It would have been desirable to measure genetic response in terms of annual changes in average line performance. This was not possible with this data since the selected sires were the top bulls from the two lines and improvement in the cow herd was not considered. However, the results of the foundation vs. selected sires comparisons suggest that positive genetic responses were obtained from selection since seven years of selection resulted in sires capable of producing calves which were 5.6, 5.9 and 6.9 percent heavier at birth, weaning and yearling age and grew 11 percent faster postweaning than calves produced by foundation sires.

The magnitude of the cumulative selection differentials discussed previously indicates that appreciable selection was applied in both selection lines. Thus, positive genetic responses were expected. The foundation vs. selected sires comparisons indicate that positive genetic responses were obtained as a result of selection while time trends in average line performance suggest that on a per year basis the changes were small in magnitude. Although annual genetic responses apparently are small, the cumulative nature of selection indicates that over time appreciable improvement in performance should result from selection based on weaning weight or yearling weight.

Supplemental Value of Urea and Feed Grade Biuret for Heifers Wintered on Dry Range Grass

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Story in Brief

Two winter trials were conducted to evaluate the supplemental value of urea and feed grade biuret for beef replacement females grazing low quality winter forage (dry range grass).

Yearling, crossbred replacement heifers were fed supplements containing (1) 30 percent natural protein (positive control), (2) 15 percent natural protein (negative control), (3) urea, and (4) feed grade biuret. Each non-protein-nitrogen (NPN) source (urea and biuret) furnished one-half of the supplemental nitrogen. The positive control heifers lost

less weight than the negative control heifers, indicating need for more protein than supplied by the negative control. Weight loss of urea heifers was midway between the positive and negative controls, with an apparent urea utilization of 52 percent. Biuret heifers lost slightly more weight than urea heifers, with an apparent utilization of biuret of 30 percent.

Weaned, crossbred replacement heifers were fed supplements containing (1) natural protein (positive control), (2) no supplemental nitrogen (negative control), (3) urea, and (4) feed grade biuret. Each NPN source (urea or biuret) furnished about 98 percent of the supplemental nitrogen. The positive control heifers lost considerably less weight than the negative controls. Urea and biuret heifers sustained a weight loss midway between the controls, suggesting appreciable utilization of the NPN. However, intake of NPN supplements was too low to support satisfactory winter performance of heifers.

Introduction

Low quality forages are used extensively for wintering beef cattle and supplementation with protein is usually needed for satisfactory performance. The use of NPN in range supplements has increased in recent years. This trend will probably continue as a larger amount of natural protein will be used for human consumption in the future. Research has shown, in experiments involving beef cattle wintered on low quality native range grass in Oklahoma, that urea-containing supplements are of much lower value than supplements containing natural protein due to poor utilization of urea.

The purpose of this study was to compare NPN supplements (NPN furnishing 50 and 98 percent of the total nitrogen) to supplements of natural protein for heifers wintered on dry range grass.

Procedure

Two trials were conducted at the Lake Carl Blackwell Range located 10 miles west of Stillwater. The predominant forage was of the tallgrass prairie type with climax species consisting of little bluestem, big bluestem, Indian grass, and switch grass. Number and ingredient makeup of supplements is shown in Table 1.

Trial 1.

Sixty-six crossbred (½ Charolais X ½ Angus, ½ Charolais X ½ Hereford, ½ Hereford X ¼ Angus X ¼ Holstein), pregnant yearling heifers were allotted to four treatment groups for a 77-day wintering trial. Treatments 1 and 2, positive and negative controls, consisted of 30

and 15 percent natural protein supplements (supplements 1 and 2, Table 1). Treatment 3 consisted of a 30 percent crude protein supplement with one-half of the nitrogen from urea and treatment 4 consisted of a 30 percent crude protein supplement with one-half of the nitrogen from biuret and urea (feed grade biuret) (supplements 3 and 4, Table 1).

Alfalfa hay was included at a level of 40 percent of the urea and biuret supplements because of previous indications that NPN utilization is improved by a high level of alfalfa. Supplements were supplied free-choice in mineral feeders with salt added to limit intake. Salt comprised 30 percent of the total as-fed mixture for treatments 1 and 2 and 20 percent for treatments 3 and 4. Equal intake of non-salt supplement among the four treatments was achieved. Heifers were rotated among pastures at 14-day intervals.

Trial 2.

Eighty crossbred (as described for trial 1) and Hereford weaned heifer calves were allotted to four treatments for a 90-day wintering trial. The first treatment served as the positive control and consisted of a 30 percent natural protein supplement (supplement 1, Table 1); salt was added at an average level of 30 percent to limit intake. The second treatment served as the negative control and consisted only of a mineral mixture of 50 percent dicalcium phosphate and 50 percent trace mineral salt

Table 1. Ingredient Makeup of Protein Supplements (Percent)

