Results of the subsequent feed-lot performance of selected steers from this study are summarized in the report "Effect of Stilbestrol Implants on Summer Gain and Subsequent Feed-Lot Performance of Yearling Steers."

Summary

Gains of steers grazing dried range grass and fed 2 lbs. of various protein supplements per head daily were only slightly different. This was in contrast to previous tests which indicated that gains were related to quantity of supplemental protein fed and that urea was not efficiently utilized.

Implanting 12 mg. of stilbestrol increased only slightly the winter gains of weanling steer calves.

The subsequent summer gains of steers previously implanted in November were nearly equal. Therefore, total yearly gains were related to level of winter implant because of the differences in winter gains.

Effect of Level of Wintering Upon the Growth and Reproductive Performance of Beef Heifers

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Results of a long-time study on the effects of different amounts of supplemental winter feed for spring-calving beef cows are reported elsewhere in this publication. At 11½ years of age, low levels of supplemental winter feed (1.0 pound of cottonseed meal per head daily) for cows grazing native bluestem pastures has not decreased percent calf crop or weaning weights. In other trials, lesser amounts of supplemental feed during growth and reproduction have reduced weaning weight and body size to 4½ years of age.

These studies on the effects of different levels of wintering on the growing and developing heifer have been continued. Due to the variability encountered in conducting experiments under range conditions, several repetitions have been initiated. These studies differ from the original test in that more drastic treatments were imposed and heifers were selected with greater known history.

This report summarizes the 1958-59 results obtained from four repetitions of the experiment at the Fort Reno station and include data on the effects of levels of wintering on the growth and development of replacement heifers from weaner calves up to 4½ years of age.

Procedure

Each fall since 1954, an experiment has been initiated at the Fort Reno station to further study the effects of three or four different planes of nutrition during the winter period. In each trial, three or four lots of 14 or 15 weanling Hereford heifers per lot have been started on test. Heifer calves for these studies were selected at about 7½ months of age from the station herd. The majority of the heifer calves came from the original cows in this study, or from other young cows on repetitions of this study. It was possible to allot the calves according to age, sire, dam's average productivity, body weight, and grade.

The procedure followed has been fundamentally the same in each repetition. All heifers grazed on native grass pastures (primarily little bluestem, side oats grama, and less desirable annual grasses) year-long. They were pasture-mated to purebred Hereford bulls between May 1 and August 15, and all calved at about two years of age. Calves were weaned in early October. None of the calves were creep-fed. The heifers each year were placed on their respective treatments from November to mid-April, and each grazed similar native grass pastures each summer.

The amounts of supplemental winter feed (cottonseed meal and milo) were varied at frequent intervals during the winter in an attempt to obtain the following gains:

