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Effectiveness

The Value Of 20-, 30-, and 40-Percent Protein Supplements For Wintering Heifer Calves



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THE STORY IN BRIEF . . .

The tonnage of supplements containing less than 40 percent protein fed in the range beef cattle areas of the country has increased greatly in recent years. Therefore cattlemen need to know the relative value of supplements of different protein content, since protein is usually lacking in most of the roughages consumed by cattle during the winter.

To determine the relative value of supplements containing 20-, 30- and 40-percent protein when fed during the winter with prairie hay or dry native grass, Station animal husbandmen conducted feeding tests over a period of four years. The trials involved a total of 253 grade Hereford weanling heifer calves.

The results of these feeding trials show that:

- Average winter gains of calves were directly related to the protein content of the supplement.
- Heifers that gained the least during the winter gained the most during the subsequent summer.
- Average yearly gains of heifers wintered in traps and fed prairie hay increased with increases in protein content of the supplement fed during the winter.
- There were only small differences in yearly gains of heifers grazing dry native grass during the winter and fed equal amounts of 20- and 40-percent protein supplements.

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Efficient winter feeding of beef cattle consists of providing adequate roughage and properly supplementing this roughage with deficient nutrients. Mature native grass and good quality hay provide an adequate intake of energy for wintering cattle. In most instances, the total protein content of this form of feed is not sufficient for making best utilization of the roughage nor for meeting an animal's need for protein for actual tissue growth and repair. Under these circumstances, supplemental protein should be furnished.

Not too many years ago, only high-protein feeds such as cottonseed and other oil meals were fed as supplements during the winter months. In recent years, however, a greatly increased tonnage of supplements containing less than 40 percent protein has been fed in the range beef cattle areas of the country; therefore, cattlemen need to know the relative value of supplements of different protein content.

This bulletin reports the results of feeding trials at the Lake Carl Blackwell Experimental Range Unit near Stillwater, Oklahoma. These trials were designed to determine the relative value of supplements containing approximately 20-, 30-, and 40-percent protein when fed to weanling heifer calves allowed access to prairie hay or dry native grass pasture during the winter.

PROCEDURE

The experimental animals consisted of 253 grade Hereford weanling heifer calves, a different group of heifers being used in each of

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four years (1949-50, 1950-51, 1951-52, 1952-53). Five lots of calves were used during the first year. There were eight heifers in each of Lots 1, 2, and 3, and 11 heifers in each of Lots 4 and 5. In each of the three subsequent years, there were two additional lots of heifers, Lots 6 and 7. During these three years there were 10 heifers in each of the seven lots. Allotment of calves was according to weight.

During the winter feeding period the heifers of Lots 1, 2, and 3 were fed prairie hay, free-choice, in small traps. They were also fed an average of 1 lb. per head per day of 20-, 30-, and 40-percent protein supplements, respectively. The heifers of Lots 4, 5, 6, and 7 were allowed to graze the dry native grass at the Lake Carl Blackwell range area (see cover picture) during the wintering period. Those of Lot 4 were fed an average of 2 lbs. per head per day of 20-percent protein supplement, and those of Lot 5 were fed 2 lbs. of the 40-percent protein supplement. The heifers of Lots 6 and 7 were fed an average of 1 lb. per head per day of 20- and 40-percent protein supplements, respectively. The prairie hay and supplements were fed every other day. All cattle had access to a mineral mixture composed of two parts salt and one part steamed bonemeal.

The supplements containing different amounts of protein were fed in a pelleted form. The 20-percent protein supplement was composed of 66 percent ground yellow corn and 34 percent cottonseed meal. The 30-percent protein supplement was composed of 62 percent cottonseed meal and 38 percent ground yellow corn, and the 40-percent protein supplement was pelleted cottonseed meal. The calcium and phosphorus contents of the three supplements fed during the last two winter feeding periods were approximately equalized by the inclusion of steamed bonemeal and/or ground limestone. The average chemical composition of the prairie hay and of the three different supplements are given in Table I.

The average date at the start of the winter feeding period was October 31. The cattle were weighed at approximately monthly intervals throughout the experiment. During the wintering period the heifers of Lots 4, 5, 6, and 7 were rotated frequently between the pastures to minimize differences in forage available. The average date at the end of the wintering period was April 2 and the average length of the period was 153 days. When supplementary feeding was discontinued all the heifers were placed on native grass pastures.

On approximately May 15 of each year of the test, the heifers were divided into breeding groups on the basis of winter treatment and a

TABLE I.—Average Chemical Compositions of Feeds Used.

