this period all lots received 1 pound of soybean meal per head per day. When the heifers went on full feed grain, the supplemental protein was adjusted according to the feeding level designated (Table 4). During the full-feeding period, grain was fed free choice. The protein supplement, vitamin A, and calcium carbonate were fed daily. In lots receiving no protein, vitamin A and calcium carbonate were added to 10 pounds of grain and fed daily.

Good-quality prairie hay, fed daily, comprised the roughage portion of the ration.

Sorghum grain used in this experiment was obtained locally and averaged 9.8% crude protein.

Observations and Results

There was no significant difference in gains made by the cattle fed dry-rolled and steam-rolled sorghum grain, when supplemented with the same level of soybean oil meal. As in previous years, slightly less steam-rolled sorghum grain was consumed daily (Table 5).

Soybean oil meal supplementation at $\frac{1}{2}$ pound and 1 pound daily increased gain significantly (P < 0.05) more than no supplementation, and gains from 1 pound supplementation were significantly greater than from $\frac{1}{2}$ pound (P < 0.07). Average daily grain consumption increased 1 to 1½ pounds per head daily when soybean oil meal was added at either rate.

The calculated digestible protein intake of lots 13 and 14 barely satisfied minimum protein requirements, while the digestible protein intake of lots 15, 16, and 17 exceeded maximum requirements.

Based on the results of this experiment, a minimum of $\frac{1}{2}$ pound of supplemental protein was necessary to obtain satisfactory and profitable gains. One pound of added protein produced the greatest gain and also

the greatest net return. Table 5 shows that lot 16 produced the highest grading carcasses (P > 0.05).

It appears that the supplemental protein intake should represent from 15 to 30% of the total protein intake.

Table 4

Effects of added protein to dry rolled and steam rolled sorghum grain fattening ration.

April 20, 1961, to September 7, 1961—140 days.

Lot no.	13	14	15	16	17
	Dry rolled sorghum grain	Steam rolled sorghum grain	Dry rolled sorghum grain	Dry rolled sorghum grain	Steam rolled sorghum grain
Treatment					
Soybean oil meal per head daily, lbs.	0	0	0.5	1.0	1.0
No. heifers per lot	10	10	10	10	10
Av. initial wt., lbs.	646	641	648	641	649
Av. final wt., lbs.	848	847	883	904	895
Total gain, lbs.	202	206	235	263	246
Av. daily gain per animal, lbs.	1.44	1.47	1.68	1.88	1.76
Av. daily ration, lbs.: ⁵					
Dry rolled sorghum grain	14.6	.....	15.7	15.5	.....
Steam rolled sorghum grain .....	.....	14.1	.....	.....	15.4
Soybean oil meal .....	.....	.....	0.5	1.0	1.0
Prairie hay	5.0	5.0	5.0	5.0	5.0
Feed required per cwt. gain, lbs.:					
Dry rolled sorghum grain	1011.6	.....	932.3	822.6	.....
Steam rolled sorghum grain .....	.....	955.3	.....	.....	875.4
Soybean oil meal .....	.....	.....	29.8	53.2	56.9
Prairie hay	346.5	339.8	297.9	266.2	284.6
Total	1358.1	1295.1	1260.0	1142.0	1216.9
Feed cost per cwt. gain: ¹					
Dry rolled sorghum grain	\$18.20	.....	16.78	14.80	.....
Steam rolled sorghum grain .....	.....	17.20	.....	.....	15.76
Soybean oil meal .....	.....	.....	1.04	1.86	1.99
Prairie hay	\$ 2.60	2.55	2.23	2.00	2.13
Total	\$20.80	19.75	20.05	18.66	19.88
Av. carcass value per head ²	\$190.30	184.80	207.99	213.53	207.85
Initial cost per head ³	\$148.58	147.43	149.04	147.43	149.27
Cost of feed ⁴	\$ 42.07	40.69	47.12	49.08	48.90
Total cost, animal plus feed	\$190.65	188.12	196.16	196.51	198.17
Profit or loss per head ⁵ ..	\$ -1.35	-3.32	+11.83	+17.02	+9.68

1. Feed cost: Sorghum grain, dry or steam rolled, \$1.80 per cwt.; soybean meal, \$3.50 per cwt.; prairie hay, \$15 per ton.

2. Carcass grade price × carcass wt.; Choice, \$38 per cwt.; good, \$26 per cwt.; standard, \$24 per cwt.

3. Initial live wt. × \$23 per cwt.

4. Feed cost per cwt. gain × total gain.

5. Each lot supplemented with 10,000 I.U. vitamin A and 30 gms. calcium carbonate per head daily; salt fed free choice. None of these included in cost of feed.