

3. Within weight groups and ration groups, wether lambs did not consistently gain more rapidly than ewe lambs; however, in three cases out of four they required less feed per cwt. gain.

4. Considering gain based on body weight, there was little difference in average daily gain of the three weight groups. The heavier lambs gained considerably faster, but difference was due mostly to greater body size.

5. The death loss in this trial was extremely low—only one lamb died.

6. This study would again indicate that a positive margin is necessary to return a net profit with lambs fed in dry-lot even with excellent gains and feed efficiency.

## **The Reproductive Performance of Hereford Heifers on Different Levels of Winter Feeding and Summer Grazing**

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The common practice of restricting the breeding of beef cow herds to a single limited season each year forces the producer to make the decision as to whether to breed heifers first as yearlings or as two-year olds. Several important factors must be considered in arriving at this decision: the size and condition of the yearling heifers; the level of winter feeding that will, or must, be provided; the amount of gain they can be expected to make during their yearling summer grazing season; and, probably most important, the amount of attention that can be given to the heifers during their first calving season.

The results of previous studies at Ft. Reno have indicated that if a beef heifer is sufficiently well developed she may calve first at two-years of age, and her later reproductive performance, mature size, and life span will not be adversely affected. It is true that two-year-old heifers may have a lower calf crop percentage and wean lighter weight calves than do older heifers. However, their performance at older ages is equal to that of heifers calving first at three-years of age, and, because

of the extra calving season, their lifetime performance is greater. The most serious limitation of two-year-old calving is the increased number of difficult births. Most studies have shown that nearly one-half of the heifers will require assistance. The producer must be in a position to provide careful attention during the calving season. If he cannot provide this additional attention he would be wise to delay breeding.

If heifers are to be bred to calve at two years of age they must have reached sexual maturity and established a regular estrual cycle by 15 months of age. Several factors are known to influence the age of puberty. There are indications that there is a difference between the beef breeds. There is also good evidence that the hybrid vigor expressed by crossbreds in other traits is also seen in earlier puberty. However, probably the most important single factor is the nutritional level on which the heifers are maintained from weaning until puberty. This is particularly true in the case of spring bred heifers that must reach puberty during the critical winter feeding period.

Previous work at Ft. Reno has shown that the heifers on a high level of winter feeding, that necessary to produce daily gains of 1.0 to 1.25 lbs. per day, had the best reproductive performance. However, because of the cost involved, the best practical level was the moderate level, which gave winter gains of 0.5 lbs. per day, even though reproductive performance was not as good. Most heifers fed at a low level, which gave no gain during their yearling year, conceived but calf crop weaned percentages and weaning weights were reduced to the point that the moderate level was more profitable. It should be pointed out that these results were obtained under the conditions at Ft. Reno where, in most years, good grass is available from early spring through late summer.

The average calving date has been later for heifers maintained on the lower levels of winter feeding during their yearling winter. Since age at first estrus and breeding dates were not obtained it was not possible to determine whether this later calving was the result of delayed puberty or poor fertility or a combination of both.

This report is concerned with the effect of four levels of winter feeding and two levels of summer grazing on the occurrence of first estrus and breeding performance of yearling beef heifers. The data presented was obtained on heifers that were part of Project 650 at Ft. Reno.

### Experimental Procedures

One hundred five weaner Hereford heifer calves were selected in the fall of 1961 from the Ft. Reno experimental herd. They were allotted to seven groups of 15 each on the basis of sire, dam's productivity, age, grade and shrunk weight. The heifers were started on winter treatment in early November and fed (approximately 160 days to mid April) according to the following program:

Lot 1. (High-Continuous Summer Grazing) Gains of approximately 1.0 lb. per day until April 15, then continuous access to native grass pasture during the summer.

Lot 2. (High-Restricted Summer Grazing) Winter gains as in lot 1 until April 15, then were allowed access to native grass pasture on Monday, Wednesday and Friday and were confined to dry lots on other days.

Lot 3. (Moderate-Continuous Summer Grazing) Winter gains of 0.5 lbs. per day until April 15, then continuous access to native grass pasture as above.

Lot 4. (Moderate-Restricted Summer Grazing) Winter gains as in lot 3. Restricted grazing during summer.