Feed	Percent dry matter	Percentage composition of dry matter							
		Crude fiber	Crude protein	Nitrogen-free extract	Ether extract	Ash	Calcium	Phosphorus	
20% protein pellet									
Fed in 1949-50 & 1950-51	91.2	5.7	21.3	63.5	5.9	3.6	0.15	0.44	
Fed in 1951-52 & 1952-53	91.0	4.8	21.4	63.7	3.8	6.3	1.23	0.92	
30% protein pellet									
Fed in 1949-50 & 1950-51	91.6	8.3	31.1	49.2	6.6	4.8	0.22	0.77	
Fed in 1951-52 & 1952-53	91.7	7.2	30.4	50.9	4.0	7.5	1.20	0.94	
40% protein pellet									
Fed in 1949-50 & 1950-51	92.8	11.3	41.8	32.9	7.7	6.3	0.24	0.89	
Fed in 1951-52 & 1952-53	92.7	10.1	42.8	31.8	6.2	9.1	1.12	1.09	
Prairie hay (avg. of 4 years)	93.2	33.5	4.7	50.7	3.3	7.8	0.41	0.06	

TABLE II.—Data on Weanling Heifer Calves Fed 20-, 30-, and 40-percent Protein Supplements During the Wintering Period (Four-Year Average).

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7
Heifers per lot (total)	38	35 ¹	38	41	41	30	30
Winter feeding period (average, 153 days)							
Average daily ration (lb.)							
20-percent protein pellet	1.00	----	----	2.01	----	1.01	----
30-percent protein pellet	----	1.01	----	----	----	----	1.01
40-percent protein pellet	----	----	1.00	----	2.01	----	----
Prairie hay	9.34	10.20	10.37	----	----	----	----
Range	----	----	----	ad lib.	ad lib.	ad lib.	ad lib.
Mineral	0.08	0.08	0.07	0.10	0.10	0.10	0.09
Average weight data (lb.)							
Initial, October 31	433	425	429	430	430	430	431
Final, April 2	422	459	510	445	468	404	446
Total gain	— 11	34	81	15	38	—26	15
Average daily gain	— 0.07	0.22	0.53	0.10	0.25	— 0.17	0.10
Average financial results (dollars)							
Initial value per head	123.40	121.29	122.40	122.56	122.56	131.13	131.45
Feed cost per head	15.90	17.53	18.14	14.95	17.15	9.68	12.85
Total cost per heifer (feed+heifer)	139.30	138.82	140.54	137.52	139.71	140.8	144.30
Value per head at end of winter ²	120.65	128.58	140.64	125.04	128.55	118.89	130.12
Net return per head	— 18.65	— 10.24	0.10	—12.48	—11.16	—21.92	—14.18
Summer grazing period (average, 212 days)							
Average weight data (lb.)							
Initial, April 2	422	459	510	445	468	404	446
Final, October 31	683	698	719	706	698	680	687
Total gain	261	239	209	261	230	276	241
Average daily gain	1.24	1.13	0.99	1.24	1.09	1.31	1.44

TABLE II.—(Continued)

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7
Yearly (average, 365 days)							
Average weight data (lb.)							
Initial, October 31	433	425	429	430	430	430	431
Final, October 31	683	698	719	706	698	680	687
Total gain	250	273	290	276	268	250	256
Average daily gain	0.68	0.75	0.79	0.76	0.73	0.68	0.70
Feed cost (dollars)							
Winter	15.90	17.53	18.14	14.96	17.15	9.68	10.80
Summer	14.10	14.10	14.10	14.10	14.10	14.14	14.14
Yearly	30.00	31.63	32.24	29.06	31.25	23.82	23.82
Average feed prices							
	20 percent protein pellet			\$72.62	per ton		
	30 percent protein pellet			78.78	per ton		
	40 percent protein pellet			86.99	per ton		
	Prairie hay			13.75	per ton		
	Range						
	Winter			3.31	per head		
	Summer			14.06	per head		

(1) Three calves were removed because of pregnancy, two in 1950-51 and one in 1951-52.
 (2) The weights were shrunk 3 percent.

bull was placed with each group. The different groups of heifers had access to pastures of approximately the same size and of comparable grazing. The summer grazing phase was completed on the average date of October 31. At the end of the summer period the cattle were weighed and removed from the experiment. The average length of the summer period was 212 days and the average length of the yearly period was 365 days.

