Stilbestrol and Urea in Rations for Wintering Beef Cattle

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The administration (implanting and feeding) of stilbestrol to fattening cattle is generally accepted as a means of increasing gain and improving feed efficiency. There are indications that the response from stilbestrol is less when the energy content of the ration is low, such as is the case with our usual winter rations. During the 1957-58 winter feeding season, tests were conducted to study the effect of implanting or feeding stilbestrol to calves wintered on prairie hay or dry native grass pasture. Many of the calves in these tests were allotted to different groups in such a manner that we could study the use of urea in protein supplements. Cattle and sheep are able to utilize, to varying degrees, the nitrogen from urea. This utilization is possible because of the microorganisms in parts of the ruminant stomach. The utilization of nonprotein nitrogen is apparently affected, therefore, by the nutrition of the microorganisms. Efficient utilization of urea will result only when other nutrients are provided in needed amounts.

There have been many studies which indicate that urea may satisfactorily replace part of the protein in the rations of fattening cattle. There is a lesser number of tests on the value of urea in wintering rations in which the quantity of concentrate feed offered as a supplement to grass hays or dry, native grass pasture is very limited. Tests conducted at this station in recent years have indicated that urea is apparently not efficiently utilized by cattle wintered on dry range grass when it is added to a mixture of corn and cottonseed meal to produce a pellet containing 40 per cent protein with one-third of the nitrogen furnished by urea. However, the addition of trace minerals or dehydrated alfalfa meal to the urea-containing pellet resulted in increased gains. Prairie hay apparently furnishes nutrients not present in dry range grass, because the addition of trace minerals to a urea-containing pellet fed as a supplement to prairie hay did not increase gains.

Additional tests on the use of urea in wintering rations have been conducted during the 1957-58 winter feeding season in order to study the effect of various additives in increasing gains of cattle fed urea-containing supplements.

The chemical composition of protein supplements and hays fed in these tests is given in Table 1.

Trial I.—Urea in Protein Supplements for Wintering Steer Calves Grazing Native Grass

Procedure

Sixty, grade, Hereford, steer calves were divided into 4 lots of 15 on November 11, 1957, and were allowed to graze the native grass

Table 1.—Chemical composition of feeds.

	Percent dry matter	Percentage Composition of Dry Matter						
		Ash	Protein	Fat	Fiber	N.F.E.	Ca	P
Trials I and II								
40 percent protein pellet	92.90	7.65	43.33	3.31	13.50	32.21	0.59	1.29
Urea-containing pellet	92.04	7.36	44.50	2.85	8.93	36.36	1.03	1.30
40-Urea plus trace minerals	92.01	7.34	46.33	2.90	9.46	33.99	1.06	1.30
40-Urea plus 4 trace minerals	91.33	7.29	46.53	2.93	8.95	34.30	1.07	1.30
Trial III								
40 percent protein pellet	92.15	8.52	42.86	5.23	10.63	32.76	0.75	1.54
Urea-containing pellet	91.55	8.01	43.69	4.50	8.38	35.42	1.06	1.37
40-Urea plus trace minerals	91.37	7.86	42.28	4.48	8.15	37.23	1.00	1.38
40-Urea plus trace minerals and aureomycin	91.86	7.89	43.82	4.08	7.84	36.37	1.01	1.38
40-Urea plus trace minerals and B vitamins	91.31	7.58	43.67	3.94	8.63	36.18	1.11	1.31
Winter-cut prairie hay	94.49	5.56	3.31	1.82	42.18	47.13	0.42	0.04
Trial V								
Cottonseed meal	90.46	6.42	42.84	4.62	12.95	33.17	0.35	1.00
Cottonseed meal plus stilbestrol	90.45	6.51	43.26	4.65	12.76	32.82	0.34	1.04
Prairie hay	94.75	6.53	5.08	1.66	32.26	50.47	0.48	0.05

pastures on the south side of Lake Carl Blackwell. In addition to the dried grass, they were fed an average of 2 lb. per head daily of the following protein supplements:

Lot 1. 40 per cent protein supplement.

