1962

50th Annual Feeders Day Progress Report

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1962

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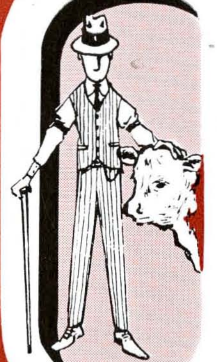


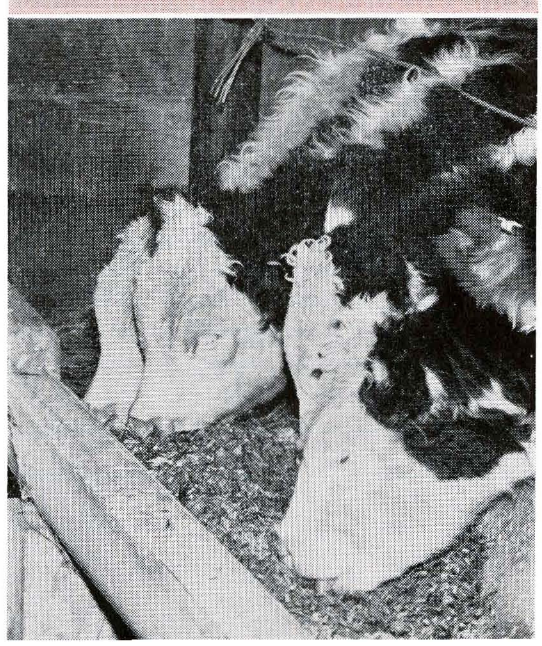
annual FEEDERS DAY Progress Report

Years of.....

IMPROVING BEEF PRODUCTION

through

- Breeding
- Nutrition
- Management



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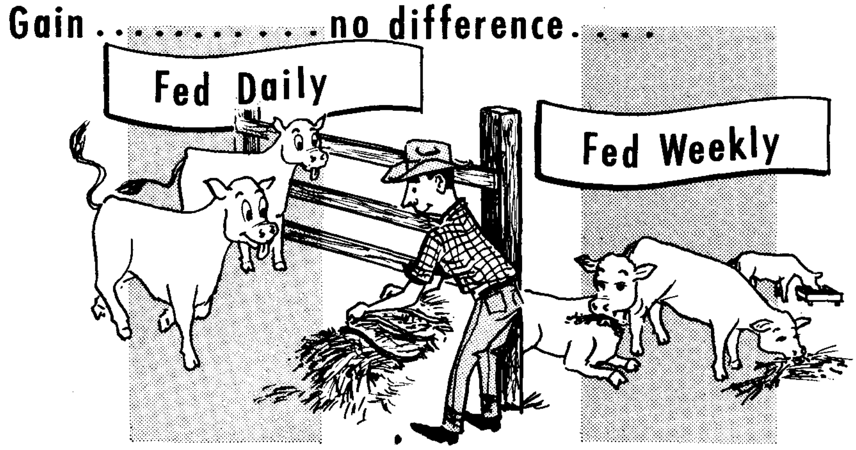
Effect of Lengthened Feeding Interval On Winter and Summer Gains of Beef Calves

J. A. Rothlisberger, W. W. Rowden
and J. E. Ingalls



Feeding pastured calves protein supplements weekly instead of daily during the winter made little difference in either winter or summer gains, according to research results to date.

Two sources of protein were used in the trial. (1) Second cutting alfalfa hay was fed at the rate of four pounds per head daily. One group of calves was fed four pounds per head daily and one group was fed 28 pounds per head once each week. (2) Forty percent protein, pellets or cake, was fed at the rate of one pound per head daily. One group was fed one pound per head daily and one group was fed seven pounds per head once each week. Approximately equal amounts of protein were provided by the alfalfa and 40% supplement as fed.

The 133 good to choice heifer calves were individually weighed and randomly allotted to four groups December 8, 1960. The previous month the calves were all grazed together on native pasture and were fed one pound of 40 percent cake daily. Salt and a mixture of salt and steamed bone meal were available at all times.

The calves averaged 379 pounds at the beginning of the trial. All four lots were grazed on native grass pastures that varied from 200 to 300 acres in size. The pasture grass was a mixture of midgrasses and short grasses. Lot 1 was fed one pound of 40 percent protein cake per head daily throughout the winter period. The cake was fed on the ground. Lot 2 was fed seven pounds of protein cake per head once each week. The cake was fed in bunks. Lot 3 was fed four pounds of alfalfa hay per head daily. Lot 4 was fed 28 pounds of alfalfa hay per head once each week. The alfalfa hay was fed on the ground in unbroken round bales.

All calves were individually weighed April 27, 1961, and grazed together on native range during the summer. The experiment was completed September 7, 1961, when all cattle were again individually weighed.

Table 1 shows the winter and summer gains made by each group. There was no difference in either winter or summer gains made by the group receiving 40 percent protein cake. The group that was fed four pounds of alfalfa hay per head daily gained 19 pounds more during the winter than the group fed alfalfa hay once each week. There was no difference between the two hay groups in summer gain. However, these are the results from only one year, and it is possible that the difference in winter gain may be a pasture difference rather than a treatment difference. The experiment should be repeated for several years to give more conclusive results.

In a previous experiment the calves fed on a weekly basis gained slightly more than those fed daily.

The group fed cake once a week showed no signs of digestive disturbances such as scouring, bloating, or going off feed. The calves were called together each Monday morning (by honking the horn on a pickup) and fed. The calves took approximately 20 minutes to clean up the cake. All the calves remained at the bunks until the cake was eaten. The calves fed alfalfa hay once each week showed no signs of bloat. It took three to four days for the calves to clean up the hay.

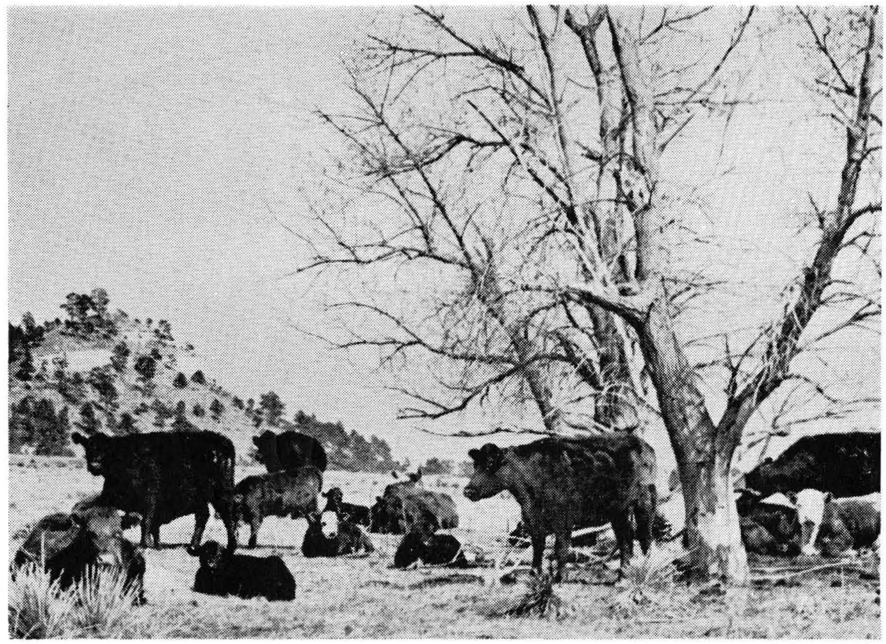
The groups fed weekly seemed to range over their pasture during the winter more than the groups fed daily. However, it was no problem to gather the calves once a week to feed even though they did not meet the feed truck at the gate as did the groups fed daily.

Table 1. Winter, Summer and Total Gains, in Pounds.

	1 lb. 40% protein cake per head daily	7 lbs. 40% protein cake per head weekly	4 lbs. alfalfa hay per head daily	28 lbs. alfalfa hay per head weekly
No. animals	33	33	33	34
Winter gain (140 days)	79	79	97	78
Summer gain (133 days)	214	211	216	217
Total gain (273 days)	293	290	313	295
Average daily gain (winter and summer)	1.07	1.06	1.14	1.08

PROGRESS REPORT

Heterosis Experiment at Fort Robinson



Cows with crossbred calves in pasture at Fort Robinson.