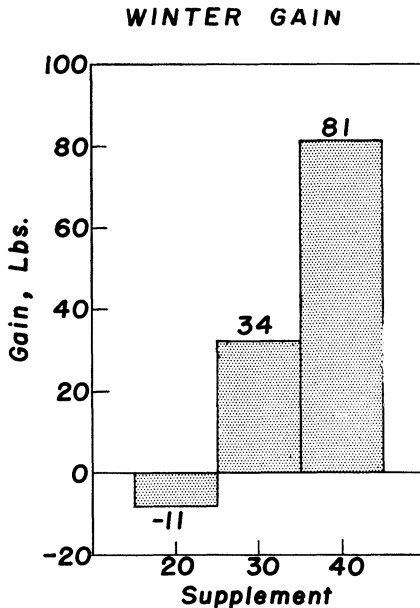
RESULTS AND DISCUSSION

Table II summarizes the average weight changes, feed consumption, and financial results. The data for all lots except Lots 6 and 7 represent a 4-year average. The figures for those two lots represent a 3-year average.

Heifers Fed Prairie Hay in Trap

(LOTS 1, 2, AND 3)

The average winter gain of the heifers wintered in traps and fed prairie hay supplemented with lb. per head per day of 20-, 30-, and 40-percent protein supplements was -11, 34, and 81 lbs., respectively. (See Figure 1.) The gains of the heifer calves were directly related to the protein content of the supplement fed. It appears that the level of protein was the factor limiting gains.



The average hay consumption of the heifers fed the 30- and 40-percent protein supplements was about equal and exceeded that of the heifers fed the 20-percent protein supplement.

The average feed cost per head during the wintering period increased with each increase in the protein content of the supplement. However, the average winter gain increased sufficiently so that the net return per heifer was positively related to the percentage of pro-

Fig. 1.—Average winter gains of heifer calves fed prairie hay and 1 lb. per head daily of a supplement containing 20-, 30-, and 40-percent protein. Average gains of heifers increased with increases in protein content of the supplement.

tein in the supplement. The 4-year average shows that the lot of heifers fed the 40-percent protein supplement was the only one in which the value per heifer at the end of the winter exceeded the total cost per heifer (feed plus heifer). In this lot the net return per heifer was only \$0.10. The low average net return was mainly due to increased feed prices and decreased cattle prices during the last two years of this study.

In the spring there was usually a strong demand for thinner heifers such as those of Lot 1, so the appraised value per hundred-weight at the end of the wintering period favored cattle which had been fed the 20-percent protein supplement in three of the four years.

During the summer grazing period the average gains of the cattle were inversely related to their winter gains and the protein content of the supplement fed in the winter. The heifers of Lots 1, 2, and 3 made average summer gains of 261, 239, and 209 lbs. respectively. As has been previously observed in work at this Station and elsewhere, and experienced by ranchers in this area, the heifers that gained the least during the winter gained the most during the subsequent summer grazing period.

The average yearly gain of the heifers of Lots 1, 2, and 3 was 250, 273, and 290 lbs., respectively. Thus, the average yearly gain was directly related to the protein content of the supplement fed during the winter. See Figure 2 for pictures of heifers in Lots 1, 2, and 3.

Heifers Grazing Native Grass Pastures

(LOTS 4, 5, 6, AND 7)

The heifers that were allowed to graze the dry cured native grass and fed 2 lbs. per head per day of 20- and 40-percent protein supplements during the winter (Lots 4 and 5) gained an average of 15 and 38 lbs. per head, respectively, during the wintering period. The heifers fed 1 lb. per head per day of 20-percent protein supplement (Lot 6) lost an average of 26 lbs. per head, while those fed 1 lb. of the 40-percent protein supplement (Lot 7) gained an average of 15 lbs. per head. (See Figure 3.) Thus, on an equal intake basis, the supplement containing the higher amount of protein (40 percent) promoted the greater winter gain.

During the three years in which both Lots 4 and 7 were included in the study, the heifers of Lot 4 (2 lbs. 20-percent protein) gained an average of 12 lbs. per head and those of Lot 7 (1 lb. 40-per-

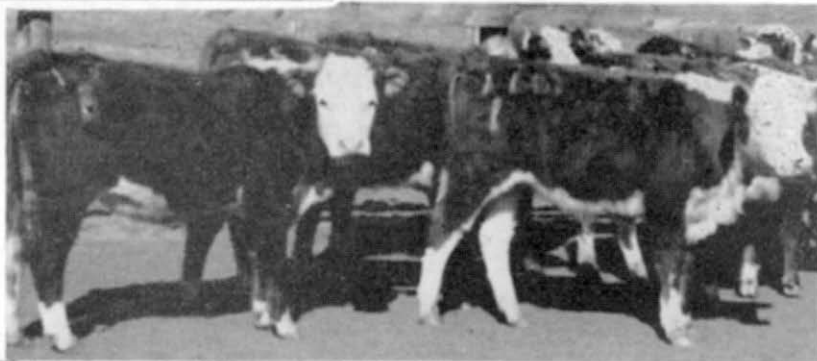


Lot 1

Heifers in this lot were fed prairie hay, free-choice, and 1 lb. per head per day of 20-percent protein supplement during the winter of 1951-52. The average winter gain for 4 years for heifers fed this ration was -11 pounds. However, these calves made the greatest gains during the summer, averaging 261 pounds for the 4 years.

