One lamb out of the 255 implanted (this includes those implanted on wheat pasture) died from a blockage of the urinary tract. Most of the increase in gain due to stilbestrol came during the first part of the feeding period. Stilbestrol decreased dressing percentage and carcass grade (less than 1/6 grade) slightly in most instances.

Aureomycon increased average daily gains and feed efficiency of each group of lambs except those fed the high roughage ration (Lots 7 and 8).

The average daily gain of all groups was satisfactory, and the feed slightly on the high roughage ration and also decreased feed efficiency.

Theaverage daily gain of all groups was satisfactory, and the feed cost per cwt. of gain, in most instances, was considerably lower than the selling price; however, due to initial cost, death loss, shrinkage, miscellaneous costs, and negative margin, practically all groups showed a net loss.

Effect of Different Levels of Winter Supplement and Age at First Calving Upon the Performance of Beef Cows and Replacement Heifers

J. E. ZIMMERMAN, L. S. POPE AND DWIGHT STEPHENS

The most common system of cow herd management in the Southwest is to graze year-long on native grass pasture, with supplemental feed during the winter as required. The amount of winter supplement required is dependent upon the length of the lactation period before spring grass appears, the type and amount of forage available, the quality of supplemental feed provided, and weather conditions. Since winter supplemental feed is the major cash cost in the operation of a commercial cow herd, it is important to feed the most economical quantity of supplement in terms of the number, size and quality of calves at weaning as well as the condition, thriftiness and longevity of the cows.

A study was initiated at this station with 90 weanling Hereford heifer calves in the fall of 1948 to study the effect of the level of winter supplement and age at first calving on the lifetime performance of range beef cows. This report gives the results of the ninth year (1956-57) of this experiment and contains a summary of results obtained to the fall of 1957.

In the fall of 1954, more carefully controlled studies were undertaken to evaluate the effects of different levels of supplemental feed with heifers bred to calve at two years of age. By repeating these range trials several years, variations in climate and range conditions could be minimized. Thus, a series of repetitions was initiated using weanling Hereford heifer calves, the majority of which were from the original cows. From the records available, it was possible to allot the calves according to age, sire, dam's average productivity, body weight and grade. Four groups of heifers have now been included in the study. Results obtained to the fall of 1957 are reported.

Original Study with Cows Wintered at Different Levels and Calving First at Two or Three Years of Age.

In the fall of 1948, six lots of 15 heifer calves each were placed on experiment. These heifers were obtained from the experiment station herd and a large commercial herd. Since the summer of 1949, the study has been carried out at the Fort Reno Station. The cattle have grazed year-long on native grass pastures consisting mostly of bluestem, Indian and switch grass and less desirable annual grasses. The stocking rate has varied from 8 to 12 acres per cow and adequate grass has been available at all times. A mineral mix consisting of two parts salt and one part steamed bone meal was available throughout the year. During the winter feeding period (early November to mid-April) the cows have received the following supplemental feeds per head per day in addition to the weathered native grass:

Lots 1 and 2 (low level)—1.0 pound of cottonseed cake.

Lots 3 and 4 (medium level)—2.5 pounds of cottonseed cake.

Lots 5 and 6 (high level)—2.5 pounds of cottonseed cake and 3.0 pounds of oats.

The supplements were fed every other day, twice the daily allowance at each feeding. In establishing these levels, consideration was given to the prevailing practices of many ranchers in the state, and to available information on the requirements of beef cows. It was believed that the low level would supply about two-thirds of the digestible protein needed by range beef cows, whereas, the high level would not only supply ample protein but additional energy. Heifers in Lots 1, 3 and 5 were pasture-bred during the early summer of 1950. Heifers in Lots 2, 4 and 6 were not bred until one year later and calved first as three-year-olds in the spring of 1951.

To date, these cows have been subjected to their respective winter treatments for ten consecutive years. Since the data for the winter of 1957-58 are incomplete, this report deals with cow performance during the 1956-57 season, and will summarize the results obtained to the fall of 1957 (first nine years of tests).* The results of the 1956-1957 test are shown in Table 1, and a summary of results obtained to the fall of 1957 is given in Table 2.