First Winter as Calves

Low level—no gain

Medium level—0.5 lb. gain per day

High level—1.0 lb. or more gain per day

Second and Subsequent Winters as Bred Heifers

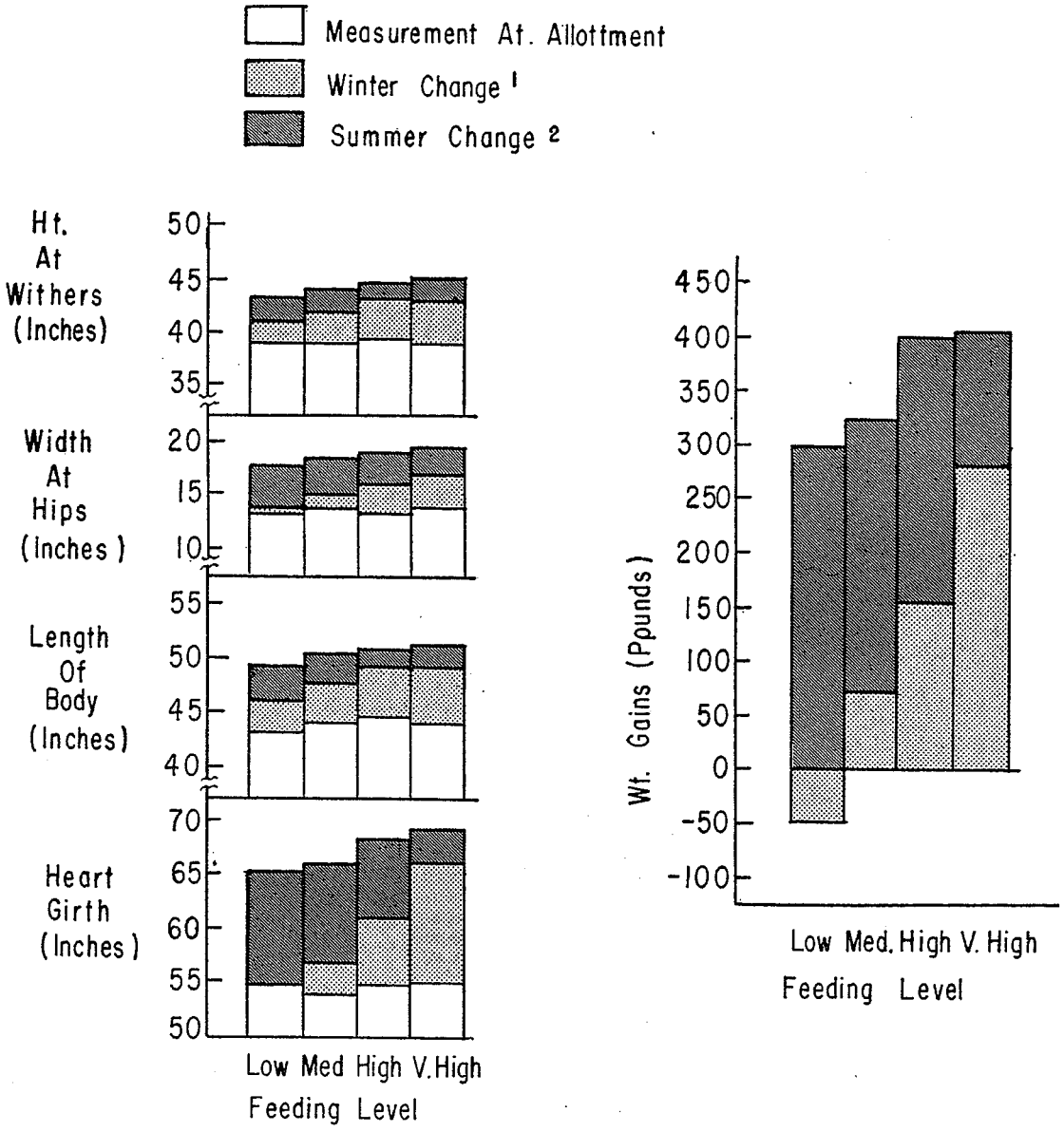
Low level—20% or more loss of fall weight to spring after calving

Medium level—10% or more loss of fall weight

High level—little or no loss in body weight

The 1957 and 1958 trials included a fourth level (very high treatment) which consisted of a full-feed of 65 percent concentrate mixture during the wintering period. The results of this level for 1958-59 season are included in this report.

As noted above, supplemental feed was varied in order to produce the desired winter gain or loss. In order to restrict the amount of winter gain, low level heifers were first confined to dry lot and fed wheat straw with no supplement for several weeks. They were then placed on native grass with limited supplement. Very high level heifers had access to the fattening type mixture from a self-feeder plus native grass all winter. Medium and high level heifers received supplements and grass all winter. The wintering period extended about 165 days each year.



[1] From Fall At 8 Mos. Age To Following Spring, 1959

[2] From Spring At 13 Mos. Age To Following Fall, 1959 On Summer Pasture.

Figure 1.—Weight changes and body measurements to 1½ years of age for beef heifers wintered at four levels, (1958-59) Trial 6.

Results

1. Weaner Calves

Figure 1 shows the growth data in terms of skeletal development and body weight from weaning to 1½ years of age for heifer calves on four different levels of wintering. One heifer was lost in Lot 1 shortly after allotment from causes not believed related to treatment.