Lot 2

Lot 2 heifers were fed prairie hay, free-choice, and 1 lb. per head per day of 30-percent protein supplement. Their average winter gain was 34 pounds, and their average summer gain was 239 pounds. The experiment showed that average winter gains of calves are directly related to the protein content of the supplement.



Lot 3

Prairie hay, free-choice, and 1 lb. per head per day of 40-percent protein supplement composed the winter ration of Lot 3 calves. Note the thriffter appearance of these heifers over those of Lots 1 and 2. Their average winter gain was 81 pounds; their average summer gain, 209 pounds. All three pictures were taken at the end of the 1951-52 winter.



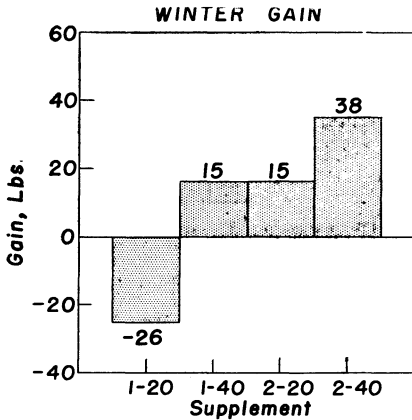


Fig. 3.—Average winter gains of heifers grazing native grass pasture and fed different quantities and kinds of protein supplements. On an equal intake basis, the supplement containing the higher amount of protein promoted the greater winter gain.

The average financial results for the wintering period were losses in all lots. However, when the supplements were fed at the same level, the financial loss was greater when feeding the 20-percent protein supplement than when feeding the 40-percent protein supplement.

The only consistent difference in appraised value per hundred-weight among these lots of heifers was between Lots 5 and 6. The thinner heifers of Lot 6 were always appraised higher than the fleshier ones of Lot 5.

During the summer grazing period the heifers of Lots 4, 5, 6, and 7 gained an average of 261, 230, 276, and 241 lbs., respectively. As was observed with heifers wintered in traps, when the supplements were fed in equal amounts, the summer gain was inversely related to the winter gain and the protein content of the supplement.

The average yearly gain of the heifers fed the 20- and 40-percent protein supplements at the one-pound level was 250 and 256 lbs., respectively. The average yearly gain of the heifers fed the above supplements at the two-pound level was 276 and 268 lbs., respectively. These small differences in gain suggest that if the supplements are fed at the same level and good grazing is available in the summer, heifers fed 20- and 40-percent protein supplements may make about equal yearly gains. However, it is possible that feeding only small amounts of low-protein supplements to calves during the winter months may have an

cent protein) gained an average of 15 lbs. per head. These results indicate that protein and not energy was the first limiting factor under this system of feeding and management. It may be that when pastures provide only limited amounts of dry cured native grass, the additional energy supplied by 2 lbs. of the 20-percent protein supplement would be beneficial.

The average feed cost per head during the winter was higher for the heifers fed the 40-percent protein supplement than for those fed an equal amount of the 20-percent protein supplement. The average

adverse effect on their subsequent performance in later years. Tests designed to study this problem are now in progress.

SUMMARY

When supplements containing 20-, 30-, and 40-percent protein were fed in equal amounts under approximately the same experimental conditions, the average winter gains were directly related to the protein content of the supplement. The average winter gain of the heifers wintered in traps and fed prairie hay supplemented with 1 lb. per head per day of 20-, 30-, and 40-percent protein supplements as —11, 34, and 81 lbs., respectively. Heifers that were allowed to graze the dry native grass during the winter and fed 2 lbs. of 20-percent protein supplement, 2 lbs. of 40-percent protein supplement, 1 lb. of 20-percent protein supplement, and 1 lb. of 40-percent protein supplement gained an average of 15, 38, —26, and 15 lbs., respectively, during the winter season.

Heifers that gained the least during the winter gained the most during the subsequent summer grazing period. The average yearly gains of the heifers wintered in traps and fed prairie hay increased with increases in the protein content of the supplement fed during the winter. The differences in yearly gains were very small when the 20- and 40-percent protein supplements were fed in equal amounts to heifers grazing the dry native grass during the winter.