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Deferred Breeding of Beef Cows

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SUMMARY

Calving at two years of age reduced the percentage of calves produced by the same cows at the ages of three and four but not at the ages of five and six.

In the case of the two-year olds the lessened calving percentage at the ages of three and four does not offset the value of the calves produced.

At the age of six and one-half years cows which had produced their first calves as two-year-olds had produced an average of 0.7 calf more for the entire time than the cows which produced their first calves as three-year-olds.

The birth weight of the calves and the gain made by the calves from birth to weaning apparently increases with the age of the cow at least up to the age of five years.

Early breeding does not affect the size of the calves produced in subsequent years.

Two-year-old heifers suckling calves weighed 200 pounds less than dry two-year-olds.

The foregoing difference in weight was reduced to less than 100 pounds by the time the heifers were four years old.

The effects of early breeding were not changed by light or heavy winter feeding nor by the use of silage or of barley in addition to alfalfa hay.

Straw was a satisfactory substitute for a part of the alfalfa hay at the rate of 1½ pounds of straw for one pound of hay.

Silage was likewise a satisfactory substitute for a part of the alfalfa hay at the rate of two pounds of silage for one of hay.

Cows producing their first calves as two-year-olds were more profitable in the long run than cows producing their first calves as three-year-olds. The difference in profit at the end of four years was $36.15 per head.

A two-thirds ration of hay for winter feeding was distinctly more profitable than a full ration.

Heifers wintered on straw and alfalfa and beginning to calve as two-year-olds showed a profit of $49.44 per head.

Heifers fed a full feed of alfalfa and beginning to calve as three-year-olds showed a loss of $36.10 per head.

Deferred Breeding of Beef Cows

By

ROBERT WITHYCOMBE, E. L. POTTER, and F. M. EDWARDS

The objects of this test were (1) to determine the advantages and disadvantages of breeding beef cows to bring their first calves at two years of age as compared with breeding to bring their first calves at three years of age, (2) to compare light and heavy winter feed for growing heifers and for breeding cows, and (3) to determine the values of straw, silage, and grain fed with and compared with alfalfa for growing heifers and for breeding cows.

Plan of the test. One hundred head of weanling heifer calves were divided into ten lots of ten heifers each. The test was continued in its entirety for four years. Certain phases were continued for six years. The different lots were placed on summer range identical in all cases and on winter feed were handled as indicated in Table I.

TABLE I. OUTLINE OF FEEDING AND BREEDING PLAN
The heifers were all grazed on the same summer range.

Lot number	Winter feed	Age at time of producing first calf
		years
1	Straw with light feed of alfalfa	2
2	Straw with light feed of alfalfa	3
3	Light feed of alfalfa	2
4	Light feed of alfalfa	3
5	Full feed of silage and alfalfa	2
6	Full feed of silage and alfalfa	3
7	Full feed of alfalfa	2
8	Full feed of alfalfa	3
9	Full feed of alfalfa with light barley ration	2
10	Full feed of alfalfa with light barley ration	3

It will be noted that treatment of the several lots differed in respect to winter feed and the age when first bred. In winter each lot was fed as in Table I for five consecutive winters. At the beginning of the experiment each heifer was branded with a number on the hip and on the jaw, and an individual record was kept of her weights, gains, and calves. These individual numbers made it possible to run all the cattle together on summer range and yet be sure to get them in their proper lots the following winter. It was likewise possible to average the results by whatever grouping seemed necessary. For example, in studying the effects of early breeding on calving percentages in subsequent years only those cows that actually calved as two-year-olds were considered. Similarly, in studying the effects of early breeding on the development of the cows the only cows considered were those that produced a calf every year.

It will be noted that there were five different methods of winter feeding with two lots on each system of feeding. Of the pairs of lots on each feed, one lot was bred to produce their first calves as two-year-olds and the

Figure 1. A typical lot at the beginning of the test. Approximate age, 8 months. All lots were at this time as nearly alike as it was possible to get them.

other as three-year-olds. This made it possible to study the effects of early breeding under five different systems of winter feeding.

