Winter Feeding Studies With Beef Heifers

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Supplemental winter feed is the largest "cash cost" to the cow-calf producer. The wintering period is the most critical time in the nutrition of range beef cattle. Obviously, the amount of winter supplement fed may be of great economic significance in terms of growth, and reproductive performance of the female and net returns from the cow herd.

Studies on the optimum amount of supplemental winter feed for developing replacement heifers or wintering beef cows on the range have been in progress at the Oklahoma Station since 1948. To date, about 520 head of cows and heifers have been wintered at different feeding levels. The original group of cows have completed 13 consecutive winters on low, moderate, or high levels of supplemental feed.

In other phases of the study, weaner heifers have been fed varying amounts of supplement so as to produce Low, Moderate, or High rates of winter gain and their growth and reproductive performance have been followed through at least three calf crops. All studies have been conducted under range conditions, similar to the way most cow-calf operations are handled in the Southwest. The yearly results of previous studies are available in Feeder's Day Reports since 1948.

The data from the original group of cows have shown that limited amounts of supplemental winter feed (1 lb. of cottonseed meal per head daily) on dry, weathered native grass pastures resulted in nearly an 8 percent increase in calf crop weaned and almost twice the number of cows surviving to 13 years of age when compared to high levels of supplemental winter feed (2½ lbs. of cottonseed meal plus 3 lbs. of oats per head daily). The cost of producing 100 lbs. of calf was nearly twice as much for the high level as compared to the low level ($7.21 vs. $13.86). Greater fertility and less disease loss were experienced among cows fed limited amounts of supplemental feed. Beef cows so fed from weaning until maturity required a longer time to recover from the low feed level imposed each winter than better fed cows (approximately 1½ years longer to reach maturity). Low level feeding also delayed calving, although weaning weights were only slightly affected.

As a follow-up to this long-term trial, a series of repetitions of the project were started in 1954 using weanling heifer calves out of the original cows and others in the Experiment Station herd. These heifers were alloted to treatment each year according to body weight, age, sire, productivity of dam, and dam's winter feeding level. They were wintered each year at Low, Medium or High levels. Three groups on each treatment were continued until the cows weaned their third calves. In contrast to the older cows, winter performance was reduced by the Low level treatment. A reduction in percent calf crop and weaning weights

was observed. Feeding the young, developing heifers at the High level in these experiments hastened time of calving and increased weaning weights, but the additional feed cost more than offset the advantage obtained. The Medium level proved most profitable—considering percent calf crop and weaning weight.

More recently, additional trials have been initiated in which widely different planes of winter nutrition have been studied. In the two trials summarized for this report, weaner beef heifers were started on test at approximately eight months of age, and continued through successive winters on Low, Moderate, High, or Very High feeding levels. Summarized in this report are the growth and reproductive data for the first and second calf crops. Further trials are now underway in which alternate levels of winter feeding (Low the first winter, High the second, etc.) are being studied, but these have not progressed to the point where conclusions can be drawn.

Experimental Procedures

Sixty weaner Hereford heifer calves were selected each fall in 1958 and 1959. They were divided into four groups of 15 each on the basis of dam's productivity, sire, age, shrunk weight, and grade. The heifers started on test weighing approximately 457 lbs. each in early November, and were fed according to the following programs each winter:

Lot 1 (Low)—No gain during the first winter as weaner calves, and fed to lose at least 20 percent of body weight during subsequent winters as bred females.

Lot 2 (Medium)—Gains of 0.5 lbs. per head daily the first winter as weanling calves, and a loss of less than 10 percent of fall weight during succeeding winters.

Lot 3 (High)—Gains of approximately 1.0 lb. per head daily during the first winter, with no weight loss as bred females.

Lot 4 (Very High)—Full-fed a 50 percent concentrate mixture to gain as rapidly as possible, both as weanling calves and bred females.

All heifers started on test between seven and nine months of age. The daily supplement of cottonseed meal and ground milo required to produce the necessary gain was adjusted frequently throughout the winter. Low level heifers were confined to a small trap and fed wheat straw for four to six weeks during the early winter each year to insure the desired weight loss. On the average it required less than 1.0 lb. of cottonseed meal per head daily to achieve the Low level of wintering, 2 lbs. cottonseed meal and 1 lb. ground milo on the Medium level, and 2 lbs. cottonseed meal and 5 lbs. ground milo at the High level. Very High level heifers were placed on self-feeders with a 50 percent concentrate mixture each winter and consumed from 25 to 35 lbs. of the mixture per head daily. A mineral mixture of two parts salt and one part bone meal was available, free choice to all lots throughout the year.