Lot 2. 40 per cent protein supplement containing urea.

Lot 3. Same as Lot 2 plus trace minerals (iron, copper, cobalt, manganese, iodine, and zinc).

Lot 4. Same as Lot 2 plus iron, copper, cobalt and zinc.

The 40 per cent protein supplement was 97.9 per cent cottonseed meal, 1.1 per cent dicalcium phosphate and 1.0 per cent monosodium phosphate. The latter two ingredients were added at such rates that the calcium and phosphorus contents of all pellets were approximately equal. The 40 per cent protein supplement containing urea was 59 per cent cottonseed meal, 33 per cent ground yellow corn, 5 per cent urea* and 3 percent dicalcium phosphate. Urea furnished approximately one-third of the nitrogen in this pellet. The third supplement was the same as that fed to Lot 2 except trace minerals** were added at the rate of 0.1 lb. per 100 lb. of the supplement. According to the manufacturer's recommendations the additional minerals provided were, in mg. per lb. of pelleted supplement: manganese, 55.4; iodine, 1.72; cobalt, 1.18; iron, 43.6; copper, 3.3; and zinc, 3.04. At the rate fed, the trace minerals cost only 1 or 2 cents per head during the winter.

Previous tests have indicated that the addition of the trace mineral mixture described above increased utilization of a urea-containing protein supplement. In an attempt to determine which of the minerals was responsible for the increased utilization, the calves in Lot 4 were fed the same supplement fed to Lot 2 except that four trace minerals (iron, copper, cobalt and zinc) were added in the same amounts as fed in Lot 3. Many of the minerals in the commercial mixture were present in the form of sulfates. Since sulfates may affect the utilization of urea, the supplement in Lot 4 contained iron, copper and cobalt as carbonates and zinc as the oxide.

All pelleted supplements were fed every other day. A mixture of 2 parts salt and 1 part steamed bone meal was available in all lots.

Results

Average weights and winter gains of the steers are given in Table 2. The steers fed the cottonseed meal pellets gaind 7 lb. in the 130-day period. All other groups of cattle were fed the urea-containing pellet and lost weight. In contrast to the results in five previous tests, the addition of trace minerals did not improve the utilization of urea (Lot 2 vs. 3). The steers in Lot 4 lost considerably more weight than other steers. The reason for this greater loss is not apparent.

* Urea was furnished by Nitrogen Division, Allied Chemical and Dye Corporation.

** Mineral mixture furnished by Calcium Carbonate Company.

Table 2.—Trial I. Urea in protein supplements for wintering steer calves grazing native grass (130 days)

	Lot 1 40-CSM	Lot 2 40-Urea	Lot 3 40 Urea + trace minerals	Lot 4 40-Urea + 4 minerals
Number of steers	15	15	15	15
Average weight per head (lb.)				
Initial 11-11-57	475	474	479	477
Final 3-21-58	482	461	463	434
Gain	7	—13	—16	—43

Trial II. Urea in Protein Supplements for Wintering Yearling Heifers Grazing Native Grass

Procedure

Sixty-eight, grade, Hereford, yearling heifers were divided into 3 lots on November 11, 1957, and allowed to graze the native grass pastures on the south side of Lake Carl Blackwell. In addition to the dried grass, they were fed an average of 2 lb. per head daily of the following protein supplements:

Lot 1. 40 per cent protein supplement containing urea.

Lot 2. Same as Lot 1 plus trace minerals (iron, copper, cobalt, manganese, iodine and zinc).

Lot 3. Same as Lot 1 plus iron, copper, cobalt and zinc.

These supplements are the same as those fed to Lots 2, 3 and 4, respectively, in Trial I. The feeding procedures were as described in Trial I.