The winter of 1956-57 was mild, with above average rainfall. There was some growth of annual grasses throughout the winter. Winter weight losses followed a very inconsistent trend, with the lots receiving the least supplement losing the least weight. A trend had been noted in the three previous winters for the medium level lots to lose slightly more weight than the low level lots, but the differences were small. Cows in Lots 5 and 6 (high level) have lost the least weight in previous winters, but during the winter of 1956-57 they lost more weight than the low level lots and almost as much as the medium level lots. It

* Detailed data for other years may be found in Okla. Agr. Expt. Sta. Misc. Pub. MP-19, 22, 27, 31, 34, 43, 45 and 48 (1948-1957).

Table 1.—Weight data, feed costs, and calf production records for cows wintered at low, medium and high levels of supplemental feed (1956-57).

Age at first calving	Two-year-olds			Three-year-olds		
Lot number	1	3	5	2	4	6
Level of winter supplement	Low	Med.	High	Low	Med.	High
Winter Phase (161 days)						
No. of cows/lot 1955[1]	14	14	10	14	11	13
Average cow weights (lbs.)						
Fall 10/30/56	1103	1165	1164	1182	1128	1223
Gain to calving	+110	+67	+128	+112	+ 83	+113
Loss from calving to 4/9/57	—138	—256	—251	—146	—231	—217
Spring 4/9/57	1075	976	1042	1148	981	1113
Cost of winter feed/cow ($)	12.58	20.09	33.51	12.58	20.09	33.51
Summer Phase (206 days)						
Average cow weights (lbs.)						
Spring 4/9/57	1075	976	1042	1148	981	1113
Fall 11/1/57	1132	1133	1164	1193	1102	1199
Summer gain	+57	+156	+122	+ 45	+121	+ 86
Summer feed cost/cow ($)	17.79	17.79	17.79	17.79	17.79	17.79
Total yearly feed cost/cow ($)	30.37	37.88	51.30	30.37	37.88	51.30
Calf production records						
Number of calves born[2]	14	15	10	13	11	12
Number of calves weaned[2]	13	13	10	13	10	11
Average calving date	3/22	3/7	3/8	3/20	3/15	3/8
Average calf weights (lbs.)						
At birth (corrected for sex)	85.1	81.6	87.3	82.8	81.9	80.0
At weaning (corrected for age and sex)	479	503	474	494	476	490

[1] The project was initiated in the fall of 1948 with 15 heifers per lot. As of Nov. 1 1956 a total of 14 had been removed. During 1956-57 one cow was removed from each of Lots 2, 3, 4, 5 and 6.
[2] One set of twins included in Lot 3.
[3] One calf in each of Lots 1, 4 and 6 was stillborn; one calf in Lot 3 was premature; and one calf in Lot 3 died at two weeks of age of an acute virus infection.

Table 2.—Summary of 9½ years results in long-time study with beef cows wintered at different levels (1948-1957).

Age at first calving	Two-year-olds			Three-year-olds		
Lot number	1	3	5	2	4	6
Level of winter supplement	Low	Med.	High	Low	Med.	High
No. of cows at start of experiment	15	15	15	15	15	15
No. remaining on test Nov. 1957	14	13	9	13	10	12
Ave. weight changes of cows on test (lbs.)						
Initial weight 10/29/48	473	471	476	476	461	470
Ave. winter weight loss	—98	—108	— 64	—101	— 98	— 71
Ave. summer gain	172	181	142	180	169	152
Final wt. 11/1/57	1132	1133	1164	1193	1102	1199
Calf production records at 9½ yrs. of age.						
Heifers assisted at first calving	6	8	4	–	–	1
Calves lost at first calving	1	1	2	–	–	2
Total number of calves weaned	104	106	85	95	81	84
% calf crop weaned[1]	91.2	93.8	87.6	96.0	86.2	84.8
Total no. of calves weaned/cow	7.30	7.50	7.01	6.72	6.03	5.94
Average calving date	3/15	3/8	3/9	3/16	3/6	3/5
Average calf weights (lbs.)						
At birth (corrected for sex)	76.8	76.5	78.4	77.0	77.8	78.3
At weaning (corrected for age and sex)	480	476	477	494	474	492
Total feed, pasture and mineral cost/cow ($)	254.55	337.54	453.84	254.55	337.54	453.84
Cow cost per cwt. calf weaned	7.27	9.45	13.74	7.66	11.80	15.53

[1] Based on the total number of cows remaining on test and bred to calve in each year.

has been a consistent observation that the low level cows are better "rustlers" and spend more time grazing than cows receiving more supplemental feed, but this probably could not account for the unusual trend in weight loss. The lots were not rotated between pastures during the winter of 1956-57, as they had been in previous winters, and pasture differences may have been responsible for part of the difference in weight loss.

