Self-Fed Dry and Liquid Supplements Containing Natural Protein and Non-Protein-Nitrogen For Wintering Range Cows

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Story in Brief

Hereford and Angus cows wintered on a dry 30 percent all-natural protein supplement lost less weight and had higher condition scores than cows on a dry supplement containing 15 percent all-natural protein, or 30 percent supplements in which one-half of the protein equivalent was provided by urea or biuret.

Cows wintered on a liquid 30 percent protein supplement lost considerably more weight and had lower condition scores than cows wintered on the dry 30 percent all-natural protein supplement, even though more liquid supplement was consumed. Cows on liquid cane molasses consumed twice as much liquid cane molasses as liquid supplement and lost slightly less weight and were in poorer condition at the end of the experiment than the liquid supplement cows.

Weight and condition of cows in this experiment indicated that utilization of urea in dry and liquid supplements and biuret in a dry supplement was poor, and underscored the need for finding methods for improving the utilization of non-protein-nitrogen at high levels in range supplements.

Salt was effective in controlling intake of dry self-fed supplements at a desired level, but the self-feeding of supplements did not result in the utilization of non-protein-nitrogen at a satisfactory level.

Introduction

Wintering feed costs represent one of the major expenses in a cow-calf operation and cattlemen are continually seeking ways of lowering this cost. Non-protein-nitrogen (NPN) sources, especially urea, are extensively used in feedlot rations as a replacement for natural protein and

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have lowered the cost of protein supplement. However, research has shown that utilization of urea by range cows is disappointingly poor, and methods for utilizing relatively high levels of urea and other NPN in range supplements need to be developed.

The use of NPN can lower the cost of range supplements. The increasing human demand for natural protein will increase the price spread between natural protein and NPN in the future.

Results with urea in range supplements, particularly at high levels, have generally been poor. Some of the problems associated with urea in range supplements are: (1) It is broken down in the rumen at such a rapid rate that the bacteria are not able to utilize all the resulting ammonia to synthesize protein so a considerable amount of it's potential protein value is lost. (2) Dry winter grass is very low in readily available energy, which is needed for good conversion of ammonia to protein. (3) When high levels of urea are fed toxicity problems can develop under certain conditions. (4) Palatability may be a problem when high levels are fed. In view of the above problems, urea is presently omitted from range supplements or is used at levels to furnish only 10-30 percent of the protein equivalent of the supplement. Higher levels of urea would be desirable to further decrease the cost of supplements.

Considerable research has been conducted in search of sources of NPN without the disadvantages of urea which could be utilized by cattle to synthesize protein. Biuret is a NPN compound that shows considerable promise as a protein substitute in range supplements. Biuret is broken down more slowly in the rumen, and it is reported to be more palatable. One possible disadvantage of biuret is that a longer period of adaptation may be required for biuret than urea; the bacteria in the rumen must become adapted to biuret before it can be utilized for protein synthesis.

Another item of considerable expense and an increasing problem for cattlemen is labor. Labor output may be reduced by self-feeding supplements. Research at the Oklahoma Experiment Station and elsewhere during the past 20 years has shown that salt can be used to effectively control the level of intake of feeds. The use of salt to control the intake of supplements relatively high in NPN has not been investigated. It has been theorized that the self-feeding of supplements containing NPN will improve NPN utilization due to the intermittent release of ammonia.

Another method of self-feeding protein supplements to range cattle which has gained popularity throughout the country is the use of liquid supplements. One of the major advantages of liquid supplements is the convenience of feeding, as many feed dealers will deliver the supplement to the self-feeding tank. Most liquid supplements are formulated in a molasses base and contain urea as the major nitrogen source. Phosphoric acid is usually added as a phosphorus source and to control intake, and

liquid supplements contain various vitamins, minerals and in some cases antibiotics or other additives.

The purpose of this trial was to compare supplements containing natural protein to supplements containing urea or biuret. Also dry self-fed supplements were compared to liquid self-fed supplements.

Procedure

The experiment was conducted at the Lake Carl Blackwell Range located 10 miles west of Stillwater. The predominant forage is of the tallgrass prairie type with the climax species consisting of little bluestem, big bluestem, Indian and switch grasses. Since these grasses were dormant during the wintering trial the major portion of the cows' diet consisted of dry weathered grass. Prairie hay was fed only on a few occassions when snow covered the range forage.

The experimental cattle were mature Hereford and Angus cows 4 to 6 years old at the beginning of the trial. All cows included in the trial had been bred to Charolais bulls; cows started calving the latter part of January and calved throughout the trial.