Results

Results of this trial are summarized in Table 3. All groups of heifers lost weight. The losses were 63, 85 and 72 lb. in Lots 1, 2 and 3, respectively. Heifers which were fed supplemental trace minerals lost more weight than those not fed trace minerals. These results are in general agreement with those obtained in Trial I but not in agreement with results obtained in previous years. The feeding of four trace

Table 3.—Trial II. Urea in protein supplements for wintering yearling heifers grazing native grass (130 days)

	Lot 1 40-Urea	Lot 2 40-Urea + trace minerals	Lot 3 40-Urea + four minerals
Number of heifers	22	23	23
Average weight per head (lb.)			
Initial 11-11-57	705	711	710
Final 3-21-58	642	626	638
Gain	—63	—85	—72

minerals (Lot 3) did not result in decreased gains as noted in Trial I.

The difference in results obtained this year from those in previous years is apparently related to the composition of the forage in the pastures. The 1957 growing season was relatively wet and cool and the pastures contained a large quantity of forage.

Trial III. Urea in Protein Supplements for Wintering Calves on Winter-Cut Weathered Forage

Procedure

In Trials I and II, cattle have been wintered on dry range grass and pelleted supplements. In Trial III, the roughage was native grass forage harvested in early November. This roughage was lower in protein and phosphorus and higher in crude fiber than good quality prairie hay harvested from similar areas in July. The composition of weathered forage was more like the dry grass available in the pastures during the winter than prairie hay. Prairie hay was not used as the roughage because previous tests have indicated relatively efficient utilization of urea-containing pellets when fed as supplements to good quality prairie hay.

On November 5, 1957, fifty, grade, Hereford calves were divided into 5 lots of 10 head (6 heifers and 4 steers per lot). They were fed the mature harvested forage and an average of 2 lb. per head daily of the following supplements:

Lot 1. 40 per cent protein supplement.

Lot 2. 40 per cent protein supplement containing urea.

Lot 3. Same as Lot 2 plus trace minerals.

Lot 4. Same as Lot 3 plus aureomycin (chlortetracycline).

Lot 5. Same as Lot 3 plus B vitamins.

The supplements fed to Lots 1, 2 and 3 were the same as those described in Trial I. The trace minerals, aureomycin and B vitamins were added to determine whether or not they would increase utilization of a urea-containing supplement as measured by weight gain of the calves. Aurofac 10 was added to the supplement fed Lot 4 in order to furnish 75 mg. aureomycin per head daily. The B vitamins added to the pellet fed to Lot 5 were riboflavin, pantothenic acid, niacin and choline. These were added as Fortafeed** and fed at the rate of 0.025 lb. per head daily. A mixture of 2 parts salt and 1 part steamed bone meal was available in all lots. An estimate of the roughage intake was obtained from a record of the numbers of bales fed and the average weight of a sample of bales. Since the roughage contained many weeds and the calves sorted out much of these materials an accurate measurement of feed intake could not be obtained. It is estimated that the calves consumed approximately 10 lb. per head daily although they were fed approximately 14 lb.

* Aurofac 10 is manufactured by American Cynamid Co. and furnishes 10 gm. aureomycin hydrochloride per lb. of material.

**Fortafeed is manufactured by American Cynamid Co. and furnishes 2 gm. riboflavin, 4 gm. pantothenic acid, 9 gm. niacin and 90 gm. choline chloride per lb. of Fortafeed.

Results

Weight data are given in Table 4. The average weight change during the 137-day feeding period was a loss in every lot. The losses varied from 6 to 32 lb. If these cattle had been fed good quality prairie hay and 2 lb. of the supplements as fed in this test, the expected gain would have been approximately 80 lb. Such data indicate nutritive value of the mature harvested grasses fed in this test.

The loss of 6 lb. in Lot 1 is considerably less than the losses in the other lots. The differences in gains of cattle in the lots fed the urea-containing supplements are minor and indicate no apparent value of any of the additives for increasing utilization of urea.