The wintering period extended from early November to mid-April, each year. Following this, the heifers were divided into uniform groups according to level of wintering and previous productivity, and mated to bulls produced in the purebred herd at the Ft. Reno station. The bulls were turned in during the last of April or first week in May; consequently, the heifers calved the following year in February and March. All heifers were bred to calve first as two-year-olds. The calves were castrated at six to eight weeks of age and weaned off when approximately 210 days old in early October. Females were then regrouped into their wintering levels and subjected to the same winter treatment each succeeding year. It was felt that calving the heifers as two-year-olds would impose a greater nutritional strain on the growing and developing female.

Results

All heifers have now weaned one calf, while those in the first group have weaned their second calves. Consequently, the results for the first and second winters for both repetitions up to the fall of 1960 have been summarized in Table 1.

Table 1.—Weight Changes to 1½ Years of Age for Beef Heifers Wintered at Four Levels (Summary of Two Trials)

Lot Number Level of Winter Supplement	1 Low	2 Med.	3 High	4 Very High
No. of heifers at start of experiment	30	30	30	30
No. of heifers remaining at 1½ yrs. of age[1]	29	30	29	30
Average weights (lbs.)				
Fall—initial weight	474	472	474	472
Winter gain	—13	97	145	274
Spring (1 yr. old)	461	569	619	746
Summer gain	321	260	239	146
Fall weight (1½ yrs.)	782	829	858	892
Average total feed, pasture, and mineral cost per heifer to 1½ yrs.	$20.68	$33.14	$45.17	$57.78

[1]One heifer died in lot 1 at a year of age with an impacted abomasum and one in lot 3 shortly after weaning for unknown reasons.

One heifer was lost in each of the Low and High levels, before 1½ years of age. During the first winter, weaner calves on the Low level lost 13 lbs., whereas Very High heifers gained 274 lbs. High level heifers gained slightly less than planned. Thus at the end of the first winter, there was an average difference of 285 lbs. in weight between these two groups wintered at widely different levels, with other treatments intermediate in body weight.

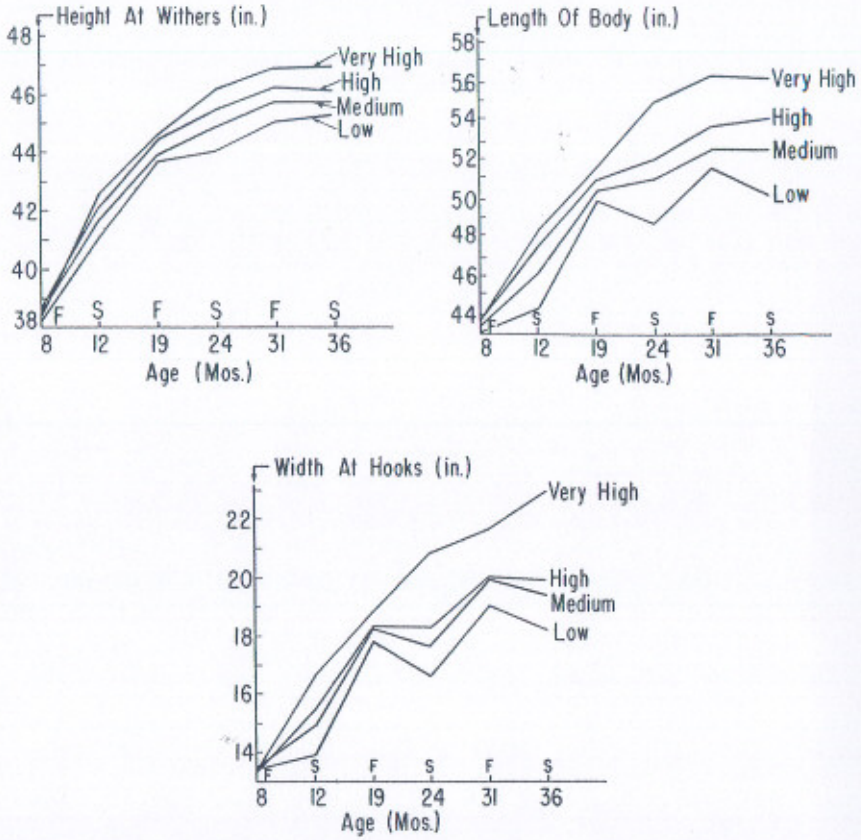


Figure 1.—Body measurement changes before and after winter feeding at four levels of winter supplement, (inches). Abbreviations F and S denote fall and spring.