In the spring as soon as grass was available, the heifers were turned on the Station pastures or on pasture rented from neighbors. During the summer they went on the national forest in the mountains east and northeast of Union. The feed on this summer range was excellent, but the country is rough and somewhat inaccessible. From 1927 on, the losses on this range were so heavy that it was necessary to close the test sooner than

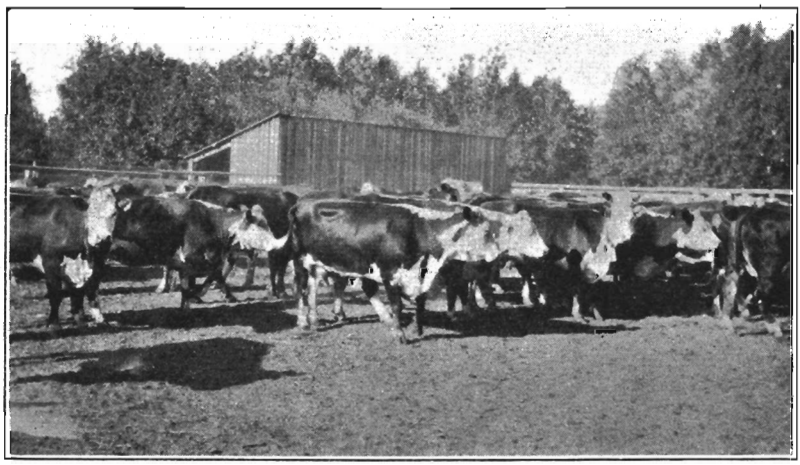

Figure 2. Cows of this test, ready for the summer range.

Figure 3. Calves from the experimental cows, branded and ready to go to the summer range with their dams.

would have been the case otherwise. Of the original 100 head, 30 disappeared on the summer range.

During the fall months the cattle were on the meadows and stubble fields of the Experiment Station farm. They were kept on this pasture as long as the weather would permit and sometimes given some supplemental hay. When winter proper set in, they were put in their respective feed lots and fed as outlined above.

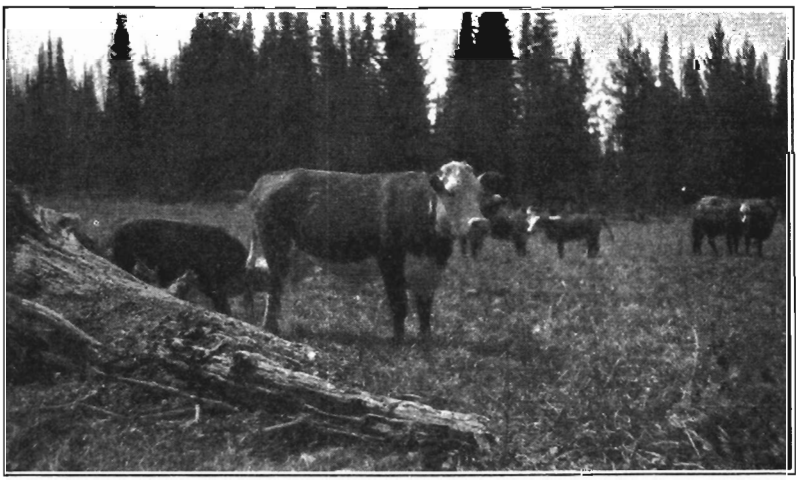

Figure 4. Cattle on the range. All lots were summered alike.

Feeds used. The feeds used were all grown on the Station farm. The alfalfa hay was put up in cocks and stacked with buck rakes and stacker, the usual practice around Union. The hay was put up as carefully as possible but all of the hay raised was fed just as it came from the stack. The barley also was raised on the Station farm and was ground with a plain roller mill. The silage was a good quality of peas and bald barley, which in previous tests had proved itself quite comparable to that of good corn silage. Barley straw was fed with occasionally some oats straw. All lots were given straw for bedding. The cattle picked this over more or less, especially those in lots 3 and 4 (on the light feed of alfalfa hay). Salt was before all lots at all times.