Table 4.—Trial III. Urea in protein supplements for wintering calves on winter-cut weathered forage (137 days)

	Lot 1 40-CSM	Lot 2 40-Urea	Lot 3 40-Urea + trace minerals	Lot 4 40-Urea + T.M. + Aurofac[1]	Lot 5 40-Urea + T.M. + Fortafeed[2]
Number of head	10	10	9[3]	10	10
Average weight per head (lb.)					
Initial 11- 5-57	498	498	509	500	498
Final 3-22-58	492	474	489	468	469
Gain	— 6	—24	—20	—32	—29

[1] 75 mg. aureomycin per head daily furnished by Aurofac 10 (American Cynamid Co.).
[2] 0.025 lb. Fortafeed per head daily. Manufactured by American Cynamid Co. and furnishes 2 gm. riboflavin, 4 gm. pantothenic acid, 9 gm. niacin and 90 gm. choline chloride per lb. of Fortafeed.
[3] One calf removed because of refusal to eat supplemental feed.

Trial IV. Effect of Stilbestrol Implants on Gains of Steer Calves Wintered on Native Grass

Procedure

The 60 steer calves used in Trial I of this experiment were divided into groups within each lot in order to study the effect of implanting two levels of stilbestrol. The treatments were:

Group 1. No implant.

Group 2. One 12 mg. implant*.

Group 3. Two 12 mg. implants*.

The experiment was started on November 11, 1957. The calves were allowed to graze the native grass pastures and were fed 2 lb. per head daily of supplemental protein feed. In addition, a 2 to 1 mixture of salt and steamed bone meal was available.

Results

The average gains of the steers are given in Table 5. Apparently the stilbestrol implants had some effect on winter weight changes. The

* Stimplants furnished through courtesy of Chas. Pfizer and Co. Inc.

Table 5.—Trial IV. Effect of stilbestrol implants on gains of steer calves wintered on native grass (130 days)

Lot No. Stilbestrol Implant*	Lot 1 none	Lot 2 12 mg.	Lot 3 24 mg.
Number of steers	19	20	19
Average weight per steer (lb.)			
Initial 11-11-57	479	476	481
Final 3-21-58	452	466	469
Gain	—27	—10	—12

* Stimplants furnished by Chas. Pfizer and Co., Inc.

control steers of Lot 1 lost an average of 27 lb. per head. Those implanted with 12 and 24 mg. of stilbestrol lost 10 and 12 lb., respectively. These differences were relatively consistent within the four groups of cattle fed protein supplements as described in Trial I.

Trial V. Effect of Feeding 5 mg. Stilbestrol to Calves Wintered on Prairie Hay

Procedure

Thirty-two weanling calves were divided into two lots on the basis of sex and weight on November 5, 1957. There were 11 heifers and 5 steers per lot. They were fed prairie hay **ad lib.** and 1.25 lb. of protein supplement per head daily as follows:

Lot 1. Pelleted cottonseed meal.

Lot 2. Pelleted cottonseed meal plus stilbestrol*.

Stilbestrol was added to the cottonseed meal at the rate of 5 mg. for each 1.25 lb. of cottonseed meal because the desired intake was 5 mg.. per calf daily. A mixture of 2 parts salt and 1 part steamed bone meal was available in both lots. Twice the daily allowance of hay and protein supplement was fed every other day.

Results

The calves consumed 10.5 to 11 lb. prairie hay per head daily. Considerable wastage of the hay made accurate measurement intake difficult, but there were no apparent differences between lots in consumption of hay.

The average gains are given in Table 6. Gains of both groups of calves were nearly the same (55 vs. 48 lb.) indicating little, if any, effect of stilbestrol on gains of calves fed prairie hay and pelleted cottonseed meal.

Trial VI. Effect of Stilbestrol Administration to Suckling Calves Upon Subsequent Performance in Wintering Studies

Procedure

Tests at this station (as reported elsewhere in this publication)

* Stilbstrol furnished through the courtesy of Eli Lilly and Co.