K. E. Gregory, R. M. Koch,
L. A. Swiger, J. E. Ingalls,
W. W. Rowden and J. N. Wiltbank

A crossbreeding experiment was started at the Fort Robinson Beef Cattle Research Station in the fall of 1957. The purpose of this experiment is to determine the influence of heterosis (increased vigor) on pre-weaning and post-weaning growth rate, feed efficiency, carcass characteristics, livability of calves, fertility and mothering ability.

Breeds used include Angus, Hereford and Shorthorn. Bulls of all three breeds are used and each bull of each breed is mated to cows of his own breed as well as to females of the other two breeds. This produces straight-breds as well as all possible crosses. The effects of heterosis on the different traits is measured by comparison of the crossbreds with the average of the straight-breds used in the cross. Four bulls of each breed are used each season. Approximately 75 females of each breed are in this experiment.

The first calf crop was born in 1960. It is planned to continue the first phase for four crops of calves. Complete growth, feed efficiency and carcass data are obtained on the steer calves born in the first phase.

Straight-bred and crossbred heifer calves born in the first phase are being kept for the second phase. This will give information on heterosis effects on fertility and mothering ability. A third phase may evaluate procedures for using heterosis, should the first and second phases of the experiment reveal it to have potential economic value.

The preliminary results involving heterosis effects on some of the traits are presented in Tables 1, 2, 3 and 4. These include results from only the 1960 calf crop. It is emphasized that this is only a progress report and no general conclusions should be drawn from the results at this time.

The results from this one calf crop show the crossbreds to have approximately five percent greater growth rate; their carcasses were slightly fatter, but there was no advantage in grade. Crossbreds had approximately eight percent ad-

**Table 1. Heterosis Effects on Growth Rate
1960 Calf Crop**

	No. born	Birth weight	No. weaned	Weaning weight 200 days	No. fed	Adj. final weight 452 days (steers only)	No. slaughtered	Adj. final weight 550 days (heifers only)
Crossbreds	110	72.6	97	451	48	957	47	745
Straightbreds	100	70.4	82	429	40	914	40	703
Difference (lbs.)		+ 2.2		+ 22		+ 43		+ 42
Heterosis effect (%)		+ 3.1		+ 5.1		+ 4.7		+ 6

**Table 2. Heterosis Effects on Carcass Traits
(Steers only) 1960 Calf Crop**

	Age (days)	Carc. wt.	Ribeye area	Fat thickness (in.)	% kid. fat	Grade
Crossbreds	463.5	607.9	10.76	.82	3.29	Choice
Straightbreds	464.6	576.8	10.32	.78	2.84	Choice
Difference	—1.1	+31.1	+.44	+.04	+.45	

vantage in livability to yearling age and reached puberty (first estrus) 58 days younger and 27 pounds lighter in weight than the straight-breds. Additional calf crops are needed to evaluate more precisely the heterosis effects on these and other traits. The crossbred calves from the second calf crop weaned 18 pounds heavier than the straight-breds.

The second and subsequent calf crops from this experiment are being individually fed to obtain information on heterosis effects on feed efficiency. Additional results from this experiment will be presented as they become available.

Table 3. Heterosis Effects on Percent Calf Crop (Steers and Heifers) 1960 Calf Crop (Cows all 3-year-olds)

	Percent calf crop			
	Birth	10 days after birth	Weaning	Yearling
Crossbreds	89	82	80	80
Straightbreds	89	75	74	72
Difference	0	+ 7	+ 6	+ 8

Table 4. Heterosis Effects on Age at Puberty (Heifers) 1960 Calf Crop

	No.	Age at puberty (days)	Weight at puberty (lbs.)
Crossbreds	47	373	523
Straightbreds	40	431	550
Difference		–58	–27

Dried Beet Pulp and Corn for Fattening Cattle

W. W. Rowden and J. E. Ingalls

Yearling heifers will gain faster, require less feed per pound of gain and reach the choice grade in less time when dried beet pulp is mixed with corn in a self-fed fattening ration. Cattle on this ration will consume less hay than those fed corn as the only concentrate.

These observations were made in a 170 day feed trial which included 200 yearling heifers. The results of feeding a ration of corn vs. a ration of 80 percent corn and 20 percent beet pulp are shown in Table 1. The dried beet pulp used in this experiment was a product sold under the trade name of "LPC Beet Pulp." The LPC stands for liquid protein concentrate. The product has a guarantee of 14 percent crude protein equivalent.

All cattle were started on 5 pounds per day of a concentrate mixture containing 80 percent corn and 20 percent beet pulp. The amount was gradually increased to about 15 pounds per day in 28 days. The beet pulp was gradually eliminated from the ration of the lots which were fed straight corn. After 28 days the concentrate mixtures were fed in self feeders. One hundred pounds of soybean meal was added to 2,000 pounds of the concentrate mixture the last one-third of the feeding period. Second cutting alfalfa hay was fed free choice. Salt and steamed bone meal also were fed free choice.

Heifers fed dried beet pulp and cracked corn gained about 15 percent faster with about 12 percent less feed required per hundredweight gain than the heifers fed only cracked corn as a concentrate. Furthermore, the carcass grades averaged one-third of a grade higher. The poor performance of the cattle fed only corn could probably be attributed to the difficulty in getting and keeping them on full feed. Also, several cattle foundered in the straight corn lots.

The results of this trial agree with those reported in the "49th Annual Feeders Day Progress Report." The data from these trials indicate that cattle will perform better when dried beet pulp is added to corn in a self-fed fattening ration.

Table 1. The Value of LPC Beet Pulp and Corn in Cattle Fattening Rations.

	Lot 1	Lot 2	Lot 3	Lot 4
Grain Mix	100% corn	100% corn	80% corn 20% beet pulp	80% corn 20% beet pulp
Av. daily gain, lbs.	1.96	2.04	2.28	2.32
Av. daily ration, lbs.				
Cracked corn	12.7	13.0	11.4	10.6
LPC beet pulp	0.4	0.4	2.9	2.7
Soybean oil meal	0.5	0.5	0.5	0.5
Alfalfa hay	5.5	5.7	5.1	4.8
Feed required per cwt. gain, lbs.				
Cracked corn	648	640	502	460
LPC beet pulp	18	18	125	115
Soybean oil meal	25	25	24	22
Alfalfa hay	282	279	224	205
Total	973	962	875	802
Carcass grade	High good	High good	Low choice	Low choice

Hormone Implants for Suckling and Weanling Calves[1]

J. K. Matsushima, D. C. Clanton
and Guy N. Baker

Three separate trials were conducted in 1961 to determine the value of testosterone and thyroxine implants in calves. These tests involved 257 head of suckling calves and 91 weanling calves. Neither testosterone nor thyroxine, administered alone or in combination, significantly increased weight gains. The implants did not appear to cause any change in the physical appearance of the calves, nor was there any noticeable difference in the temperament of the treated and non-treated animals.

Trial A included six treatments as shown in Table 1. The thyroxine implants were specially prepared for this test in the form of pellets. The testosterone implant was in the paste form. The calves that received both the thyroxine and testosterone implants were given the preparations in separate ears. The calves were allotted into six groups on a rotational basis as the calves were born. The implants were administered April 25, 1961, when the calves were approximately eight weeks old. The calves were weaned October 17, 1961. During the suckling period the calves were summered in three separate pastures. They were distributed as evenly as possible so that each pasture had a comparable number of calves with each of the six treatments.

Trials B and C included Hereford and Angus-Hereford crossbred calves. The calves in the treated and non-treated groups were allotted according to breeding. The suckling calves were born in March and April, 1961, while the weanling calves were mostly 1960 fall calves. The treated group of the suckling calves were implanted May 4, 1961, with 5 mg. thyroxine paste and 75 mg. testosterone, while the weanling calves were implanted on the same date with 10 mg. thyroxine paste and 100 mg. testosterone. There was no benefit in total gain from the implants (Table 2).

[1] Appreciation is expressed for the cooperation of Wesley F. Hansen of North Platte and Bill Curry of Columbus.

Table 2. Effect of Thyroxine-Testosterone Implant on Suckling and Weanling Calves.

	Control	Implant
Suckling calves		
No. of calves	47	44
Initial weight, lbs.	114	111
Total gain, lbs.	278	278
Weanling calves		
No. of calves	24	25
Initial weight, lbs.	288	292
Total gain, lbs.	208	198

Table 1. Effect of Thyroxine, Testosterone and Combination of Two Hormones on Suckling Calves.