Shelter. The cattle were wintered in open lots with a six-foot board fence furnishing some protection from storms. Each lot of 10 head had a pen 45 by 115 feet. A small spot in each lot, perhaps 25 or 30 feet in diameter, was kept bedded with straw. There were a few trees and brush around the lots but otherwise the location was very cold and windy. No sheds were used. Water, while on winter feed, was supplied by a small stream which ran through the edge of the lots in a wooden flume. The water was cold but ran fast enough to prevent freezing and was clean at all times.

Stock used. The heifers were well-bred grade Herefords purchased as follows:

62 head from L. B. Pierce, La Grande, Oregon.
16 head from C. A. Hunter, Wallowa, Oregon.
22 head from Mrs. H. McDonald, Wallowa, Oregon.

A few of the heifers were supposed to be pure bred but were unregistered. The bulls used were pure-bred Herefords.

CALVES PRODUCED BY TWO-YEAR-OLDS

The heifers which were to calve as two-year-olds were bred to begin calving on April 1. A few calves came the last of March but most of them came in April and May. A few came later. Since these heifers were themselves early calves, they were probably all a little past 24 months at the time their first calves were born. Their exact age, however, was not known. These two-year-old heifers produced a calf crop of 85.7 percent based on the number of calves born or 81.6 percent based on the number of calves weaned. This was, of course, a satisfactory calving percentage. The calves were strong and vigorous and the cows took good care of them. They were apparently of average size. In quality they were above the average. Casual observation of these calves the year they were born did not lead the writers to expect that the later calves would be any larger or better. The calves dropped in subsequent years did not appear to be different but the test weights showed that they were somewhat larger at birth and made larger gains. The exact difference will be shown later. It may be said, therefore, that the calves from two-year-old cows were slightly smaller than calves from older cows.

INFLUENCE OF EARLY BREEDING AGE ON CALVING PERCENTAGE IN SUBSEQUENT YEARS

The biggest question in connection with breeding cows to produce their first calves at two years of age is whether the percentage of calves produced in subsequent years will be reduced and if so, how much. This question is answered in Table II.

TABLE II. CALVING PERCENTAGES

Year	Age of cows at time of calving	Group I (First calves at 2 years)	Group II (First calves at 3 years)
	yrs.	%	%
1926	2	100.0	.....
1927	3	79.6	95.2
1928	4	86.1	100.0
1929	5	94.7	93.6
1930	6	83.3	83.3

Note: Group I includes only those heifers that actually calved in 1926, hence the calving percentage of this group for that year is 100 percent.

The percentages in this table are based on actual pregnancies. Calves that died or were born dead are included. On the other hand, twins are counted as one calf. In 1926 there were 49 head of heifers in Group I and 49 in Group II. Death and stray loss gradually reduced the numbers in each group, but otherwise the groups remained the same until the end of 1929, when the experiment proper was closed. However, 18 cows in Group I and 12 in Group II were retained for another experiment. The calving percentages of these cows for 1930 are added to the table for whatever value they may have.

It will be seen from Table II that the heifers that calved at two years of age did not produce as many calves at three and at four years of age as the heifers that did not calve when they were two-year-olds. At the age of five years, however, this difference seems to have disappeared, and at the age of five and six the calving percentage in the two groups of heifers was practically the same. The smaller calf crop produced by Group I as threes and fours did not offset the extra calf crop produced at two years of age. At the time the cows were six and one-half years of age Group I had produced an average of 4.4 calves while Group II had produced an average of 3.7 calves, or a difference of 0.7 calf in favor of Group I.

It has been stated that cows calving as two-year-olds are frequently barren after that age. Only one cow out of Group I failed to calve after she was two years old. She was lost on the range in 1929, however, so that it is not known whether she would have calved again. One other cow in Group I did not calve in 1927 or 1928 but she did calve in 1929. These are the only two cows in the test that failed to calve for as long as two consecutive years.

INFLUENCE OF EARLY BREEDING ON SIZE OF CALVES

The question of the influence of early breeding on size of calves involves two points: (1) the size of the calves produced by the two-year-old heifers, and (2) the size of the calves produced by these heifers in subsequent years. The calves varied in ages so that the weights at any particular date would not be significant. It was therefore necessary to record the birth weights and the daily gains from birth until weaning for all calves except those dropped while the cows were on the summer range. The results are given in Table III.