The experiment was conducted during an 84-day period from December 5, 1970 to February 27, 1971. The cows were rotated to different pastures at 28-day intervals to minimize differences in performance due to possible pasture differences. Six different supplements were fed; all were self-fed. Four supplements were dry and two were liquid. The ingredient make-up of the dry supplements is shown in Table 1. Supplement 1 contained 30 percent, all-natural protein. Supplement 2, containing 15 percent natural protein, was fed as a negative control. Supplements 3 and 4 contained 30 percent protein equivalent; one-half of the total protein, 15 percent, consisted of natural protein whereas urea or

Table 1. Ingredient Makeup of Dry Supplements

Lot	1	2	3	4
Supplement	Natural	Natural	Urea	Biuret
Crude protein, %	30	15	30	30
Dehydrated alfalfa meal	5.00	5.00	5.00	5.00
Milo, ground	33.00	72.77	63.06	61.46
Soybean meal (44% protein)	56.83	17.44	19.42	19.87
Dicalcium phosphate	0.88	1.28	1.27	1.27
Monosodium phosphate	3.28	3.51	3.58	3.59
Sodium sulfate	----	----	2.35	2.35
Urea (45% nitrogen)	----	----	5.31	----
Biuret[1] (37% nitrogen)	----	----	----	6.46
Vitamin A[2]	+	+	+	+

[1] Kedlor, a feed grade source of biuret.
[2] Added at a level of 10,000 I.U. per lb. of supplement.

biuret furnished the remaining 15 percent (one-half) of the protein equivalent. Supplement 2, the negative control, served two purposes. First, the difference in performance between cows receiving supplement 1 (30 percent protein) and supplement 2 (15 percent protein) would indicate if additional protein were needed beyond that amount provided by supplement 2. Second, the performance of cows fed either supplement 3 or supplement 4, in comparison to cows fed supplements 1 *and* 2, should provide some indication of the degree of utilization of urea or biuret.

The four dry supplements were formulated to contain 1.5 percent phosphorus, 0.5 percent calcium and the nitrogen-sulfur ratio was approximately 14:1.

The consumption of the dry supplements was controlled by adding various levels of salt. The range in salt levels used in the supplement-salt mixtures to accomplish similar levels of supplement intake is shown in Table 2.

Supplement 5 was a liquid supplement containing 30 percent crude protein; it was available to the cattle at all times. Aluminum sulfate was added to the liquid supplement for a short time in the early phase of the experiment to prevent overconsumption when initial intake was high (7 to 8 lb. per cow daily).

Table 2. Supplement Consumed, Winter Weight Change and Condition Score of Cows Wintered on Various Range Supplements[1]

Lot	1	2	3	4	5	6
Supplement	Natural	Natural	Urea[2]	Biuret[3]	Liquid[4]	Molasses
Crude Protein, %	30	15	30	30	30	3
No. of cows	10	10	9	9	9	9
Daily supplement, lb.[5]	2.60	2.69	2.93	2.71	3.42	6.80
Salt in mixture,%	25.0-29.5	23.3-25.0	20.0-25.0	20.0-20.8	----	----
Wt. per cow, lb.						
12-5-70 (initial)	1075	1036	1026	1052	1023	1063
1-2-71	1063	1058	1024	1052	1018	1049
2-26-71 (final	953	858	870	876	837	886
No. cows calved by						
2-27-71	7	8	4	8	4	5
Wt. change per cow[6]						
lb.	—122	—178	—156	—176	—186	—177
percent	—11.4	—17.2	—15.2	—16.8	—18.2	—16.7
Condition score[7],						
2-27-71	4.0	3.6	3.5	3.4	2.9	2.2

[1] Cows were grazed on dry native grass.
[2],[3] To furnish one-half of protein equivalent.
[4] Approximately 90% of protein equivalent from urea.
[5] Not including salt.
[6] Since the number of cows which calved by the completion of the test period was not equal among lots, and since calving involves considerable weight loss, all weight change, figures were adjusted to a common basis compared to the negative control, Lot 2. Therefore, the winter weight change figure is a weighted value, calculated by the following formula:

Av. winter weight change of the lot = Av. weight change of cows which calved X 80% + Av. weight change of cows which did not calve X 20%.

[7] On a scale of 1-9, with 1 the thinnest and 9 the fattest.

Supplement 6 was liquid cane molasses. It was included in the experiment to serve as a negative control for the liquid supplement; since molasses contains little protein (3 percent) but a similar level of energy as liquid supplements, the relative performance of cows consuming liquid supplement and molasses should offer some indication of the degree of utilization of urea in the liquid supplement. Aluminum sulfate was added to the molasses throughout the experiment in an attempt to limit consumption.

At the conclusion of the experiment cows were scored for condition on a scale of 1 to 9, with 1 being the thinnest and 9 the fattest.