Treatment	Control	Thyroxine 10 mg.	Thyroxine 20 mg.	Testosterone 75 mg.	Thyroxine 10 mg. plus Testosterone 75 mg.	Thyroxine 20 mg. plus Testosterone 75 mg.
No. calves	34	36	35	35	35	33
Initial weight, lbs.	109	112	108	108	106	108
Weaning weight, lbs.	420	428	420	420	421	414
Total gain	311	316	312	318	315	306

Testosterone an

J. K. Matsushima, C. H. Adams,
G. N. Baker and D. C. Clanton

A previous year's test indicated that a combined implant of testosterone and thyroxine was more effective than when either hormone was administered singly or there was no hormone implant. Furthermore, the steers with the two hormone implants produced carcasses with less fat cover and more lean as estimated by the larger rib eye area.

Another experiment was conducted in 1960-61 to find if these same hormones would be more effective if implanted at castration time (four to six weeks of age) rather than at weaning time when the cattle are put in the feedlot for fattening.

The results from a 259-day feeding test did not show any appreciable difference in the performance of steers due to the time of implanting. The various hormone treatments and time of hormone administration and the results of the test are shown in Table 1. The initial weight of the calves on each treatment shows that the calves implanted with a combination of testosterone and thyroxine weaned

Testosterone an

J. K. Matsushima, D. C. Clanton
and Lionel Harris

Yearling steers implanted with a combination of testosterone and thyroxine at the time they were put in the feedlot gained faster and more efficiently than steers not implanted or implanted with either testosterone or thyroxine singly (Table 1). The steers implanted with the combination also produced more desirable carcasses (Table 2). These are the results of an experiment conducted during the winter of 1960-61 at the Scotts Bluff Experiment Station.

Thyroxine Implants for Fattening Steer Calves

approximately twenty-five pounds heavier than the non-implanted calves.

In this test, none of the hormone-treated cattle performed better than the non-treated groups in the feedlot. All through the feeding period a number of cattle showed stiffness in their joints. Some of the cattle became so stiff that they could not move easily. Consequently, seven animals had to be removed from the test. Blood samples were taken on each animal at the time of removal. The vitamin A values on most were near normal, 50 to 70 gamma vitamin A per 100 ml. plasma.

Vitamin A supplement was added to the ration (after the calves had been on test 60 days) at the rate of 30,000 I.U. per head daily for ten days and then reduced to 15,000 I.U. This level was continued through the rest of the experiment. Some of the animals showed symptoms of founder. A number of the animals with slight stiffness appeared to recover after two or three weeks; however, several became stiff periodically.

A possibility of high nitrate in the silage was suspected as the cause of the stiffness. An analysis of the silage showed .85% (on dry basis) ammonia-nitrogen as KNO_3. This could be considered a relatively high level. However, it cannot be proved that the high nitrate in the silage caused the frequent cases of stiffness. The hormone treatments undoubtedly were not to blame for this condition as there were as many stiff animals in the non-implanted groups as the implanted groups.

In view of the frequent stiffness in all lots, there was a large difference in the performance of the cattle within each treatment. This could account for the lack of agreement between results of this test to those of a similar test a year ago.

Table 1. Performance of Fattening Steer Calves Implanted with Testosterone, Thyroxine, or Combination of the Two Hormones at Different Dates.

Time of implant	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Implant Material[a]	None	None	T	T	Th_1	Th_1	Th_2	Th_2	Th_1-T	Th_1-T	Th_2-T	Th_2-T
No. Steers per lot	8	8	6	6	7	7	7	6	7	6	7	7
Initial Wt.—Lbs.	437	446	440	448	454	447	456	442	470	444	468	449
Final Wt.—Lbs.	956	972	930	991	954	955	964	965	1038	993	991	972
Avg. Daily Gain—Lbs.	2.00	2.03	1.89	2.10	1.93	1.96	1.96	2.02	2.19	2.12	2.02	2.02
Total Digestible Nutrients per hundred lbs. gain[b]	581	594	619	574	619	628	617	600	583	548	607	599
Dress Percent[c]	60.8	60.4	62.0	61.6	61.3	61.9	60.7	61.7	61.6	61.4	60.1	61.3
Carcass Score[d]	16.8	16.0	17.3	17.2	16.4	17.1	17.8	16.6	16.3	16.3	16.3	16.6
Marbling Score[e]	10.6	9.9	11.2	10.7	10.7	11.0	11.7	10.6	10.4	10.2	10.0	10.1
Fat Thickness—~~cm.~~ mm	21.1	20.7	21.2	20.4	19.6	18.8	20.9	20.2	22.8	19.5	17.8	18.9
Rib eye Area—sq. in.	10.0	9.9	10.2	10.0	10.1	10.4	10.2	10.8	10.7	10.0	10.3	10.3

a Fall implant, Th_1 = 20 mg. thyroxine; Th_2 = 40 mg. thyroxine; T = 100 mg. testosterone; Spring implant, Th_1 = 10 mg. thyroxine; Th_2 = 20 mg. thyroxine; T = 75 mg. testosterone.
b Calculated from average T.D.N. values.
c Hot carcass weight—by slaughter weight x 100.
d Carcass grade score: 16, 17, 18 = low, average and high choice.
e Higher the number, greater the marbling; 15 is the highest score.

Thyroxine Implants for Yearling Steers

Five treatments were used in the experiment. Each treatment was duplicated once. The only difference in the duplicate treatments was in the source of roughage. One group was fed corn silage and the other beet top silage. The concentrate was a mixture of ground shelled corn and beet pulp pellets. One-half pound of soybean oil meal and 2 pounds of dehydrated alfalfa pellets were fed per head daily.

The treatments were:

1. O-O; no implant at the start

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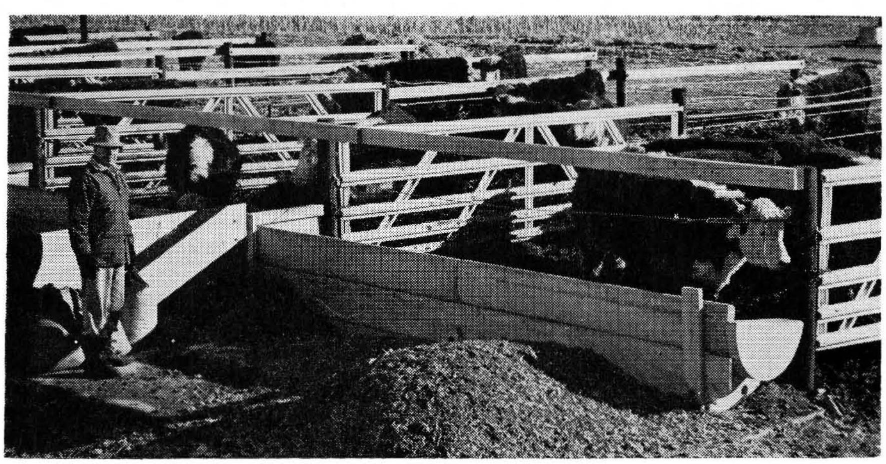


Feeding pens at Scotts Bluff Experiment Station.

Implants . . .

(continued from page 7)

of the grazing season or the fattening period.

2. O-T; no implant at the start of the grazing season, but implanted with 150 mg. testosterone enanthate at the start of the fattening period.
3. O-Th; no implant at the start of the grazing season, but implanted with 40 mg. Sodium L-thyroxine at the start of the fattening period.
4. O-TTh; no implant at the start of the grazing season, but implanted with both testosterone and thyroxine at the start of the fattening period. The levels used in treatments 2 and 3 were used.
5. TTh-O; a combination implant of 100 mg. testosterone ananthate and 40 mg. Sodium L-thyroxine at the start of the grazing season and no implant at the start of the fattening period.

Testosterone and thyroxine implants used separately did not affect gains or carcasses (Table 1 and 2). The testosterone-thyroxine combination implanted at the start of the grazing season was not as effective as the same treatment when administered at the start of the fattening period. There was little difference in the gains of the steers implanted at the start of the pasture season and those not implanted.

Table 1. Feedlot Data of Testosterone and Thyroxine Implanted Yearling Steers.