TABLE III. AVERAGE BIRTH WEIGHT OF CALVES

Year	Age of cows at time of calving	Group I (First calves at 2 years)	Group II (First calves at 3 years)
	yrs.	*lb.*	*lb.*
1926	2	67.2	.....
1927	3	70.2	68.9
1928	4	69.5	67.3
1929	5	77.8	76.3
1930	6	76.9	77.5

Table III shows that the calves produced by Group I as two-year-olds were a little smaller at birth than the calves from the same cows in later years. They were likewise a little smaller than the calves from the cows in Group II. The average birth weights of the calves from the two groups, however, for the years 1927, 1928, 1929, and 1930 were 73.6 for Group I and 72.5 for Group II. There was a difference of only 1.1 pounds and that in favor of Group I. It is reasonable to conclude, therefore, that breeding Group I to calve as two-year-olds did not lessen the size of the calves produced in subsequent years. There was, however, a very distinct tendency for the birth weight of the calves to increase slightly as the cows became older, up to the age of five years at least.

DAILY GAIN OF CALVES FROM BIRTH TO WEANING

Table IV shows the daily gain of calves in the different groups from birth until weaning time. This table, like Table III, includes only calves produced before the cows went on summer range and alive at weaning time.

TABLE IV. AVERAGE DAILY GAIN OF CALVES FROM BIRTH TO WEANING

Year	Age of cows at time of calving	Group I (First calves at 2 years)	Group II (First calves at 3 years)
	yrs.	*lb.*	*lb.*
1926	2	1.38	.....
1927	3	1.39	1.43
1928	4	1.64	1.59
1929	5	1.72	1.76

Table IV is very similar to Table III, showing the birth weights. It shows a tendency for the calves from the two-year-olds to gain less than

the calves from older cows. It likewise shows a tendency for the rate of gain for the calves to increase as the cows grow older regardless of whether the cows did or did not produce calves as two-year-olds. It also shows little difference between Group I and Group II in the average gains made by the calves for the three years 1927, 1928, and 1929. This table, together with the one on birth weights, shows three points quite distinctly. First, calves from two-year-old heifers are smaller than calves from older cows. Second, calving as two-year-olds did not reduce the size of calves produced by these cows in subsequent years. Third, both the birth weight and the daily gains of the calves increase as the cows grow older, at least up to the age of five years.

INFLUENCE OF EARLY BREEDING ON SIZE AND DEVELOPMENT OF THE COWS

Table V shows clearly the influence of early breeding on the development of the cows. Group I includes only cows that produced a calf each year at the ages of two, three, and four. Group II includes only cows that produced a calf each year at the ages of three and four. All cows were born in the early spring of 1924. The two groups were fed and handled alike except that those in Group I calved as twos while those in Group II did not.

TABLE V. AVERAGE WEIGHT OF COWS PER HEAD

Date weighed	Group I (29 cows)	Group II (34 cows)	Difference in favor of Group II
	lb.	*lb.*	*lb.*
January 15, 1925	457	456	–1
April 15, 1925	524	531	7
July 12, 1925	636	635	–1
October 29, 1925	737	745	8
November 28, 1925	782	779	–3
July 3, 1926	896	1008	112
November 13, 1926	850 *	999	149
December 20, 1926	880	1082	202
May 6 1927	974	1146	172
July 13, 1927	1017	1170	153
October 8, 1927	988 †	1089 *	101
December 1, 1927	991	1094	103
April 27, 1928	1091	1184	93
June 25, 1928	1142	1221	79
October 12, 1928	1046 ‡	1123 †	77
November 28, 1928	1080	1179	99

*First calves.
†Second calves.
‡Third calves.