	Supplement number, description and % crude protein[1]					
	1 Natural 30	2 Natural 15	3 Urea-Alfalfa[2] 30	4 Kedlor-alfalfa[2,3] 30	5 Urea-mineral[2] 107	6 Kedlor-mineral[2,3] 105
Corn	27.77	68.75	28.96	24.51	20.00	10.00
Soybean meal, sol (44%)	58.25	17.25	13.05	13.94	----	----
Ground alfalfa hay	5.00	5.00	40.00	40.00	----	----
Molasses, sugarcane	5.00	5.00	5.00	5.00	----	----
Monosodium phosphate	2.50	2.75	3.60	3.60	11.79	8.76
Dicalcium phosphate	0.75	1.20	----	----	6.97	5.58
Sodium sulfate[4]	0.68	----	4.00	4.00	13.80	11.94
Trace mineral mix	0.05	0.05	0.05	0.05	0.17	0.15
Vitamin A[5]	+	+	+	+	—	—
Urea	----	----	5.34	----	37.27	----
Kedlor 250[3]	----	----	----	8.90	----	53.57
Salt	----	----	----	----	8.00	8.00
Magnesium oxide	----	----	----	----	2.00	2.00

[1] Approximate crude protein as determined by feed composition tables, Crampton and Harris (1969).
[2] NPN source provided 50% of crude protein equivalent for urea and/or biuret.
[3] Kedlor 250, feed grade biuret, approximate chemical composition (dry weight basis): Biuret 60% urea 15%, cyanuric acid 21%, and total nitrogen 37%.
[4] Formulated to supply 12:1 nitrogen: sulfur ratio.
[5] 10,000 IU per pound of supplement.

with no nitrogen included. The third treatment consisted of a biuret-mineral supplement with a high (107 percent) crude protein equivalent supplied by urea (supplement 5, Table 1). The fourth treatment consisted of a feed grade biuret from feed grade biuret (supplement 6, Table 1).

Ground corn (at levels of 20 and 10 percent) and salt (8 percent) were included in the NPN-mineral supplements to encourage intake. Since the NPN-mineral supplements absorbed enough moisture to become very wet, magnesium oxide (2 percent of the supplements) was added to lower hygroscopicity to a satisfactory level. All supplements were fed free-choice in mineral feeders. Intake of the natural protein supplement was limited to equal the nitrogen intake of the urea supplement; nitrogen intake of the biuret supplement was substantially lower than for natural and urea supplements. Heifers were rotated among pastures at 14-day intervals.

Results and Discussion

Trial 1.

Results are presented in Table 2. Daily intake of supplemental protein was the same for all groups. Heifers fed the 30 percent natural protein supplement (positive control) lost less weight than heifers receiving the 15 percent natural protein supplement (negative control), demonstrating the need for more protein than supplied by the negative control. Weight loss of urea-supplemented heifers was midway between positive and negative controls, suggesting an apparent urea utilization of 52 percent. Weight loss of biuret-supplemented heifers was slightly greater than that of urea-supplemented heifers, with an apparent utilization of 30 percent. The level of apparent urea utilization in this trial, with a self-fed supplement containing a high level of alfalfa, was the highest observed on this experimental winter range.

Table 2. Performance of Yearling Heifers During Winter Supplementation Period in Trial 1.

Item	Supplement, % crude protein			
	Natural 30	Natural 15	Urea-Alfalfa 30	Kedlor-Alfalfa 30
No. heifers	16	17	16	17
Daily non-salt supplement intake, lb.	2.05	2.05	2.05	2.05
Daily crude protein intake, lb.	0.62	0.31	0.62	0.62
Initial weight, lb.	723	746	735	736
Weight loss, lb.	28	49	38	43
Weight loss, %	3.9[1]	6.6[2]	5.2[1,2]	5.8[2]

[1,2] Values with different superscripts differ significantly ($P<.05$).

Trial 2.

Performance data are presented in Table 3. Heifers fed the 30 percent natural protein supplement (positive control) lost less weight than those which received no protein supplement (negative control). NPN-supplemented heifers sustained weight losses intermediate between the control groups, but the NPN supplements were not different from each other in weight loss. Supplemental nitrogen intake by positive control and urea groups was similar; intake of the positive control supplement was restricted to that of the urea supplement. Nitrogen intake by the biuret heifers was only one half that of the urea group, so their similar weight loss was somewhat surprising.

The weight loss of the urea-fed heifers was midway between the weight loss of positive and negative control with an apparent utilization of urea nitrogen of 53 percent. Although the weight loss of biuret supplemented heifers was similar to that of urea supplemented heifers, a valid estimate of nitrogen utilization from feed grade biuret was not possible because nitrogen intake was not comparable. The intake of both high NPN supplements in this trial was not sufficient to sustain a satisfactory level of perfarmance by the heifers.

Table 3. Performance of Weaned Heifers During Winter Supplementation Period in Trial 2.

Item	Supplement, % crude protein			
	Natural 30	No Nitrogen supplement	Urea-mineral 107	Kedlor-mineral 105
No. heifers	20	20	20	20
Daily non-salt spplement intake, lb.	0.7	----	0.21	0.11
Daily crude protein intake, lb.	0.21	----	0.22	0.12
Initial weight, lb.	505	503	503	502
Weight loss, lb.	87	122	103	107
Weight loss, %	17.2[1]	24.2[2]	20.5[2]	21.3[1]

[1,2] Values with different superscripts differ significantly ($P<.05$).