Summer weight gains were greatest for those lots which lost the most weight during the previous winter. Average weights of all lots in the fall of 1957 were within 35 pounds of the average weight in the fall of 1956. No significant differences were noted in number of calves born, number weaned, birth weights or weaning weights of the calves. However, it is interesting to note that cows in Lot 3 which lost the most weight during the winter weaned the heaviest calves. The average calving date was slightly later for the low level lots.

In Table 2, data obtained to the fall of 1956 (first nine years of the test) are summarized. Both low level of wintering and two-year-old calving adversely affected the body weight of the cows, but differences have been small. The high level lots have, with the exception of the winter of 1956-57, lost the least weight each winter and gained the least during the summer, while losses and gains of the low and medium level lots have generally been similar.

There have been no consistent differences in birth weights (corrected for sex) or weaning weights (corrected for age and sex) among the lots. The average calving date has consistently been from 7 to 12 days later for the low level lots than for the medium and high level lots. There has been some advantage for the lower levels of winter supplement in percent calf crop weaned. More cows have been removed from the high level lots. Most of these cows were removed for failure to wean a calf two years in a row.

A comparison of the performance of cows bred to calve first at two years of age versus those calving first at three years of age is given in Table 3. Here the results from 30 additional cows of the same age have been included. They received the same winter treatment as Lots 3 and 4, but were given additional supplement during the late summer during the first five years of the experiment. The results indicate that cows bred to calve first at two years of age may experience more difficulty at first calving (60 percent of the heifers had to be assisted at first calving). The average weaning weight per calf is somewhat lighter for cows calving first as two-year-olds, but this is due entirely to the lighter weights of the calves they produced at two years of age. Cows calving first at two years of age have had a slight advantage in percent calf crop weaned and have weaned 1.15 more calves per cow than those cows calving first at three years of age.

Second Trial

A second trial was initiated in October, 1954, with 42 heifers from the experimental herd. These heifers were divided into three lots of

Table 3.—Production records at 9½ years for cows that calved first as two- and three-year-olds.

Age at first calving	Two-year-olds	Three-year-olds
Number of cows at start of experiment	60	60
Number of cows remaining Nov. 1, 1957	48	46
Number of possible calvings[1]	437	390
Number of calves weaned	400	344
Percent calf crop weaned	91.5	88.2
Number of calves weaned per cow	7.32	6.17
Average weaning weights (corrected for age and sex)	478	487
Average calving date	3/11	3/9
Cow cost/cwt. calf weaned	9.90	11.51

[1] Considers the total number of times the cows should have calved. Percent calf crop is based on this figure.

14 heifers each on the basis of shrunk weight, age, sire and dam's productivity, with one lot being wintered at each of the levels used in the first trial. All of the heifers were bred to calve first at two years of age. During the winter of 1956-57, in an attempt to establish greater differences among treatments, the low level lot received no supplemental feed, the medium level lot received 2 pounds of cottonseed meal all winter plus 2 pounds of milo after February 20, and the high level lot received 2.5 pounds of cottonseed meal all winter with 3 pounds of milo to January 15 and 5 pounds during the rest of the winter period.

Results of the second trial (1956-57) may be found in Table 4. This includes data for the second calf crop produced by these cows.* Differences in weight gain among the lots were very small considering the large differences in amount of supplemental feed provided. It must be emphasized that grazing conditions were quite favorable during the winter of 1956-57. There was a large supply of annual grasses (primarily rescue grass, downy brome and hairy brome) throughout the winter. The low level heifers gained an average of 79 pounds during the winter with no supplemental feed. Summer gains were small as might be expected considering the fleshy condition of the heifers at the end of the winter period. The difference in average weight in the fall of 1957 between the high and low level lots was only 84 pounds compared to a difference of 118 pounds the previous fall.

There were no significant differences between the lots in number of calves born or number weaned. The average calving date for the high level lot was about two weeks earlier than for the other lots. There

* Data for other years may be found in Okla. Agr. Expt. Sta. Misc. Pub. MP-45 and 48 (1956-57)

Table 4.—Summary of performance of beef cows wintered at low, medium and high levels of supplemental feed. (Second trial, 1956-57).