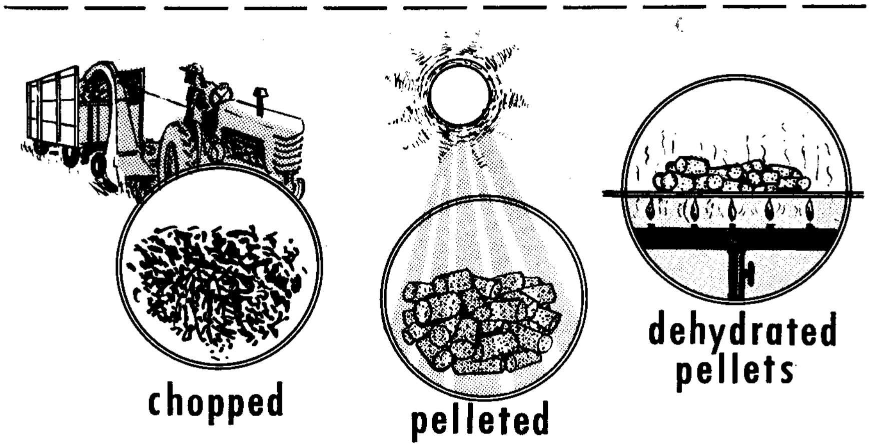
Treatment	O-O	O-T	O-Th	O-TTh	TTh-O
No. steers	15	16	16	16	13
Initial wt., lbs.	727	723	721	723	731
Final wt., lbs.	1121	1117	1124	1151	1142
Avg. daily gain, lbs.	2.48	2.48	2.53	2.69	2.59
Feed Consumed/Cwt. Gain:					
Grain mix[1]	577	568	569	561	583
Soybean oil meal	20	20	20	19	19
Dehy. alfalfa pellets	81	81	79	74	77
Silage	1419	1407	1368	1327	1378

[1] Started on 50% ground shelled corn and 50% dried beet pulp and later changed to 65% corn and 35% beet pulp.

Table 2. Slaughter and Carcass Data of Testosterone and Thyroxine Implanted Yearling Steers.

Treatment	O-O	O-T	O-Th	O-TTh	TTh-O
Carcass wt., lbs.	688	691	692	711	719
Dress percent[1]	61.5	61.8	61.5	61.7	62.6
Carcass grade score[2]	16.8	16.9	17.0	17.2	16.5
Rib eye area, sq. in.[3]	10.9	11.1	11.2	11.1	11.2
Fat thickness, cm.	2.12	2.15	2.02	2.07	1.98

[1] Hot carcass weight divided by live weight at packing plant.
[2] Carcass grade: 18 = high choice; 17 = average choice; 16 = low choice.
[3] Measurement taken between 8th and 9th rib.



Three Methods of Processing Alfalfa When Fed to Fattening Yearling Steers

Guy N. Baker and Kemal Biyikoglu

An experiment was started at the North Platte Experiment Station in September 1959 to determine the relative feeding value of chopped alfalfa hay, pelleted alfalfa hay, pelleted dehydrated alfalfa hay, and a combination of chopped alfalfa hay and pelleted dehydrated alfalfa. These were fed both with and without an implant of 24 mgs. of diethyl stilbestrol. In the second year, 1960-1961, one-half pound of 44 percent soybean oilmeal pellets was added to the alfalfa rations in a third group.

To help eliminate feeding value differences because of origin of the hay it was cut from the same field as nearly on the same day as possible.

Yearling steers were used in the 1959-1960 test. Alfalfa rations consisted daily of five pounds of chopped suncured, five pounds of pelleted suncured, five pounds of pelleted dehydrated or five pounds of a mixture of 20 percent pelleted dehydrated and 80 percent chopped suncured.

1959-1960 Test

Results of the first year's test are shown in Table 1. According to this data there was very little, if any, advantage between chopping or pelleting the alfalfa hay for fattening steers other than the handling advantage.

Feeding all dehydrated alfalfa pellets resulted in faster gains and a savings of 95.2 pounds of rolled corn for 100 pounds of gain as compared to chopped alfalfa. Feeding pelleted alfalfa required 56.1 less pounds of rolled corn for 100 pounds of gain than did chopped alfalfa.

Table 1. First year's test Sept. 23, 1959 to May 6, 1960—226 days. Lots 21 to 24 received 24 mg. stilbestrol implant on October 21, 1959. Eight steers per lot.

	Lot 17	Lot 18	Lot 19	Lot 20	Lot 21	Lot 22	Lot 23	Lot 24[a]
Initial weight per head	722.5	718.4	717.0	722.1	721.6	723.5	722.9	722.0
Gain per head	411.5	447.2	437.0	447.9	410.7	474.0	513.8	464.9
Ave. daily gain	1.82	1.98	1.93	1.98	1.82	2.10	2.27	2.06
Average daily feed per head:								
Rolled yellow corn	14.50	14.73	14.09	15.15	14.76	15.81	15.64	15.45
Chopped alfalfa hay	5.48	0.77	0.76	4.67	5.59	0.65	0.66	4.66
Pelleted alfalfa hay	...	5.00	...	...	...	5.00	...	...
Pelleted dehy. alfalfa	...	...	5.00	0.97	...	...	5.00	1.00
Corn silage	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.37
Feed for 100 pounds gain								
Rolled yellow corn	796.5	744.6	730.4	768.9	812.4	753.9	688.0	751.0
Chopped alfalfa hay	300.7	39.0	39.5	236.6	308.0	31.0	29.1	226.5
Pelleted alfalfa hay	...	252.7	...	...	...	238.4	...	...
Pelleted dehy. alfalfa	...	...	259.1	49.4	...	...	220.0	48.4
Corn silage	185.4	170.5	174.9	171.3	185.8	160.9	148.5	164.0

[a] One steer died 2/10/60.

Implanting the steers with 24 mg of diethystilbestrol 28 days after the start of the project resulted in 0.13 pounds faster daily gains and a savings in 100 pounds of gain of 10.1 pounds of corn, 5.6 pounds of chopped alfalfa, 1.7 pounds of pelleted alfalfa, 10.0 pounds of pelleted dehydrated alfalfa and 11.0 pounds of corn silage.

1960-1961 Test

In this test 12 lots of 10 head each of yearling steers were used. The first 8 lots were a repeat of the 1959-1960 tests except that 24 mgs of diethylstilbestrol were implanted 56 days after the cattle were put on feed. The four extra lots were fed similar rations except one half pound of 44 percent soybean oilmeal pellets was added per head daily and no diethylstilbestrol was used. Ground ear corn was used to bring the steers to full feed.

For results see Table 2.

It also shows relative costs for 100 pounds of gain by each treatment. No cost was added for the 24 mg implant of diethylstilbestrol.

Results

Lots 8, 12 and 16, which received pelleted alfalfa hay, made higher average daily gains than lots fed alfalfa hay processed by other methods. Lots 8, 12 and 16 also required less corn per 100 pounds of gain and approximately the same amount of other feeds as the other lots.

Lots 15 to 18, that received 0.5 pound of soybean oil meal pellets daily, gained 0.16 pound more daily than lots 7 to 10, but did not produce this gain significantly cheaper.

In both years' tests the use of 24 mgs. of diethylstilbestrol increased the rate and economy of gain. The addition of 0.5 soybean oil meal pellets to the ration increased the rate of gain but did not reduce the cost of gain.

Table 2. Second year's test. Replications 10 head per lot beginning October 12, 1960, and continuing 196 days to April 26, 1961, for lots 11 and 14 and 203 days to May 3 for lots 7-10 and 15-18.

Lot No.	Initial Wt.	Final Wt.	Gain Per Head	Ave. Daily Gain	Pounds Feed Consumed for 100 lbs. Gain: Ground Ear Corn	Rolled Shelled Corn	Corn Silage	Chopped Alfalfa Hay	Pelleted Sun Cured Alfalfa	Dehy. Alfalfa Pelelts	Soybean Meal Pellets	Feed Cost 100 lb. Gain
7	727	1134	407	2.01	116.8	605.0	184.7	286.2	...	...	...	$17.25
8	731	1197	436	2.29	104.9	562.4	161.6	58.2	218.1	...	...	16.73
9	731	1138	407	2.00	122.5	617.2	185.0	66.7	...	249.8	...	19.34
10	734	1167	433	2.13	108.7	565.6	173.6	220.4	...	46.9	...	16.35
Ave.	731	1152	421	2.14	110.8	587.6	176.2	156.9	54.5	74.2	...	17.42
11	728	1234	506	2.58	97.0	531.1	132.0	192.2	...	...	...	$14.14
12	734	1296	563	2.87	86.9	511.2	118.7	51.2	174.2	...	...	14.53
13	734	1283	549	2.80	88.9	529.3	121.6	52.2	...	178.4	...	15.44
14	733	1262	529	2.70	91.5	521.1	126.3	154.9	...	37.1	...	14.05
Ave.	732	1269	537	2.72	91.1	523.2	124.7	112.6	43.6	53.9	...	14.54
15	738	1197	458	2.26	101.2	554.3	164.0	250.4	...	...	22.1	$16.42
16	731	1216	485	2.39	102.1	528.7	155.1	52.0	209.3	...	20.9	16.67
17	730	1215	485	2.39	110.3	538.7	155.1	55.7	...	209.3	20.9	17.54
18	734	1172	438	2.16	113.9	567.2	171.8	217.0	...	46.4	23.2	17.35
Ave.	734	1200	466	2.30	106.8	547.2	161.5	143.8	52.3	63.9	21.8	17.00
											Grand Ave.	$16.32

Cost for 100 lbs. feed—ground ear corn $1.50, rolled shelled corn $1.80, soybean meal pellets 44% protein $4.00, corn silage $0.40, chopped alfalfa hay $1.35, pelleted alfalfa hay $1.65, dehydrated alfalfa pellets $1.90.