Lot 5. (Low-Continuous Summer Grazing.) No gain or loss in weight until April 15, with continuous access to native grass pasture during the summer.

Lot 6. (Low-Restricted Summer Grazing) No gain or loss in weight until April 15, then restricted grazing during the summer.

Lot 7. (Low-High, Continuous Summer Grazing) Fed at the same level as lots 5 and 6 until March 15, and then fed at the High level until start of the breeding season on May 1. The heifers had continuous access to native grass pastures during the summer.

Lots 1 and 2, 3 and 4, and 6 and 7 ran together in dry native grass pastures during the winter. The heifers were weighed at two week intervals and the daily level of supplemental feed (cottonseed cake and ground milo) adjusted to produce as nearly as possible the gains outlined above. In order to obtain the desired gains it was necessary to start supplemental feeding of the high level lots on November 18, and of the moderate and low level lots on December 19. The heifers in lot 7 were separated from lot 6 on March 15 when lot 7 was raised to the high level which included sorghum silage as well as ground milo cottonseed cake. The heifers in Lot 5 were fed the same as lot 6 but ran in a separate pasture.

The heifers were started on test between seven and nine months of age at an initial weight of approximately 440 lbs. The occurrence of estrus was determined by the use of vasectomized bulls that were either painted daily on the brisket with grease or wore a harness with a grease filled pad covering the brisket. The heifers were checked daily for grease marks on the rump. Since birth dates of the heifers were known, age at first estrus could be calculated. Weight at first estrus was calculated from the weights at the regular two week weigh periods before and after first estrus. Vasectomized bulls were available only for Lots 1 and 2, 3 and 4, and 6 and 7, so no estrus dates were obtained for Lot 5 prior to the breeding season.

All heifers were exposed to fertile bulls wearing grease marking harnesses between May 1 and August 14, 1962. Breeding groups were checked several times daily and any heifer with a grease mark was recorded as bred on that date. All heifers were checked for pregnancy by rectal palpation approximately 45 days after the end of the breeding season.

## Results and Discussion

### Occurrence of First Estrus:

The average age and weight when first estrus was attained by heifers in the various lots is presented in Table 1. These figures are somewhat misleading in comparing the different lots because the averages were calculated only on heifers that reached puberty. Two heifers in Lot 6 never reached puberty during the study, therefore the averages for this lot are over estimates.

The average age at which first estrus occurred in the 90 Hereford heifers checked in this study was 371 days. The averages for the wintering levels were: high, 353 days; moderate, 373 days; and low, 386 days. Restricting grazing did not affect age at puberty of heifers on the high level, probably because most had cycled before the amount of grass became a factor. However, the average age at puberty was delayed 30 days in the heifers wintered at the moderate level and which were limited in their access to grass during the grazing season. These observations indicate that the moderate level of winter feedings does interfere with the reproductive development of the heifers, since a number of the heifers apparently do not reach puberty until after grass is available in the Spring. However, this delay in attainment of puberty does not handicap the heifers in their subsequent breeding performance in the breeding season. Comparisons of this sort could not be made in the low level group because the heifers on continuous summer grazing were not checked for estrus prior to the breeding season.

A higher percentage of the heifers in the high level of winter group (83.3%) had reached puberty before the start of the breeding season on May 1, than had those on the moderate level (66.7%) or low level (60%). These observations indicate that one of the reasons for a later average calving date in the low level groups of previous trials was they did not reach puberty until after the breeding season had started.

The data presented in Table 2 gives the percent of heifers in each level of wintering group that reached puberty each month from ages of 9 months to 17 months. If the heifers are to calve at two years of age they must be bred at 15 months of age. As can be seen from the accumulative total column of Table 2, the high level was the only group in which all heifers had attained puberty by that age. In the case of the heifers on the moderate level, 90% had reached sexual maturity by 15 months of age, but only 70% of the low level heifers would be ready to breed at that age. It is interesting to note that level of feeding had little or no effect on the small group of heifers that will reach puberty

Table 1.—The Effects of Different Levels of Winter Feeding and Summer Grazing on the Weights and Reproductive Development and Performance of Yearling Hereford Heifers.