Lot number Level of winter supplement	1 Low	2 Med.	3 High
No. of cows per lot 11/2/56	12	14	14
No. of cows remaining 11/1/57	12	13	11
Average cow weights (lbs.)			
Fall 11/2/56	922	994	1040
Gain to calving 2/4/57	+124	+119	+156
Gain from calving to 4/12/57	— 45	— 51	— 43
Spring 4/12/57	1001	1062	1153
Total winter gain	79	68	113
Fall 11/1/57	1091	1111	1175
Summer gain	90	49	22
Winter feed cost per cow ($)	7.72	19.50	35.70
Summer feed cost per cow ($)	17.79	17.79	17.79
Total yearly feed cost per cow ($)	25.51	37.29	53.49
Calf production records			
Number of calves born	11	14	13
Number of calves weaned[1]	10	13	11
Average calving date	3/11	3/9	2/23
Average calf weights (lbs.)			
At birth (corrected for sex)	78.3	82.6	79.7
At weaning (corrected for age and sex)	399	421	425

[1] One calf in each lot was stillborn. One calf in Lot 3 died at one week of age of unknown causes.

was a trend, as observed in the previous year, for higher levels of winter supplement to be reflected in slightly heavier calves at weaning. However, the difference in average calf weights between the low and high level lots was only 26 pounds, and the low level proved to be most profitable in this comparison.

Third Trial

The third trial was initiated in October, 1955, with 3 lots of 14 heifers each from the station herd. Allotment and management of these heifers were the same as for the second trial, except that the level of supplemental feed was varied during each winter in an attempt to attain the following gains from early November to mid-April:

First Winter as calves

Low level—no gain during the winter period.

Medium level—0.5 lb. gain per day.

High level—1 lb. or more gain per day.

Second winter as bred yearlings

Low level—no gain to calving, marked loss of body weight after calving with a total loss of approximately 250 lbs. from fall to spring.

Medium level—moderate gain to calving (50 lbs.) with approximately 150 lbs. loss from calving to the end of the winter period.

High level—high gain to calving (100 lbs. or more) with essentially no loss while nursing calves.

Results of the third trial for 1956-57 may be found in Table 5*. Average gains for these heifers were 21, 80 and 156 for the low, medium and high level lots, respectively, during the first winter as calves (1955-56). During the second winter (1956-57) the gains to the start of the calving period approached the desired level. After calving the level of supplement seemed to have little effect on the weight losses of the

Table 5.—Summary of performance of beef heifers wintered at low, medium and high levels of supplemental feed (third trial, 1956-57).

Lot number Level of winter supplement	1 Low	2 Med.	3 High
No. of cows per lot 11/2/56	14	14	14
No. of cows remaining 11/1/57[1]	11	11	14
Average cow weights (lbs.)			
Fall 11/2/56	835	848	897
Gain to calving 2/4/57	— 7	38	81
Gain from calving to 4/12/57	—84	—91	—116
Spring 4/12/57	744	795	862
Total winter gain	—91	—53	—35
Fall 11/1/57	872	866	930
Summer gain	128	71	68
Winter feed cost per cow ($)	7.72	20.34	35.85
Summer feed cost per cow ($)	17.79	17.79	17.79
Total yearly feed cost per cow ($)	25.51	38.13	53.64
Calf production records			
No. of calves born	13	12	14
No. of calves weaned[2]	10	10	12
Ave. calving date	3/6	3/3	2/19
No. of heifers requiring assistance	9	7	12
Ave. difficulty at calving score[3]	3.54	3.00	3.86
Ave. calf weights (lbs.)			
At birth (corrected for sex)	75.0	72.4	78.4
At weaning (corrected for age and sex)	349	361	372

[1] One cow in Lot 1 died in calving and one died two weeks after calving of malignant edema. One cow in Lot 1 was removed after becoming sensitive to sunlight. One Lot 2 cow was removed after a pasture injury, one was killed by lightning and one was removed after showing no evidence of being in heat through two breeding seasons.

[2] Number weaned in Lot 1 includes an orphan calf raised by a foster dam. Its weight is not included in the average weaning weight. Two calves in each of Lots 1 and 2 were stillborn; one calf in Lot 1 and one in Lot 3 were injured at calving and died soon after; and one calf in Lot 3 died soon after birth of unknown causes.

[3] 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.

* Data for previous years may be found in Okla. Agr. Expt. Sta. Misc. Pub. MP-48 (1957)

Table 6.—Summary of body measurements (fourth trial).