Calves and feeding shed at Northeast Experiment Station.

Enzymes with Varying Protein Levels for Finishing Cattle

Walter Tolman, A. D. Flowerday and J. K. Matsushima

Fattening steer calves receiving a 12 percent protein ration gained more rapidly and produced better carcasses than those receiving an 11 percent protein ration (Ration 1 versus 6, Table 1). When enzymes were added to the rations, irrespective of the amount, the calves receiving the 11 percent protein ration gained more, but those receiving the 12 percent protein ration did not (Table 1). However, the differences in gains and carcasses were not significant. The average gain of all lots of steers that received the 11 percent protein ration was the same as for all lots of steers that received the 12 percent protein. These were the results of an experiment during 1961 at the Northeast Experiment Station, Concord, Nebraska.

The daily ration used in the experiment was a full feed of corn and 2.5 pounds each of prairie hay and alfalfa hay. One pound of soybean oil meal was used in the higher protein ration and 0.4 pound in the lower protein ration. Enzymes were fed at three levels, and in two lots during alternate months (Rations 5 and 10). In these two lots 0.02 pound enzymes were fed for 28 days followed by no enzymes the next 28 days. This procedure was repeated throughout the experiment. The enzymes fed were a commercial product, the result of wheat bran fermentation by both bacteria and fungus. They were carbohydrate and protein digesting enzymes.

The calves were high quality Herefords that had been purchased in the Sandhills. Most of the calves were sired by one bull through artificial insemination.

The calves received 5 mg. stilbestrol per head daily. Vitamin A was supplemented at the rate of 1,000 International Units per 100 pounds live weight until April 25, when the rate was increased to 2,000 I.U. per 100 pounds liveweight. Trace mineral, block salt and a mixture of loose salt and bonemeal, equal parts, were available free choice.

The difference in gains, feed efficiency and carcass values, when studied by statistical analysis, were not considered statistically significant. Further studies are being conducted at the Northeast Nebraska Experiment Station with the hope that enough information will be developed to justify recommendations as to enzyme feeding.

Table 1. Performance of Steer Calves Fed Enzymes at Two Protein Levels, January 10, 1961, to August 22, 1961 (224 days).

No. steers/lot	11% Protein Ration					12% Protein Ration				
	10	10	10	10	10	10	10	10	9	10
Avg. daily ration, lbs.[1]										
Enzyme	.000	.005	.010	.020	Int.	.000	.005	.010	.020	Int.
Soybean oil meal	0.4	0.4	0.4	0.4	0.4	1.0	1.0	1.0	1.0	1.0
Corn	12.5	13.4	12.7	12.6	12.4	12.6	11.6	12.1	12.0	11.6
Prairie hay	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Alfalfa hay	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Average weights, lbs.										
Initial liveweight	409	407	408	409	413	415	412	409	405	407
Final liveweight	933	989	951	956	941	977	938	947	945	934
Daily gain	2.34	2.60	2.42	2.44	2.36	2.51	2.35	2.40	2.41	2.35
Feed/cwt. gain, lbs.										
Concentrates	561	530	541	530	543	543	535	548	539	538
Roughage	214	192	206	204	212	200	212	208	208	212
Carcass data										
Average carcass wt.	558	599	570	585	562	588	572	581	575	565
Dressing %[2]	59.8	60.5	59.9	61.1	59.7	60.1	60.9	61.3	60.8	61.3
Grade[3]	14.4	15.3	15.1	15.0	14.8	15.2	14.9	15.4	15.0	15.2
Rib eye area, sq. in.	9.8	10.7	10.3	10.4	9.8	10.5	10.6	10.2	11.0	10.0

[1] Vitamin A supplement was fed at the rate of 1,000 I.U. daily per 100 pounds liveweight until April 25, when the rate was increased to 2,000 I.U. per 100 pounds liveweight. Salt, trace mineral salt and bonemeal-salt mixture were available free choice.
[2] Dressing percent is calculated by dividing chilled carcass weight by experiment (live animal) final weight.
[3] Carcass grade score: 16 = low choice, 15 = high good, 14 = average good.

Cobalt Supplementation on Nebraska Ranges[1]

D. C. Clanton and W. W. Rowden

The use of cobalt "bullets" did not increase gains in calves and yearlings when tested during two years at three different locations in the range area of Nebraska (Table 1).

It is generally accepted that cobalt deficiency is associated with special soil types. Nebraska has been suggested as a possible cobalt deficient area. With this in mind, comparative experiments were conducted on two ranches in the Sandhills and at the Fort Robinson Research Station to determine if cobalt supplementation would increase gains in growing cattle.

A 20-gram bullet containing 90 percent cobalt oxide was used as the cobalt supplement. The bullet was administered with a balling gun. The weight of the bullet causes it to remain in the reticulum area of the stomach. The bullet is dissolved very slowly so that there is sustained release of cobalt in the rumen over a long period. The cobalt bullet is adapted for experimental work because it permits control of the cobalt intake. It is known that each animal receives a given amount of supplement. Such control is not possible when using free choice mineral supplements. The disadvantage of the cobalt bullet is that occasionally an animal will regurgitate the bullet and it is lost.

Two groups of calves, one in the Sandhills at Ranch A and one at Fort Robinson, were treated with cobalt bullets in December 1960. Comparable groups were left untreated. The treated and untreated calves were ranged together. There were no differences in the winter or summer gains of the two groups of cattle at either location.

Another group of yearling steers was treated at Ranch A in May 1960. Their summer gains were similar to a comparable group of steers that were not treated. The two groups of steers ran together during the experiment.

At Ranch B replacement yearling heifers were used. One-half of the heifers were treated in August 1960 with a cobalt bullet. The gains of the two groups of heifers were similar from August 1960 to May 1961.

From this data it can be concluded that cobalt supplementation did not improve gains in growing cattle wintered on the range in Nebraska.

Comparisons were made on short- and mid-grass winter ranges (Fort Robinson) and on tall-grass winter ranges (Ranches A and B). Soil type, rainfall and vegetative composition were different at the two extreme locations. Ranches A and B were typical Sandhills ranches.

[1] The cooperation of Don Cox and Reed Hamilton-Keith Dubry made the experiment possible. They owned the cattle and pasture and supplied the necessary labor and facilities to conduct the experiment at Ranches A and B.

Cobalt bullets.

Table 1. The Effect of Cobalt Supplementation on Average Daily Gains in Four Comparisons at Three Locations.

Ranch Location[a]	Class and No. of Cattle	Average Daily Gains, lbs. Winter	Summer	Winter and Summer
A	Yearling steers		5/13/60–9/14/60	
Cobalt	42 head		2.12	
Control	44 head		2.16	
A	Steer calves		12/26/60–9/7/61	
Cobalt	38 head	0.37	1.90	1.10
Control	38 head	0.42	1.80	1.08
B	Yearling heifers		8/3/60–5/3/61	
Cobalt	31 head	0.32		
Control	32 head	0.31		
Fort Robinson	Heifer calves		12/12/60–9/7/61	
Cobalt	67 head	0.62	1.63	1.12
Control	66 head	0.60	1.61	1.10

[a] Ranches A and B were typical Sandhills ranches. The vegetation was predominantly tall grasses. At Fort Robinson the vegetation is short and mid-grasses.

J. K. Matsushima,
M. W. McCullough and
D. C. Clanton

Plant Estrogens in Cattle Rations

Previous experiments show that cattle gain faster with dehydrated alfalfa or alfalfa hay included in fattening rations. Furthermore, experiments show that stilbestrol has less effect on cattle gains when dehydrated alfalfa is increased from 1½ to 4 pounds in the daily ration. Speculation is that plant estrogens are responsible for these results. In order to test the speculation, three separate batches of dehydrated alfalfa containing different levels of coumestrol (predominant estrogen in alfalfa) were fed to fattening steers.