Summer Grazing	Level of Supplemental Winter Feeding						
	High		Moderate		Low		Low-High
	Con- tinuous	Re- stricted	Con- tinuous	Re- stricted	Con- tinuous	Re- stricted	Con- tinuous
Lot	1	2	3	4	5	6	7
No. of heifers	15	15	15	15	15	15	15
Avg. Body Wts. (lbs.)							
Oct. 26, 1961	437	438	438	438	439	436	438
Mar. 15, 1962	564	570	505	519	438	453	448
May 2, 1962	647	652	568	585	442	445	527
Sept. 11, 1962	815	738	760	706	683	611	735
Avg. gain per heifer (lbs.)							
Winter (10-26-61 to 4-17-62)	183	181	82	101	—18	—7	46
Summer (4-17-62 to 9-11-62)	195	119	240	167	262	182	251
Occurrence of first estrus							
Avg. age (days)	359	347	358	388	---	371	400
Avg. weight (lbs.)	547	533	504	539	---	453	498
No. heifers in which first estrus occurred before May 1.	12	13	11	9	--	10	8
No. of heifers establishing a regular estrus cycle before May 1.	8	11	8	8	--	0	1
No. of heifers never in heat during breeding season (May 1-Aug. 14)	0	0	0	0	0	7	0
Breeding Performance							
No. settled	14	14	15	14	11	8	14
Percent of heifers settled on first service (%)	60	69	71	67	80	88	64
Avg. date of first breeding	5-23	5-20	5-30	5-28	6-19	7-5	6-4
Avg. date of conception	6-3	5-28	6-10	6-10	6-26	7-7	6-19
Avg. cost per heifer for supplemental winter feed	28.32	28.32	12.35	12.35	2.98	2.98	13.16

under 1 year of age. However, in the majority of the heifers, higher levels of feeding hastens sexual maturity.

The weights given in Table 1 at which first estrus occurred varied depending on the level of winter feeding. These data indicate that the Hereford heifers used in this study tended to reach puberty at a certain age rather than at a certain weight.

Table 2.—The Effects of Levels of Winter Feeding on the Age at Which Hereford Heifers Reach Puberty as Evidenced by the Occurrence of First Estrus.

Age	Percent of Heifers Reaching Puberty During This Month			Accumulative Total-Percent of Heifers That Have Reached Puberty by This Age		
	Low	Moderate	High	Low	Moderate	High
9 Months	3.3	3.3	0	3.3	3.3	0
10 Months	13.4	10.0	10.0	16.7	13.3	10.0
11 Months	13.3	20.0	36.7	30.0	33.3	46.7
12 Months	16.7	23.4	23.3	46.7	56.7	70.0
13 Months	13.3	6.6	27.0	60.0	63.6	90.0
14 Months	3.3	10.0	3.3	63.3	73.3	93.3
15 Months	6.7	16.7	6.7	70.0	90.0	100.0
16 Months	16.7	6.7	0	86.7	96.7	100.0
17 Months	6.6	3.3	0	93.3	100.0	100.0

#### Regularity of the Estrous Cycle:

The age at which first estrus occurs is of less practical importance than the age at which a regular estrous cycle is initiated. Many of the heifers in this study reached puberty, as measured by the occurrence of first estrus, at a relatively early age, but did not continue to cycle. In several cases two or more months elapsed between the occurrence of first and second estrus. As can be seen in Table 1, more than 50% of the heifers on the high and moderate levels of winter feeding had established a regular cycle before the breeding season began on May 1. However, only 1 heifer out of the 30 checked in the low levels had established a regular cycle.

#### Breeding Performance:

The breeding performance of heifers on the high and moderate levels of winter feeding were very similar. The greatest difference of any practical significance was the dates of first breeding and conception of the moderate level groups were approximately 1 week later than those for the high level groups. A slightly higher percentage of the moderate level heifers conceived on first service. Restricting summer grazing had no effect on breeding performance of heifers in these two wintering groups.

The breeding performance of the two groups of heifers maintained at a low level for the entire level was far from satisfactory, especially for the group that were restricted in their summer grazing. The percent of heifers settling during the breeding season for the two low level groups were 73.3% for those on continuous summer grazing and 53.3% for those restricted in their summer grazing. These conception figures compare to 93.3% or more for all other groups. Not only did fewer heifers settle, but the dates of conception were delayed. The low level group on continuous grazing had an average conception date some three