Summer gains were, of course, inversely related to winter performance. At the end of the following summer, when the heifers were approximately 1½ years of age, there was only 110 lbs. difference in the weight between Low and Very High levels; other treatments were intermediate to these two extremes. Again, as in numerous studies, this demonstrates the tremendous recovery capacity of the Low level heifers when on good-quality native grass the following summer.

Fully as important as the weight changes in the heifers were skeletal changes in terms of height, width and length of body. An attempt was made to study the development of these heifers before and after winter treatment by photographs as well as by actual physical measurements. The most important measurements are shown in Figure 1. It will be noted that there were only small differences in height at the end of the

first winter period, whereas the later developing parts of the body (width and length) showed more extreme differences due to treatment. Both width and length seemed to be markedly affected by body fatness. Heart girth was the measurement most affected by treatment, but this would be expected since heart girth varies directly with body size and condition.

It will be seen, however, that at the end of the following summer, there was considerable recovery in these measurements for Low as compared to Very High treatments. There seemed to be little advantage at 19 months of age in terms of skeletal size, from wintering heifers at above the medium level, but differences tended to become greater each year so that at three years of age, significant differences were found for all of these measurements.

First Calving Performance

The two-year-old calving performance of beef heifers in which both repetitions are summarized is presented in Table 2. It will be noted that Low level heifers lost 212 lbs. from fall to spring, which is approximately 27 percent of their body weight. In contrast, Very High level heifers gained 180 lbs., or approximately 20 percent of their body weight from fall to spring, with other groups again intermediate. Thus, at the end of the second winter, there was a difference of 502 lbs. in body weight after calving between Low and Very High level heifers. As had been observed in the past, there was an inverse relationship between winter and summer gains with the Low and Medium level heifers tending to catch up in body weight. Nevertheless, the following fall after weaning their first calves, there was still a difference of 219 lbs. between the extreme groups, but only 109 lbs. between the Low and Highs, and a 63 lbs. average between Medium and High levels.

In summarizing the calving performance, the number of calves born or weaned varied only slightly among the treatments, except for the Very High level where more calves were lost at birth. Two heifers were lost from this group due to calving difficulties. More Medium level heifers calved than in any other lot. Percent calf crop weaned was only slightly different between Low, Medium or High level heifers, while Very High level heifers weaned only a 63 percent calf crop at first calving.

It is significant that in all levels of winter experiments to date, there has been a delayed calving of Low and Medium level heifers as compared to Highs, probably due to failure to show estrus when first exposed. In the two trials summarized in Table 2, a difference of 18 days in average calving date between the Low and High levels existed. Surprisingly, difficulty at first calving was not increased by Low levels of wintering. High and Very High level heifers appeared to have more difficulty, probably because of heavier birth weights and more internal fat in the heifers.

Table 2.—Two-Year-Old Calving Performance of Beef Heifers Wintered at Four Levels (Summary of Two Trials)

Lot number Level of wintering	1 Low	2 Med.	3 High	4 Very High
No. of heifers at start of experiment	30	30	30	30
No. of heifers remaining at 2½ yrs. of age[1]	29	29	29	28
Average weights (lbs.)				
Fall (1½ yrs. of age)	782	829	859	892
Winter gain	—212	—117	—70	180
Spring (2 yrs. of age)	570	712	788	1072
Summer gain	278	199	169	—5
Fall (2½ yrs. of age)	848	911	957	1067
Calving Performance				
No. of heifers bred to calve	29	30	29	30
No. of calves born	27	30	27	27
No. of calves weaned	24	24	24	19
Percent calf crop	82.8	80.0	82.8	63.3
Average calving date	3/20	3/14	3/2	3/2
Average difficulty at calving score[2]	1.74	1.59	2.15	2.68
Average calf weights (lbs., corrected for sex)				
At birth	59.0	68.2	72.4	69.8
At weaning	332	394	432	407
Financial Results (Average)				
Total feed, pasture, and mineral cost per heifer (1½ to 2½ yrs.)	$25.44	$36.37	$48.83	$105.02
Return above cow cost per heifer (1½ to 2½ yrs.)[3]	48.78	45.58	44.17	—38.04
Return above cow cost per heifer (initial to 2½ yrs.)	28.10	12.44	—1.00	—95.82

[1]Three heifers were lost due to difficulty at first calving; one in Lot 2 and two in Lot 4.