Dehydrated alfalfa samples of three levels of estrogenic activity—0, 122, and 245 parts per million (ppm) coumestrol, were fed as the protein supplement in this experiment. Four pounds of dehydrated alfalfa pellets were fed daily with a basic ration composed of 75 percent ground ear corn, 20 percent dried beet pulp and 5 percent dried molasses. Prairie hay was fed at the rate of three-fourths of a pound per steer daily. A preformed vitamin A supplement was included in the daily ration at the rate of 12,000 International Units. A mineral mixture composed of 20 percent trace mineral supplement, 40 percent iodized salt, and 40 percent steamed bonemeal was fed free-choice. Iodized block salt also was available. Each dehydrated alfalfa sample was fed with and without stilbestrol. This made it possible to determine the combined effects, if any, of stilbestrol and coumestrol.

All of the steers were individually fed. Two digestion trials were completed during the 159-day feeding period. This afforded an opportunity to relate the effects of different levels of estrogen in dehydrated alfalfa to the digestibility of feed and general performance of the animals.

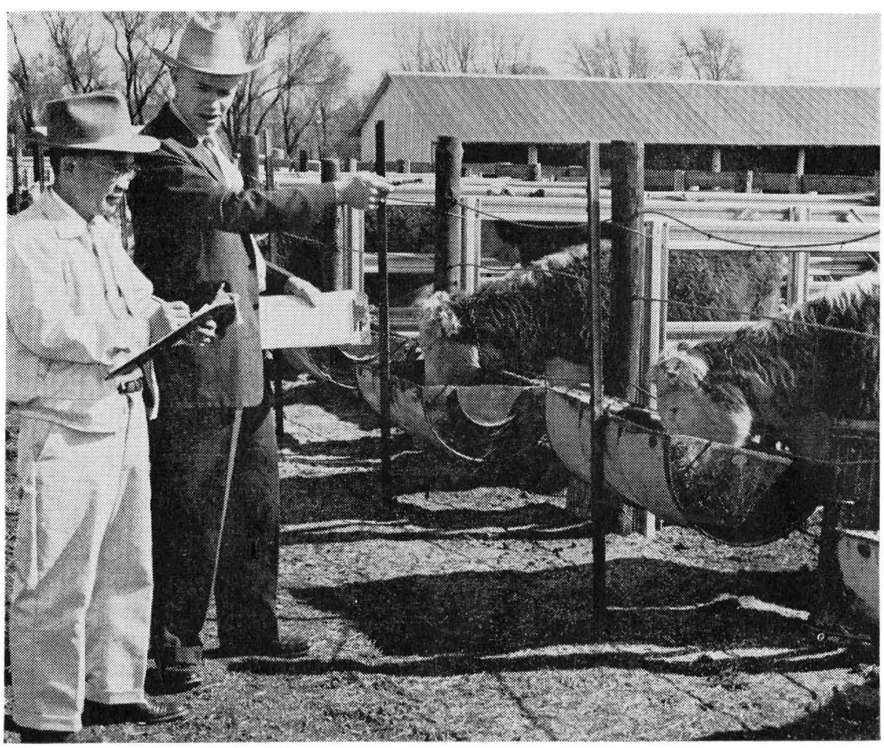
Results

The greatest response in gain and efficiency of gain was noted when stilbestrol was fed in the ration which contained the low estrogen dehydrated alfalfa (Table 1). No significant difference in gain was found among the three groups (without stilbestrol) fed the three levels of coumestrol from the dehydrated alfalfa. This would indicate: (1) that coumestrol is not the factor in dehydrated alfalfa which contributes to greater gains in fattening cattle; or, (2) levels of coumestrol ranging from 122 to 245 ppm. are too high; or, (3) the quantity of major nutrients in the three samples of dehydrated alfalfa was so variable (Table 2) that the estrogenic effects were masked.

None of the three dehydrated alfalfa samples had any effect on carcass grade, ribeye area, marbling, or thickness of fat over the rib section. The inclusion of 10 mg. stilbestrol also had no effect on these same carcass measurements.

Data from the digestion trials was not conclusive.

Further research is needed to determine if it is the estrogen or some unknown factor in alfalfa that generally increases the performance of beef cattle, particularly when fed in a fattening ration.



Dr. Matsushima and Dr. Clanton inspect individual feeders in heifer experiment.

Protein, Energy

D. C. Clanton and
D. R. Zimmerman

The first year's results of a project designed to establish protein and energy requirements for bred heifers was reported in the 49th Annual Feeders Day Progress Report. The second year's results have been added to those of the first and appear in this report.

The project was started in the fall of 1959. Thirty-two bred yearling heifers were divided into four groups of eight head each. They were individually fed one of four rations (Table 1) for 140 days during the winter of 1959-60 and again during the winter of 1960-61. Each group received the same ration both winters.

The low levels of protein and

Table 1. Performance of Cattle When Fed Dehydrated Alfalfa with Varying Levels of Estrogenic Activity.

	Low Estrogen (0 ppm) Coumestrol	Medium Estrogen (122 ppm) Coumestrol	High Estrogen (245 ppm) Coumestrol	Low Estrogen (0 ppm) Coumestrol	Medium Estrogen (122 ppm) Coumestrol	High Estrogen (245 ppm) Coumestrol
	No stilbestrol			With stilbestrol		
Lot number	2	4	6	1	3	5
No. steers per lot	7	7	7	7	7	7
Initial weight, lbs.	730	729	726	728	729	733
Final weight, lbs.	1131	1131	1116	1179	1163	1169
Total gain, lbs.	401	402	390	451	434	436
Avg. daily gain, lbs.	2.52	2.53	2.45	2.84	2.73	2.74
Feed required/cwt. gain:						
Ground ear corn	584	589	595	534	570	546
Dried beet pulp	162	163	165	148	158	152
Dried molasses	27	33	34	30	32	30
Dehydrated alfalfa pellets	158	156	162	142	141	145
Prairie hay	36	36	37	32	33	33
1. Dressing percent[a]	61.2	60.2	60.0	60.2	59.9	60.5
2. Carcass grade[b]	17.9	17.6	16.9	16.6	17.6	16.6
3. Marbling score[c]	11.6	11.4	10.9	10.6	11.2	10.3
4. Fat thickness, mm.[d]	24.6	26.2	24.6	26.8	25.2	24.9
5. Ribeye area, sq. in.	11.88	11.45	11.23	11.54	11.26	12.03

a Dressing % = hot carcass weight / slaughter weight

b Carcass grade score, 16, 17, 18 = low, average and high choice.

c Marbling score = higher the number, more abundant the marbling.

d Fat thickness = average of three measurements taken between the 8th and 9th rib.

Table 2. Composition of the Dehydrated Alfalfa Samples with Different Estrogenic Potencies and Other Ration Ingredients.

	Coumestrol, P.P.M.	Dry Matter, %	Crude Protein, %	Ether Extract, %	Crude Fiber, %	Ash, %	Gross Energy kcal per gm.
Low estrogen	0	90.7	16.8	3.2	27.5	9.6	4.1
Medium estrogen	122	89.8	17.6	2.8	26.4	9.7	3.9
High estrogen	245	90.2	19.1	3.0	25.8	8.5	4.1
Prairie hay	0	90.9	6.1	1.9	34.7	7.1	3.8
Basic mixture[a]	0	88.4	8.5	2.1	10.3	2.5	3.7

a Basic mixture = 75% ground ear corn, 22.5% dried beet pulp, and 2.5% dried molasses.

Requirements for Bred Heifers

energy were calculated to provide for maintenance only. This was approximately 50 percent of the crude protein and digestible energy recommended by the National Research Council as minimum needs for optimum production. The high protein and high energy levels were calculated to provide one and one-half times the amount required for maintenance. This was approximately 75 percent of the levels recommended by the National Research Council.

Digestion and metabolism trials were conducted both years, using half of the heifers in the experiment. The digestible protein content of the rations used in 1960 was close to the calculated values, but the digestible energy content was lower (Table 1). The two high energy rations (2 and 4) were much lower. The difference between the low and high energy rations was not as great as planned.

The second year an attempt was made to repeat the same rations. The level of protein fed was similar but the energy level appears different (Table 1). Pelleted roughage was used during the second winter to make feeding easier. After 100 days part of the ration was coarse roughage. It is felt the pelleted roughage affected the digestibility and metabolism of the energy in the ration. All pelleted roughage was used during the digestion and metabolism trials.