The supplement feeding comparison was terminated on February 27, at which time all cows were divided into two breeding groups and fed a natural-protein supplement until April 20. Calves were weaned on September 22, 1971.

Results and Discussion

A summary of the amounts of supplement consumed and performance of the cows is shown in Table 2. Intake of the four dry supplements was similar, with a range in daily intake of only 0.13 pounds per cow daily; intake of the natural 15 percent, urea and biuret supplements was almost identical. The percent of salt in the supplement-salt mixture necessary to limit intake differed somewhat among supplements. The natural 30 percent supplement was the most palatable and required the highest level of salt to limit intake, followed by the natural 15 percent supplement. The urea and biuret supplements were the least palatable, and the biuret supplement appeared to be slightly less palatable than the urea supplement since less salt was needed to limit intake of the biuret supplement.

The cows consumed more of the liquid 30 percent supplement than of the dry supplements, and the consumption of the molasses was excessively high even after a high level of aluminum sulfate was added to decrease palatability. To decrease the total intake of molasses the feeders were left empty for short periods of time.

The winter weight change of cows is shown in Table 2. The cows consuming the natural 30 percent dry supplement lost considerably less weight than the cows on the other treatments. The winter weight loss of cows consuming the "negative control" (15 percent protein) supplement was considerably greater than that of the group consuming the 30 percent all-natural protein supplement, indicating the definite need for supplemental protein above the amount supplied by the 15 percent protein supplement. The cows consuming supplements containing urea and biuret lost only slightly less weight than the cows on the 15 percent pro-

tein supplement indicating that the utilization of NPN was low. In this trial the problem of cattle adapting to biuret may not have been serious as the weight loss for the biuret cattle was not significantly different from that of the other groups during the first 28 days of the trial.

The weight loss of the cows on the liquid supplement was considerably greater than that of cows fed the all-natural 30 percent protein supplement and similar to but slightly greater than that of cows fed the all-natural 15 percent, urea and biuret supplements. This suggests that the utilization of urea nitrogen in the liquid supplement was approximately one-half that of the natural protein.

A comparison between liquid supplement and molasses was of questionable value, as an indicator of degree of utilization of urea in the liquid supplement, since intake of molasses was double that of liquid supplement. The performance of cows on molasses certainly demonstrated that the high levels of energy will not compensate for a large deficiency of protein.

The final condition scores of the cows followed the same general pattern as weight loss, and provided further support to the conclusions previously discussed.

Table 3 shows the weaning weight of calves and the rebreeding performance of the cows. The cows wintered on biuret weaned the heaviest calves and the cows wintered on the natural 15 percent protein supplement weaned the lightest calves; weaning weights of calves in the other groups were very similar. However, it is doubtful that weaning weights in this experiment were as accurate a reflection of winter supplement treatments as cow weights. Due to management considerations unrelated to this experiment, it was necessary to terminate the supplement comparisons February 27, after which time all cows received the same 30 percent natural protein supplement for almost two months. This would tend to

Table 3. Performance of Calves Born During Winter and Fertility of Cows Wintered on Various Range Supplements

Lot	1	2	3	4	5	6
Treatment	Natural	Natural	Urea	Biuret	Liquid	Molasses
Crude Protein, %	30	15	30	30	30	5
No. of cows calved[1]	10	10	9	9	9	9
Calving date (day of yr)	215	216	213	226	199	210
Birth wt. (lb.)[2]	80	76	82	73	79	78
Weaning wt. (lb.)[3]	540	521	542	551	548	542
No. cows rebred[4]	10	9	9	9	9	8

[1] Includes cows which calved during calving season. Some calved after the wintering trials.
[2] Heifer calves adjusted to bull equivalent by multiplying actual birth weight by 1.048.
[3] Weaning weight adjusted to 205-day, steer, mature cow basis.
[4] All cows which failed to rebreed were exposed to bull at least 60 days post-partum.

mask differences due to previous supplementation, particularly since 36 percent of the calves were born after the supplement comparisons were terminated. For the same reason, it is doubtful that birth weights and rebreeding performance were greatly influenced by the supplement treatments.

At the same time, it is apparent that no winter supplement treatment adversly affected the future performance of the cows during the spring and summer. Cows which had lost more winter weight and were in thinner condition were able to compensate after wintering treatments had ended. This again was probably related to the short duration of the experiment.

Conclusions

The results of this experiment show that methods to improve the utilization of NPN on low quality dry winter range forage are urgently needed so that higher levels of NPN can be fed satisfactorially to range cows. Weight changes of cows indicated that utilization of NPN in all supplements was low.

It was again demonstrated in this experiment that salt can be effectively used to control the intake of dry self-fed supplements at a desired level.