[2]A numerical score was used to evaluate difficulty at calving. A score of 1 indicates cow calved normally without assistance, and 7 indicates extreme difficulty in which both cow and calf were lost.

[3]Assumes a value of $27.00 per cwt. for the "Low's" calves and $26.00 for all other calves. Feed costs for 1½ to 2½ years only, are included; also costs for cows not raising calves are included in this evaluation.

Birth weights have been consistently depressed by Low levels of winter nutrition. In the two trials summarized in Table 2, there was nearly 13 lbs. difference between Low and High calves at birth. Medium and Very High level heifers gave birth to calves of about the same size, and the Very High level of nutrition depressed fetal development as compared to the High level.

Weaning weights were severely affected by the Low feeding regime imposed during the two successive winters before the calves were born. Low level heifers weaned calves weighing 100 lbs. less than those on a High level, with Medium level heifers intermediate. It is also important to note that the Very High level heifers tended to wean calves only slightly heavier than those wintered at the Medium level.

Considering feed costs of the heifers to 2½ years and value of calves weaned, Low and Medium level heifers gave greater returns than High level heifers. Least profitable, of course, were those wintered on Very High level due to the tremendous feed cost. In earlier studies at this station, the Medium level group has produced slightly more calves than the Lows, with heavier weaning weights, and has therefore returned more profit. However, in these trials, percent calf crop weaned for Low and Medium treatments were essentially the same.

Table 3.—Three-Year-Old Calving Performance of Beef Heifers Wintered at Four Levels (Summary of One Trial)

Lot Number Level of Wintering	1 Low	2 Med.	3 High	4 Very High
No. of heifers at start of experiment	15	15	15	15
No. of cows remaining at 3½ yrs. of age	15	15	14	15
Average weights (lbs.)				
Fall (2½ yrs. of age)	828	891	908	1050
Winter gain	—161	—87	—47	132
Spring (3 yrs. of age)	667	804	861	1182
Summer gain	291	229	208	—15
Fall (3½ yrs. of age)	958	1033	1069	1167
Calving Performance				
No. of cows bred to calve	15	15	14	15
No. of calves born	13	14	12	13
No. of calves weaned	12	12	10	13
Percent calf crop	80.0	80.0	71.4	86.7
Average calving date	3/27	3/13	3/1	3/6
Av. calf weights (lbs., corrected for sex)				
At birth	70.9	77.2	81.3	74.5
At weaning	390	458	470	444
Financial Results (Average)				
Total feed, pasture, and mineral cost per cow (2½ to 3½ yrs.)	$28.50	$37.78	$53.87	$118.91
Return above cow cost per cow[1]	55.74	57.48	33.38	—18.83
Return above cow cost from initial to 3½ yrs. of age[2]	83.84	69.92	32.38	—114.65

[1]Assumes a value of $27.00 per cwt. for the "Low's" calves and $26.00 for all other calves. Feed costs for 2½ to 3½ years only are included; costs for cows not raising calves are also included in this evaluation.
[2]Takes into account complete feed costs from weaning to 3½ years.

Second Calving Performance

Summarized in Table 3 is the three-year-old calving performance of one of the two groups. Again noticeable is the relationship of level of winter feed to winter weight loss and summer gain. At the end of 3½ years of age, there was, however, a difference of 209 lbs. in body weight between the average of Low and Very High level females. Smaller dif-

ferences in body weight can be seen between Medium, High, and Very High level females. Consequently, it appears that at 3½ years of age, heifers wintered on the Medium level will approach the size of those wintered at higher planes, whereas Low level heifers are stunted somewhat in development. Surprisingly, with their second calves, heifers wintered at the Very High level were the most productive in terms of calf crop percentage. Again, the same delayed calving tendency for Low and Medium levels is apparent, as is also the lowered birth weight of their calves.

Weaning weights were again significantly affected, with Low level heifers weaning 80 lbs. lighter calves than those on the High level, and 68 lbs. lighter calves than the Mediums. It is very interesting to note that heifers on the Very High level weaned smaller calves than the Medium level cows. Return above cow cost for the year again favored Low to Medium treatments.