Lot number Level of winter supplement	1 Low	2 Med.	3 High
Height at withers (in.)			
Fall, 1956	40.7	40.4	40.4
Spring, 1957	41.3	41.7	42.1
Fall, 1957	42.5	42.8	43.2
Length of body (in.)			
Fall, 1956	45.2	45.4	45.2
Spring, 1957	44.5	46.6	46.8
Fall, 1957	49.3	51.8	52.1
Hearth girth (in.)			
Fall. 1956	55.6	55.8	55.8
Spring, 1957	54.1	57.6	61.3
Fall, 1957	62.2	64.2	66.1
Width at hips (in.)			
Fall, 1956	13.7	13.9	14.1
Spring, 1957	14.1	15.1	15.9
Fall, 1957	16.9	17.8	17.8

heifers, with the high level lot showing the greatest loss. During the calving period, the low level lot received no supplemental feed, the medium level lot received 2 pounds of cottonseed meal plus 2 pounds of milo and the high level lot received 2.5 pounds of cottonseed meal and 5 pounds of milo per day. Weight losses for the entire winter period were inversely related to the level of supplement. Losses for the low level lot were somewhat less than desired even though no supplement was fed. Lot 1 made the greatest summer gain and Lot 3 the smallest gain. The difference in average weight between Lots 1 and 3 was reduced from 118 to 58 pounds between April and November.

No definite trends were established in the number of calves born or number weaned. Lots 1 and 2 were very close in average calving date, while the average date for Lot 3 was about two weeks earlier. This is very similar to the results obtained in the second trial during 1956-57. More heifers had to be assisted at calving in Lot 3, but there was little difference in the average difficulty at calving score.

As in the second trial, the extra winter supplement for Lots 2 and 3 was reflected in heavier calves at weaning. However, $28.13 worth of supplement fed to Lot 3 resulted in an average of only 23 pounds extra weight per calf and again the low level was most profitable.

Fourth Trial

A fourth trial was initiated in November, 1956, with 45 heifer calves from the experimental herd divided into 3 lots of 15 head each. Allotment was on the basis of shrunk weight, age, dam's productivity, sire and grade. The amount of winter supplemental feed was adjusted in an attempt to attain a desired amount of gain as described for the third trial.

Winter gains during 1956-57 were —8, 80 and 170 pounds for the low, medium and high level lots, respectively. The low level lot received .75 pound per head of cottonseed meal every other day from January 12 to February 25 and no supplement during the rest of the winter. The medium level heifers received 2 pounds of cottonseed meal per head per day all winter plus 2 pounds of milo per head per day after February 20. The high level lot was given 2.5 pounds of cottonseed meal per head per day all winter, and in addition received 3 pounds of milo to December 21, then 4 pounds to January 12, and 6 pounds per head per day for the rest of the winter.

Summer gains were inversely related to winter gains and averaged 237, 218 and 155 pounds for the low, medium and high level lots, respectively. Average weights for the three lots in the fall of 1957 were 708, 785 and 815 pounds. Table 5 contains a summary of some body measurements taken each fall and spring. The treatments resulted in very little difference in the height of the heifers, but affected the other measurements to some extent.

Fifth Trial

A fifth trial was initiated in October, 1957, with 60 heifers from the experimental herd. They were allotted into four lots of 15 heifers each on the basis of shrunk weight, age, dam's productivity, sire and grade. The first three lots are now (winter of 1957-58) being wintered in the manner described for the third and fourth trial. The fourth lot is being wintered at a "very high" level. They are being self-fed a 65 percent concentrate ration in dry lot. All lots will be pasture mated in the summer of 1958 to calve first at two years of age.

Summary

The results of the ninth consecutive year in a long-time study at the Ft. Reno station on the effects of low, medium and high levels of supplemental feed on the performance of range beef cows are presented. Data obtained indicate a slight effect of level of winter feed on mature weight of the cows, but no significant difference on birth or weaning weight of the calves. There has been a trend for the low level lots to calve slightly later, but to wean a larger percent calf crop. The cost per cwt. of calf weaned has been least for those cows wintered at the low level, and has been less for those calving first as two-year-olds than for the cows calving first as three-year-olds. The first trial is now in its tenth consecutive year.

Four repetitions are now in progress with heifers from the experimental herd. Body weight was affected somewhat in all trials by level of winter feeding; however, summer gains have tended to compensate to a large extent for differences in winter gain. Weaning weights of calves from the second and third trials were increased by higher levels of winter feed, but the differences in weaning weight were not great enough to pay for the extra feed cost of the medium and high level.