The measures used in the experiment were—growth, condition and weight changes, feed consumption during the first summer, milk production, fertility and calf production.

The heifers on the low protein-low energy ration lost an average of 10 pounds during the experimental period the first year (Figure 1). Those on the low protein-high energy ration gained an average of 61 pounds; those on the high protein-low energy ration gained an average of 20 pounds; and those on the high protein-high energy ration gained an average of 116 pounds.

The cows that gained the least, or lost weight during the first winter, gained the most during the following summer (Figure 1). However, they did not catch up to the high gaining heifers.

The heifers were also individually fed during the first summer.

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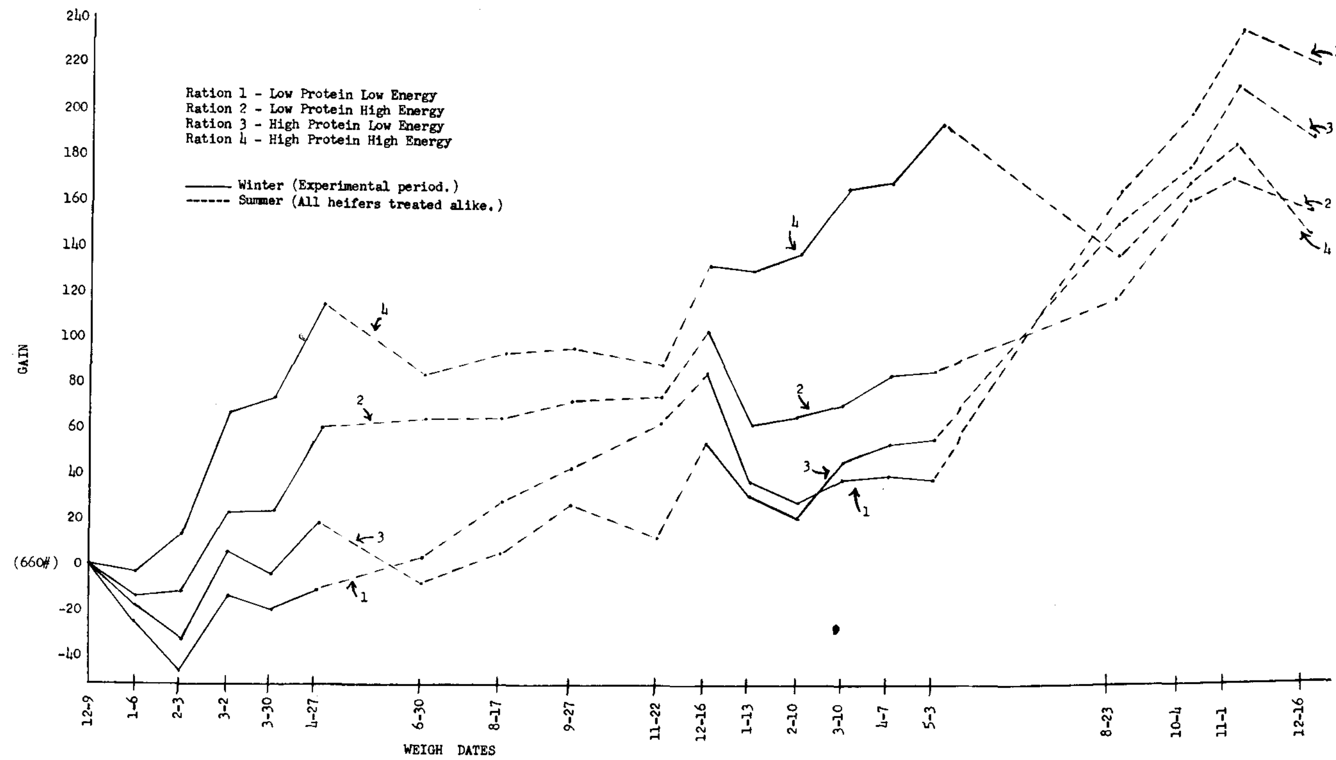

Figure 1. Average weight gains of heifers from December 9, 1959 to December 16, 1961.

At the beginning of calving the heifers were all started on a common ration of three pounds of corn and all the alfalfa hay they could eat. There was little difference in the amount of total feed eaten by each group. Heifers that received Ration 1 during the winter ate more hay per hundred pounds of body weight. However, this was a reflection from their loss in weight during the winter.

The weight changes during the second experimental feeding period (December 16, 1960 to May 3, 1961) were similar to those in the first experimental period (Figure 1). The exception was the heifers that received the high energy rations. They did not gain as much weight the second year, in fact those on Ration 2 lost weight. The average weight gains or losses were: Ration 1, −46; Ration 2, −17; Ration 3, +3; and Ration 4, +64. During the second summer the heifers that had received Rations 1 and 3 gained more weight than those that had received Rations 2 and 4. This was because all but two of the heifers were dry. They failed to breed back following first calving. When heifers made large weight gains during the winter they had large weight losses during the summer (Ration 4, Figure 1).

The growth of the heifers, as reflected by measures of the height at the withers show that the growth was closely related to the plane of winter nutrition (Figure 2). The heifers fed the high energy rations grew significantly more prior to May 1961 than those fed the low energy rations. The effect of two protein levels on growth was not significant. However, the heifers

Table 1. The Daily Ration for a 695 Pound Heifer.[a]

	1 Low Protein Low Energy	2 Low Protein High Energy	3 High Protein Low Energy	4 High Protein High Energy
Pounds per day	12	12	12	12
1960				
Crude protein				
Percent	6.20	6.90	9.50	10.20
Pounds	0.74	0.83	1.14	1.22
Digestible protein				
Percent	2.30	2.90	5.40	5.60
Pound	0.28	0.35	0.65	0.67
Digestible energy				
Kilocalories/lb.	794	1,007	851	1,074
Kilocalories/day	9,528	12,084	10,212	12,888
Metabolizable energy				
Kilocalories/lb.	669	862	713	916
Kilocalories/day	8,028	10,344	8,556	10,992
1961				
Crude protein				
Percent	6.14	5.46	10.50	9.83
Pounds	0.74	0.66	1.26	1.18
Digestible protein				
Percent	3.02	2.94	5.43	5.84
Pound	0.36	0.35	0.65	0.70
Digestible energy				
Kilocalories/lb.	859	941	913	1,032
Kilocalories/day	10,308	11,292	10,956	12,384
Metabolizable energy				
Kilocalories/lb.	831	925	884	992
Kilocalories/day	9,972	11,100	10,608	11,904

[a] The amount of the ration fed each heifer was based on her body weight.

fed low protein grew more than those fed high protein. Possibly this growth was at the expense of production, because the heifers fed the high protein ration produced the most milk. The heifers that had received the low protein rations grew faster during the lactation period (Figure 2).

The change in body condition of the heifers as reflected by the change in heart girth circumference is shown in Figure 3. Varying the energy level had a significant effect on body condition; varying the protein level did not. Those heifers that gained the most condition during the winter lost the most during the summer and vice versa (Figure 3). Again it must be remembered that most of the heifers that had received the low energy rations were dry during the second summer. This would account for their increase in condition during the summer.

Milk production was determined by weighing the calves before and after nursing. The increase in calf weight was recorded as milk produced. Five 24-hour periods were measured during both summers (Table 2). The cows that received the high protein rations produced the most milk both years.

Because of limited numbers, the calf production data (Table 3) is not too meaningful. The calves from the heifers on the higher planes of nutrition were heaviest at birth.