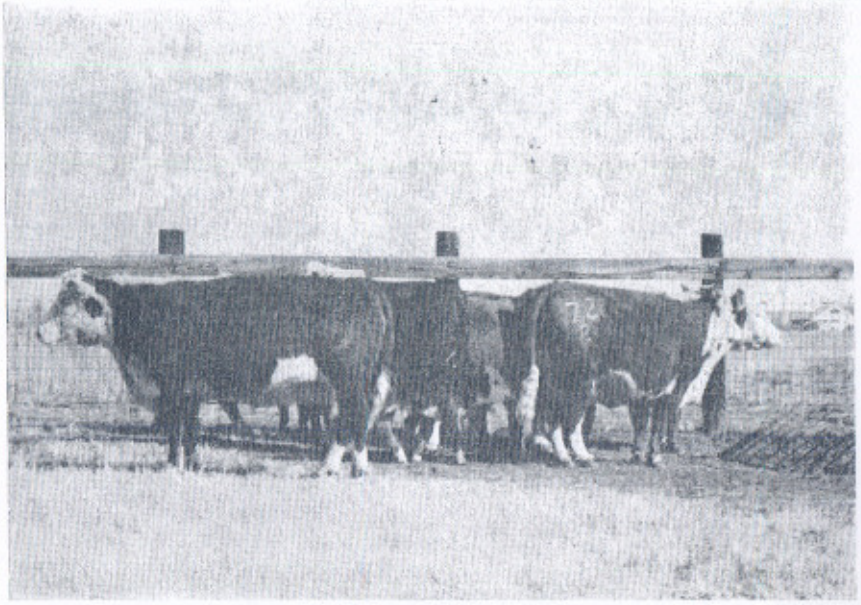
Table 4 summarizes milk production data obtained during the summer of 1960 by separating the calves from the cows and weighing the calves before and after nursing, twice daily, at six week intervals. These results parallel the weaning weight data, in that Low level females appear to be the poorest producers, while Medium or High level females were highest in production. However, two-year-old heifers wintered at the Very High level turned out to be poorer producers than those wintered on Medium or High treatments, corresponding to the differences in weaning weights observed. The high estimates found for the three-year-old Very High level females do not agree with the depressed weaning weights found in this treatment. This might be expected, however, since data was collected from only four heifers per lot.

Table 4.—Twenty-Four Hour Milk Production Estimates for Beef Females Wintered at Four Levels, 1960 (lbs.)

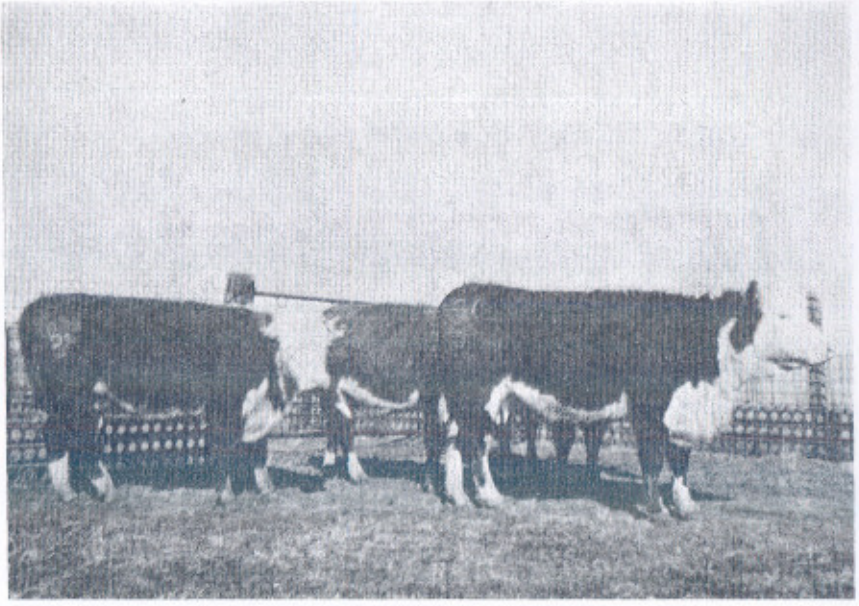
Age	Date	Level of Wintering			
		Low	Med.	High	Very High
Two-Year-Olds	May 24	8.81	13.88	13.31	7.56
	July 18	5.75	7.06	8.88	6.00
	Aug. 29	5.44	8.00	8.06	4.62
Three-Year-Olds	May 24	6.44	9.25	8 25	8 88
	July 18	7.69	9.00	8.88	10.88
	Aug. 29	6.25	8.19	6.31	5.69