Winter weight gains averaged —.30, +.43, +.96, and +1.74 lbs. per head daily for the low, medium, high, and very high treatments, respectively. Summer gains were inversely related to winter gains (Figure 1). The difference in average weight between the extremes (low vs. very high levels) was reduced from 327 lbs. at the end of the winter to 128 lbs. at the end of the summer grazing season. Likewise, differences of 203 lbs. between low and high level groups at the end of the winter was reduced to 104 lbs. at the end of the following summer. As in the past, the recovery of poorly wintered females on excellent summer pasture was remarkable. All calves averaged 489 lbs. at allotment in the fall of 1958, and weighed 764, 812, 868, and 892 lbs. for the low, medium, high, and very high levels, respectively, the fall of 1959.

Body measurements taken in early November, in mid-April, and again the following fall indicate that height, length of body, and width of hips were not greatly affected by winter treatment. Heart girth was more sensitive to nutritional regime and was closely related to body weight gain or loss. As was true with body weight, there was a strong tendency for low level heifers to increase in each measurement more than their mates during the summer grazing season, so that the differences by the following fall were much smaller than in the spring. However, the general increase in skeletal development was suprisingly small on all treatments, indicating that the heifers had much of their potential skeletal size before going into the first winter.

Total feed and pasture costs for these heifers were 46, 120, and 232 percent greater for the medium, high, and very high levels, respectively, vs. the low level heifers at 1½ years of age. These costs from low level to very high were $23.20, $33.87, $51.01 and $77.03.

2. Effect on Bred Yearlings

Results obtained from another repetition show accumulative effects of two winter's treatment. Two-year-old calving performance for 1958-59 for heifers fed two successive winters on low, medium, high, or very high regimes is shown in Table 1. Winter weight losses were greater than desired, due to the severity of winter conditions, and actually represented 24, 14, and 9 percent of the previous fall weight of the low, medium, and high level heifers, respectively.

Summer gains were inversely related to the amount of winter loss, so that the average difference in body weight between low and high level lots was only about half as large in the fall as in the previous spring. The percent calf crop weaned was 13.3 and 6.6 percent greater for the high and medium levels, respectively, over the low level heifers. There was a greater difference between medium and high level heifers than previously reported in earlier summaries.

The very high heifers, full-fed during the winter, were at a distinct disadvantage with only a 60 percent calf crop. One of the high heifers was open and five calves were dead on arrival or died shortly

Table 1.—Two Year Old Calving Performance of Beef Heifers Wintered at Four Levels, (1958-59) Trial 5.

Lot Number	1	2	3	4
Level of Winter Supplement	Low	Med.	High	Very High
No. of heifers at start of experiment	15	15	15	15
No. of cows remaining at 2½ yrs. of age	15	15	14	15
Average weights (lbs.)				
Fall (1½ yrs. of age)	801	846	849	892
Winter gain	—192	—115	— 79	+203
Spring (2 yrs. of age)	609	731	770	1095
Summer gain	+219	+160	+138	— 45
Fall (2½ yrs. of age)	828	891	908	1050
No. of heifers bred to calve	15	15	14	15
No. of calves born	14	15	14	13
No. of calves weaned	13	14	14	9
Percent calf crop	86.7	93.3	100.0	60.0
Average calving date	3/23	3/15	3/4	2/24
Average difficulty at calving score	1.8	1.8	2.4	3.1
Av. calf weights corrected for sex (lbs.)				
At birth	62	71	75	70
At weaning	341	393	422	421
Total feed, pasture and mineral cost/heifer ($) (weaning to 2½ yrs. of age)	44.24	67.63	93.20	159.81
Cost per cwt. calf weaned 1959 ($)[1]	14.96	18.44	22.09	63.27
Return above cow cost per cow[2]	38.54	35.04	24.96	—89.08

[1] Includes total feed, pasture and mineral cost for weaning to the fall of 1959 and wt. of calves produced corrected for sex by adding 25 lb. to heifer calves.
[2] Assumes a value of $28.00 per cwt. for calf.

afterwards, at least two of which were a supposedly direct result of difficult calving. This is reflected in the high "difficulty at calving" score shown in Table 1.

The low and medium heifers showed an advantage over both highs and very highs in less difficulty at calving. No consistent differences have been noted in difficulty at calving between low, medium, and high level heifers in previous tests.