It will be noted that the greatest difference was in the fall of 1926 just after the two-year-olds of Group I had weaned their calves. The difference in weight at this time was 202 pounds. The cows in Group II were fatter, but how much of this difference in weight was fat and how much actual growth could not be measured. This advantage in weight of Group II gradually diminished, and by the time the cows were five years old the difference was less than 100 pounds. It would be interesting to know whether this difference might have disappeared entirely by the time the

Figure 5. Lot 3, at the beginning of the fifth winter, on a light feed of alfalfa hay. Approximate weight, 1,070 pounds. These cows were bred to drop their first calves as two-year-olds.

cows were eight or ten years of age, but it was impossible to continue the experiment that long and the question must remain unanswered. The exact value of this extra weight is also debatable. If the cows had been sold for beef at five years of age, this extra weight would have been a distinct asset, but when kept for breeding purposes its value is less certain, especially when the data show that Group I, by this time, was producing as many calves and as large calves as Group II, and was therefore equally valuable from the breeding standpoint.

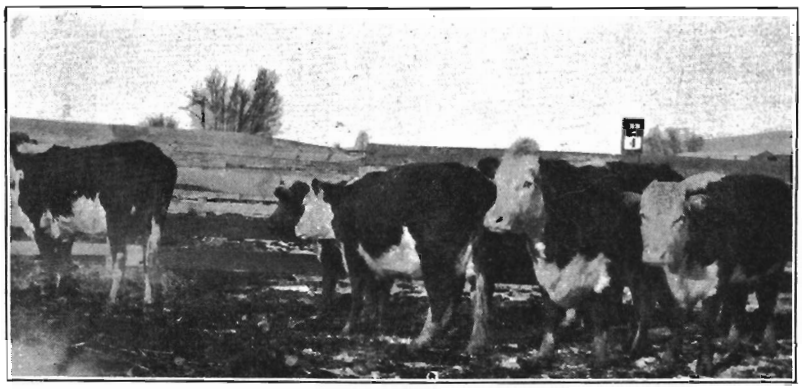

Figure 6. Lot 4, at the beginning of the fifth winter, on a light feed of alfalfa hay. Approximate weight, 1,160 pounds. These cows were bred to drop their first calves as three-year-olds.

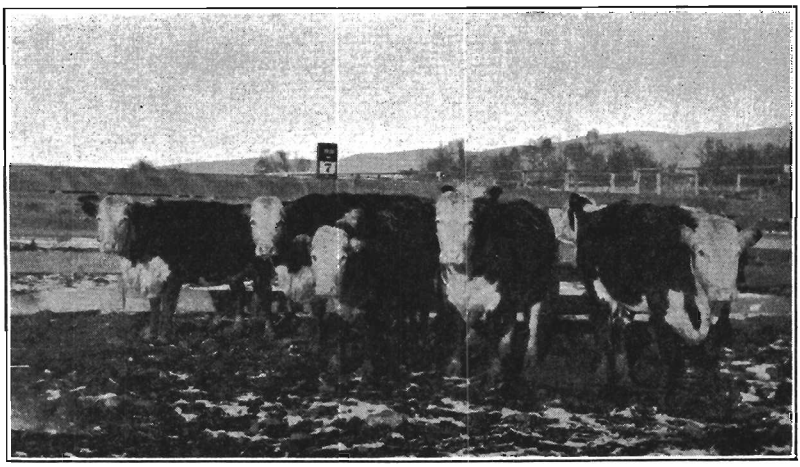

Figure 7. Lot 7, at the beginning of the fifth winter, on a full feed of alfalfa hay. Approximate weight, 1,150 pounds. These cows were bred to drop their first calves as two-year-olds.

Figure 8. Lot 8, at the beginning of the fifth winter, on a full feed of alfalfa hay. Approximate weight 1,225 pounds. These cows were bred to drop their first calves as three-year-olds.

EARLY BREEDING AS MODIFIED BY HEAVY FEEDING

The data already given concerning the effects of early breeding have been based on the data from all the experimental lots. These data show that on the average the advantage of obtaining a calf from the two-year-old heifer was partly offset by a smaller calf crop and a smaller cow as a three-year-old and as a four-year-old. The question naturally arises whether these adverse effects of early breeding could have been counteracted by

heavier feeding. Since lots 1, 2, 3, and 4 were on rather light winter feed, lots 5, 6, 7, and 8 on heavy winter feed, and lots 9 and 10 on extra heavy winter feed, it would be expected that this test would answer the question. The results, however, were not consistent. In some cases heavy feeding seemed to counteract the effects of early breeding, but in other cases it did not. Since it is impossible to draw definite conclusions from the data, they are omitted from this publication.