Summary

As a part of extensive studies of the effect of plane of nutrition during the winter on growth and productivity of beef females, results of two repetitions with heifers carried to 2½ and 3½ years of age have



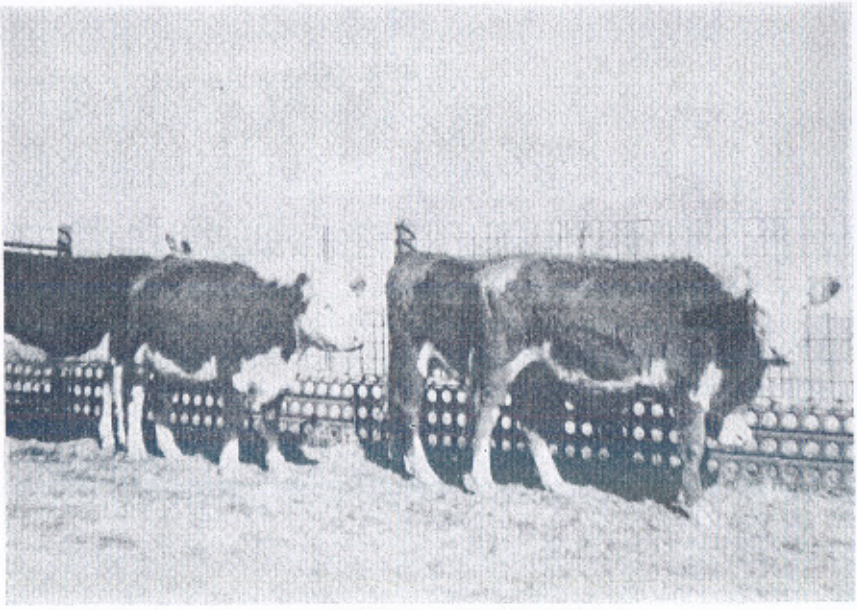
"A" Very High Level



"B" High Level

Figure 2.—Three-year-old beef heifers near the end of the third consecutive winter on different feeding levels. Heifers wintered each year since calves at the Very High level (A) received a fattening type ration for maximum winter gains. High level heifers (B) and Moderates (C) were fed to make good growth and body develop-

"C" Moderates



"D" Low Level

ment. Low level heifers (D) were restricted so that they gained little as calves, and lost nearly 20% of their fall weight as bred heifers. Average body weights of heifers of the four groups shown are 1192, 1020, 928, and 781 pounds, respectively.

been summarized. These results indicate that the cow-calf producer may operate between two "danger areas" in the nutrition of the beef female. Too low a plane of nutrition results in delayed growth and body development, retarded calving date, smaller and weaker calves at birth, poor milking heifers, and calves that wean off decidedly lighter than those from better wintered dams.

In contrast, the Very High level treatment, as practiced here, demonstrates the effect of excessive feed levels in hastening maturity and in causing large stores of body fat. Excessive feed levels may also have a depressing effect on growth of the fetus and milk production. With the tremendous costs of production involved in carrying females at the Very High level, this system is not to be recommended, although it is frequently practiced in farm herds and purebred establishments.

A Medium to High level appears to be most desirable in terms of growth and development of the female and size of her calf at weaning. Of these two, the Medium level which allows the beef heifer to gain approximately 0.5 lb. per head daily the first winter as a weaner calf, and lose less than 10 percent of her body weight each subsequent winter has seemed most desirable and profitable in previous trials due to the advantage in calf crop percentage, weaning weights, and development of the female. In the trials summarized in this paper, however, the Low level resulted in no decrease in calf crop percentage and thus these females were more profitable because of the much lower cost of wintering.

It must be remembered, however, that all cattle had year-round access to approximately six acres of high-quality native grass which permitted remarkable recovery during the summer.

Studies With Sheep Receiving Compounds Having Estrogen Activity

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Stilbestrol and hexestrol have been widely used in feeding ruminants because of increased gains and feed efficiencies when these compounds are given orally or implanted subcutaneously. More intensive studies have indicated that these increases resulted from more efficient storage of dietary calcium, phosphorus, and nitrogen. In many studies, however, undesirable side effects from these compounds have been noted. Diallyldiethylstilbestrol and diallylhexestrol, derivatives of stilbestrol and hexestrol, are of interest because of indications that they contain the potency of the parent compounds without causing the undesirable side effects. The purpose of the following experiments was to