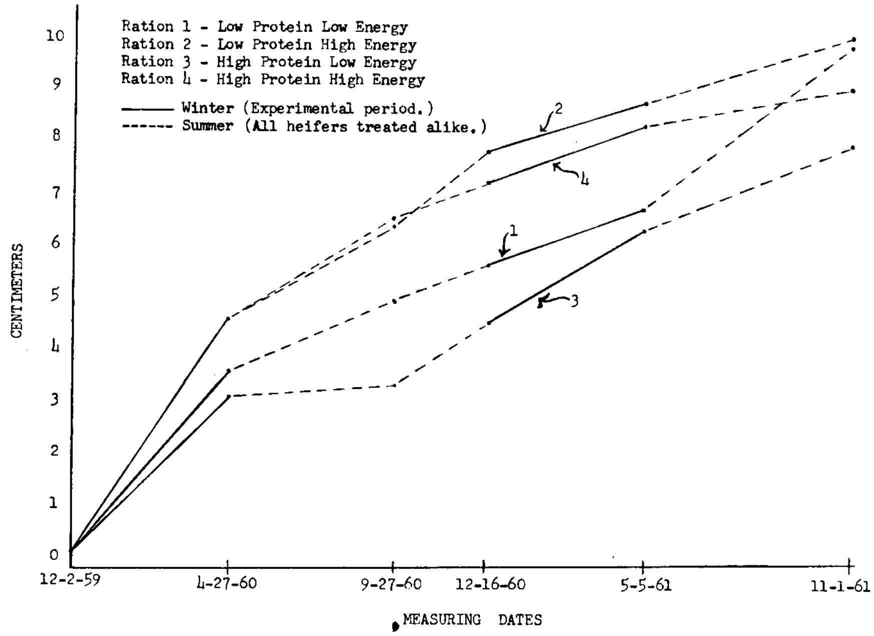

Figure 2. Average gains in wither height of heifers from December 2, 1959 to November 1, 1961.

The heifers fed the high protein-low energy ration weaned the heaviest calves in 1960; however, this difference was not significant. As shown in Table 2, the higher milk production during the latter part of the lactation period must have contributed to the heavier calves at weaning time.

The calves produced the first year by the low protein-high energy fed cows were heavier at weaning than those produced by the high protein-high energy fed cows; however, they were lighter the second year. This indicates protein deficiency may have a long time effect rather than a short time effect on production.

The level of energy fed during the first winter had a striking effect on the interval between first calving and first heat (Table 4). On the average, the heifers fed high energy rations came in heat near 50 days following calving, whereas the heifers fed the low energy rations took over 140 days. When considering all measures of fertility the heifers fed the high protein-high energy ration performed most favorably. It is interesting to note the heifers fed the low protein-high energy ration did not conceive as readily as the heifers fed the high protein-high energy ration.

The delay in onset of estrus following first calving (1960) produced by low energy diets (Rations 1 and 3) essentially prevented the comparison of the effect of energy level on reproductive performance following calving the second year (1961). This was because it was not possible to establish the level of reproductive performance for groups 1 and 3 with the few numbers of wet cows available (two per group). Also, the heat checks on

(continued on next page)

Table 2. Average Milk Production Measured at Four-Week Intervals in Pounds for a 24 Hour Period.[a]

Weeks After Calving	1 Low Protein Low Energy	2 Low Protein High Energy	3 High Protein Low Energy	4 High Protein High Energy
1960				
2	12.1	11.6	13.3	12.7
6	10.9	12.0	9.6	12.1
10	10.4	11.2	9.1	12.0
14	8.1	7.4	10.1	10.1
18	6.4	6.6	7.4	6.5
Avg.	9.6	9.7	9.9	10.7
1961				
2	7.8	9.4	12.2	12.0
6	9.5	9.5	11.0	10.2
10	9.2	9.0	11.0	9.3
14	9.8	7.5	9.2	9.8
18	8.5	7.8	6.5	8.9
Avg.	9.0	8.6	10.0	10.0

[a] The 1960 data is the average of 8 heifers. The 1961 data is the average of 2 heifers on Ration 1 and 3 and 6 heifers on Ration 2 and 4.

the cows for a time during the summer of 1961 were found to be somewhat unreliable when checked against rectal palpation data. During this period, the date of the formation of the first corpus luteum was substituted for the date of first heat. It is recognized that this involves a certain risk because quiet ovulations may have occurred in some of the cows. However, the risk is considered slight because of the low frequency of quiet ovulations observed in all the cows the first year and in cows which had fully reliable heat checks prior to their first estrus the second year. Also the number of cases where a substitution was necessary was equal for the groups involved.

The few cows providing data on the low energy rations had comparable intervals from calving to first heat, but settled less readily than the high energy cows. Level of protein had no obvious effect on either interval from calving to first heat or fertility, when compared on the high energy regimen (Ration 2 vs. Ration 4). Small numbers prevented comparison of protein levels on the low energy regimen.

Conclusions

The high protein-low energy ration used in this experiment probably came the closest of any of the rations to simulating the protein and energy intake of many bred heifers wintered on the range. These heifers produced well (Tables 2 and 3), but did it at the expense of their own well being (Figures 1, 2 and 3), and at the expense of later performance (Table 4).

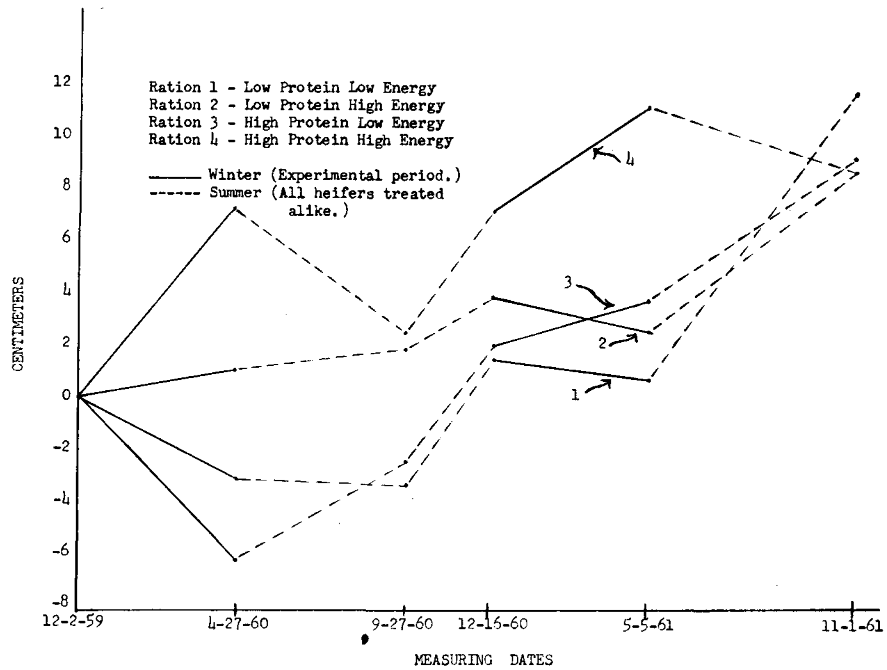

Figure 3. Average change in heart girth circumference of heifers from December 2, 1959 to November 1, 1961.

The heifers fed the low protein rations during the winter gained weight and condition during the summer regardless of their energy intake during the winter. The heifers fed high protein rations did not gain in weight and condition but produced the most milk. Apparently, the heifers fed the low protein ration used their nutrient intake during the summer to build their own body rather than produce milk. Regarding only the development of the heifer, it was harmful to feed the high protein ration without doing the same with energy. Evidently there is a desirable balance between protein and energy balance during the winter.

The most striking results were the effects of varied energy intake during the winter on the interval between calving and the first heat period (Table 4). The heifers fed the high energy rations outperformed the heifers fed the low energy rations in most respects.

It was planned to repeat the experiment through several years with these cows to observe accumulative effects, but because of the low conception rate of the heifers fed the low energy rations the energy variable has dropped out of the experiment. More data is being collected on the effects of the two protein levels.

Table 3. Average Birth and Weaning Weights of Calves.

	1 Low Protein Low Energy	2 Low Protein High Energy	3 High Protein Low Energy	4 High Protein High Energy
1960				
Birth wt. adjusted for sex	61.4	64.9	64.4	69.0
Adjusted 180 day weaning wt.	294	308	324	292
Gain from birth to weaning	233	243	260	223
1961[a]				
Birth wt. adjusted for sex		64.5		67.5
Adjusted 180 day weaning wt.		279		305
Gain from birth to weaning		214		238

[a] Since the conception rate was low for heifers on Rations 1 and 3 during 1960, only two calves were born in each group. Data from the average of two calves can be misleading, so the calf production data for Rations 1 and 3 has been eliminated for 1961. Six calves make up the average for Rations 2 and 4.

Table 4. Average Days from Calving to First Heat and Conception Rates (1960).

	1 Low Protein Low Energy	2 Low Protein High Energy	3 High Protein Low Energy	4 High Protein High Energy
Avg. days from calving to first heat period	142	54	148	51[a]
% conception on first service	67	38	50	83
No. services per conception	1.33	2.0	1.5	1.2
% settled that were exposed	100	75	100	100
% settled of total[b]	38	75	29	86

[a] Does not include one heifer that had metritis following calving.
[b] This percent is low in rations 1 and 3 because several of the heifers had not cycled before the end of the normal breeding season and were not exposed to the bull.