The average calving date for the low level heifers was 27 days later than for the very high level, 19 days later than for the high level, and 8 days later than for medium level. This trend toward later conception among poorly wintered heifers has been evident from previous trials.

Both birth weights and weaning weights of the calves were directly related to level of wintering, with the exception of the very high level treatment. However, differences in percent calf crop and weaning weight combined were not great enough to pay for the increased amount of supplemental feed given the heifers on medium, high, or very high levels up to 2½ years of age.

Cost of rearing the replacement heifer should of course be spread out over the productive lifetime of the female, and not charged against the first calf. Thus it would become less advantageous for the low level heifers. Considering percent calf crop, weaning weight, and reasonable feed costs, the medium level of treatment has been most advantageous in the repititions of this study to date.

3. Performance of Bred Two-Year-Olds

In still another group, three-year-old calving performance for the 1958-59 season among heifers wintered continuously on low, medium, and high levels is reported in Table 2. As was true in all 1958-59 trials, winter weight losses were slightly higher than desired.

Table 2.—Three Year Old Calving Performance of Beef Heifers Wintered at Three Levels, (1958-59) Trial 4.

Lot Number Level of Winter Supplement	1 Low	2 Med.	3 High
No. of heifers at start of experiment	15	15	15
No. of cows remaining at 3½ years of age	13	13	12
Average weights (lbs.)			
Fall (2½ yrs. of age)	946	992	1039
Winter gain	—222	—116	—140
Spring (3 years of age)	724	876	899
Summer gain	+210	+141	+146
Fall (3½ years of age)	934	1017	1045
No. of cows bred to calve	15	15	14
No. of calves born	14	14	12
No. of calves weaned	13	13	12
Percent calf crop	86.7	86.7	85.7
Average calving date	3/30	3/16	2/22
Average calf weights corrected for sex (lbs.)			
At birth	68	77	78
At weaning	357	407	476
Total feed, pasture and mineral cost/low ($) (2½ to 3½ years of age)	26.79	39.93	54.73
Cost per cwt. calf weaned 1959 ($)[1]	8.66	11.32	13.42
Return above cow cost per cow[2]	59.88	58.87	59.49

[1] Includes total feed, pasture and mineral cost for 1958-59 (fall of 1958 to fall of 1959) and wt. of calves produced corrected for sex only.

[2] Assumes a value of $28.00 per cwt. for calf.

The differences in percent calf crop were very small among the groups, with no consistent trend being apparent. Calving dates were later on lower feed levels reflecting condition of the heifers the previous spring. Low level cows calved an average of 36 days later than the highs, and 14 days later than the mediums.

As with the two-year-old calving group, there was a direct relationship between the amount of winter supplemental feed given the female and the birth and weaning weight of the calves the following fall. Cost of production was inversely related to winter feed level, as shown by the economy of producing 100 lbs. of calf on each level. However, due to heavier weaning weights of medium and high level cows, net return above cow cost, assuming all calves to be worth the same ($28 per cwt.), showed little difference among the levels for 1958-59. Again, lower costs of raising the replacement female would give an economic advantage to the low level of wintering due to decidedly less feed cost during the first winter.

4. Bred Three-Year-Old Heifers

Table 3 includes a summary of weight gains and calving performance for heifers calving for the third time after 4 successive winter treatments on three different levels of nutrition. Winter weight losses were again greater than planned. Summer weight gains were inversely related to amount of winter feed so that the fall weights in 1959 showed little difference between any level. This tendency for low females to eventually recover has been noted in many previous studies.

Calving performance showed no distinct trend, with the medium level weaning the smallest percent calf crop, but also weaning the heaviest calves. Birth weights were directly related to the amount of winter supplemental feed. Low level cows weaned by far the lightest calves. Average calving date for the low level was 21 days later than for the highs, and 25 days later than for the mediums. Yet, medium level females calved 4 days earlier than the high level cows showing the smaller effect of winter feed on early conception as cows advance in age.

As in the other trials, cost per cwt. calf produced showed an advantage for the lower levels, but return above cow cost for the 1958-59 season showed little difference between lots. Again, this disregards rearing cost which was much less for the lower levels as illustrated by data from Trial 6.