Table 6.—Trial V. Effect of feeding 5 mg. stilbestrol to calves wintered on prairie hay (137 days)

	Lot 1 Control	Lot 2 Fed Stilbestrol
Number of head	16	16
Average weight per head (lb.)		
Initial 11- 5-57	422	416
Final 3-22-58	477	464
Gain	55	48
Daily gain	0.42	0.37

have shown that implanting suckling beef calves with stilbestrol increased gains approximately 14 per cent. In one test spring-dropped calves were divided into three lots and all calves were creep-fed. The calves in the second lot were implanted with two 12 mg. pellets of stilbestrol (one on May 24 and the second August 13). Stilbestrol was included in the creep-ration of the third lot in such amounts that each calf consumed approximately 5 mg. per day. In this trial feeding stilbestrol had little effect on gains but implanting increased gains 36 lbs.

In order to provide preliminary data on the effect of summer treatment on gains during the winter, the calves were divided into 5 lots of 10 on the basis of sex, summer treatment and weight. Each of the lots contained, therefore, calves which had served as controls during the summer, calves which had been implanted with stilbestrol and those which had been fed stilbestrol. The calves were fed wintercut, weathered forage and 2 lb. of protein supplement as described in Trial II of this article.

Results

There was apparently little difference in weight changes between steers and heifers. The average weights and gains are given in Table 7. In the summer test, feeding 5 mg. of stilbestrol per head daily in the creep-feed of suckling calves did not increase gains. However, stil-

Table 7.—Trial VI. Effect of stilbestrol administration to suckling calves upon subsequent performance in wintering studies

Lot number Stilbestrol during summer	1 None	2 Implanted[1]	3 Fed[2]
Number of calves	13	17	16
Summer gain (lb.)	284	320	288
Gain from weaning to 11-5-57 (lb.)	—24	—30	—36
Av. weight per calf 3-22-58 (lb.)	470	516	467
Winter gain (lb.)	—28	—14	—25
Net gain[3]	232	276	227

[1] One 12 mg. implant in May and a second 12 mg. implant in August.
[2] Fed 5 mg. of stilbestrol per head daily.
[3] Gain from beginning of summer period until end of winter period.

bestrol implants (one in May and one in August) increased gains 36 lb. or nearly 13 per cent. There was some variation in losses of weight during the period from weaning in October to beginning of the winter test on November 5. In this approximately 30-day period, the losses varied from 24 to 36 lb.

In the wintering test, the calves in Lots 1 and 2 lost nearly the same amount of weight. This would be expected since there was practically no difference in gains during the previous summer. The calves which had been previously implanted lost slightly less weight during the winter. One of the purposes of this test was to determine whether or not the subsequent winter gain of cattle would be decreased when the calves had been implanted with stilbestrol during the summer. In this preliminary test the weight advantage present at weaning was increased during the wintering period. The total gains from the beginning of the summer to the end of the winter were 232, 276 and 227 lb. for Lots 1, 2 and 3, respectively.

Summary

The value of stilbestrol and urea in rations for wintering beef cattle and the subsequent performance of calves previously administered stilbestrol were studied in 6 trials.

Cattle fed a urea-containing supplement (40 per cent protein) did not gain as much as those fed pelleted cottonseed meal. The addition of trace minerals, aureomycin or certain B vitamins failed to increase the utilization of urea.

The feeding of 5 mg. of stilbestrol to calves fed prairie hay and cottonseed meal had little effect on winter gains. Implanting steer calves with 12 or 24 mg. of stilbestrol apparently slightly decreased winter weight losses of steer calves fed protein supplements while grazing native grass.

The subsequent winter weight loss of calves which had been implanted with stilbestrol during the previous summer was slightly less than the gains of those not previously implanted. This is in agreement with the results of fattening tests which are reported elsewhere in this publication.

Effect of Rapid vs. Moderate Rates of Gain on Feed Efficiency and Carcass Composition of Steer Calves

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Recent surveys suggest that consumers prefer leaner beef rather than fatter cuts. Flavor and tenderness are important considerations. Nutritive values for different grades of beef have been based principally on their caloric or energy value, and were established in an era in which larger and fatter cuts were preferred than are currently demanded by consumers. Today, beef is included in the diet more for its flavor and as a source of protein than for its energy value. Hence, feeding