It has been the policy to cull heifers only for failure to wean a calf for two consecutive years, or where disease or unsoundness would affect the data obtained. As of the fall of 1959, there were 37, 37, and 38 heifers on test among the low, medium, and high level groups of 2 years old or over. Thus treatment appears to have no significant effect on survival to this point.

Table 3.—Four Year Old Calving Performance of Beef Heifers Wintered at Three Levels, (1958-59) Trial 3.

Lot Number Level of Winter Supplement	1 Low	2 Med.	3 High
No. of heifers at start of experiment	14	14	14
No. of cows remaining at 4½ years of age	9	10	12
Average weights (lbs.)			
Fall (3½ years of age)	1040	1079	1140
Winter gain	—236	—193	—140
Spring (4 years of age)	804	886	1000
Summer gain	+255	+156	+ 92
Fall (4½ years of age)	1059	1042	1092
No. of cows bred to calve	10	10	14
No. of calves born	9	10	14
No. of calves weaned	9	8	13
Percent calf crop	90.0	80.0	92.9
Average calving date	3/23	2/26	3/2
Average calf weights corrected for sex (lbs.)			
At birth	72	76	81
At weaning	390	485	474
Total feed, pasture and mineral cost/cow ($)			
(3½ to 4½ years of age)	26.76	37.19	52.36
Cow cost per cwt. calf weaned 1959 ($)[1]	7.62	9.58	11.89
Return above cow cost per cow[2]	71.52	71.45	70.94

[1] Includes total feed, pasture and mineral cost for 1958-59 (fall of 1958 to fall of 1959) and wt. of calves produced corrected for sex only.
[2] Assumes a value of $28.00 per cwt. for calf.

Summary

Data are presented on the growth and reproductive performance during 1958-59 for four groups of replacement heifers involving three or four lots of 14 to 15 heifers per lot on low, medium or high treatments in each trial. Other results are presented comparing the performance of these heifers with those fed a 65 percent concentrate ration to induce maximum gains.

No consistent trends have been noted among the winter treatments for percent calf crop weaned or difficulty at calving, with the exception of the full-fed heifers, which weaned only a 60 percent calf crop as two-year-olds and exhibited more difficulty at calving than any other treatment.

Birth weights were reduced by the low level treatment in all cases. Low level heifers calved at about 3 weeks later than the medium level heifers, with less difference being noted between medium and high level heifers, or among older heifers. High winter feed levels resulted in heavier calves at weaning, but the cost of producing 100 lbs. of calf was markedly in favor of the lower levels of winter feed.

When total return minus costs were considered, little difference was noted between winter treatments with the exception of the very high level, which showed negative profit. Body measurements taken up to 1½ years of age show that winter treatment did not greatly affect skeletal development of the heifers. At 4½ years of age, consecutive low planes of winter nutrition had reduced body weight of the females by only 33 lbs.

Development of Replacement Beef Heifers for Expression of Maternal Traits

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Some traits of economic importance in the production of beef cattle are reproductive efficiency, mothering ability, longevity of productive life, rate and efficiency of gain, and carcass worth. The relative importance of the above factors can be expected to vary with the quality of cattle and the particular phase of the operation under consideration, but calf-crop percentage weaned and average weaning weights have been shown in one study to be of most importance in high grade Hereford cattle when the calves are finished to choice grade by full-feeding in dry-lot immediately following weaning. The first three factors listed above (reproductive efficiency, mothering ability and length of productive life) will become increasingly more important if the trend continues toward the slaughter of more youthful cattle to meet the consumer's demand for lean tender beef.

A number of studies have shown that the beef cow tends to repeat her performance from year to year when it is measured by adjusted weaning weights of her calves so that one may well cull the poor producing cows after one or two calves. It has likewise been shown in at least one study that the selection of replacement females from above average cows will be effective in improving the weaning weights in a herd. Although it has been shown that it may be economically sound to cull open cows prior to the wintering period, genetic studies do not indicate that much improvement in the hereditary worth of the herd may be expected as a result of this selection. Some traits, however, which affect longevity of productive life have been shown to be controlled to an appreciable extent by genetic factors.

The more highly heritable economic traits in beef cattle are those which have been measured precisely under uniform environmental con-