It should be remembered that none of the cattle in this test were on extremely poor feed. What would have happened if some of the heifers had been on very poor feed was not determined. It should also be remembered that the heifers which calved at the age of two years were themselves all early calves and at least fairly well grown, and that they did not begin calving until the last of March or later, the bulk of the calves coming in April and May. This test therefore gives no indication as to what might have happened if some of the heifers had been actually less than 24 months of age when their first calves were dropped, or if they had been very poorly fed, or if they had calved in January or February.

COMPARATIVE VALUES OF ALFALFA, SILAGE, BARLEY, AND STRAW

While these tests fail to show definite conclusions as to the effects of light and heavy feeding in counteracting the effects of early breeding, some points as to the relative values of alfalfa, silage, barley, and straw were quite thoroughly demonstrated.

The use of barley in addition to a full feed of alfalfa not only was expensive but failed to produce significant results. The cows receiving barley did not produce more calves or larger calves. The cows were fatter, but this fact had no practical advantage and appeared rather to have a disadvantage in that the range losses were heavier with the fat cows.

The use of silage in addition to alfalfa did not improve the calf crop or the condition of the cows. On the other hand, the silage did not show any detrimental effects. Each ton of silage fed reduced the alfalfa consumed one-half ton. Since the results were similar, one ton of silage may be considered as equivalent in feeding value to one-half ton of alfalfa when used for wintering cows.

The liberal use of barley straw for wintering cows or heifers saved half the alfalfa and reduced the annual expense. The results were equal to the results obtained from a limited ration of alfalfa but not equal to those obtained where alfalfa was fed in unlimited amounts.

The data indicate that nothing was gained from keeping the cows fat. As long as the cows were in strong, vigorous, healthy condition the amount of fat they carried seemed unimportant.

FINANCIAL CONSIDERATIONS

In determining the financial status of the various lots it is necessary to use some arbitrary valuation for the various feeds and other items involved. Actual feed prices and cattle prices of course varied from time to time during the experiment. Since, however, the object of the experiment was to study the effects of feeds and date of breeding rather than market

fluctuations, the same price for feed and other items has been used throughout the experiment. These valuations are fairly representative of conditions as they existed during the time of the test. The reader should compare these valuations very carefully with conditions as they exist on his own ranch and should modify the conclusions accordingly.

VALUES USED IN FIGURING FINANCIAL RETURNS

Hay per ton	$ 8.00
Straw per ton	1.00
Silage per ton	6.00
Barley per ton	30.00
Labor of feeding hay and straw per ton	1.25
Labor of feeding silage per ton	0.625
Labor of feeding barley per ton	2.00
Pasture including riding, per month	.80
Interest per annum	8%
Death and stray losses per annum	4%
Taxes per head per annum	$ 0.75
Initial cost of heifer calves	40.00
Value per head credited for calves produced	40.00

In determining the relative profit of the various lots, each lot was charged with all items, initial cost, feed, labor, interest and taxes, and credited with the calves produced. The value of the cows at four and one-half years of age was figured at $70 a head. They were cows of unusual size and quality and were probably worth a little more than $70 at this time. Interest was charged on the total accumulated cost at the beginning of each year, less the amount credited for calves produced. In this way it was possible to obtain a figure showing the total profit or loss at the end of the fourth year, November 28, 1928, at which time the cows were past four years old. The cost figures were not carried farther than this date as losses were making the lots too small to be dependable. In this connection it should be stated that the figure of 4 percent for death and stray losses was purely arbitrary. It was about a fair average of all our experimental work and probably represents average range conditions in the Blue Mountain section of Oregon. It was not, however, an average of this particular test. The loss during the first two years of this test was light but after that the loss on the summer range was excessive. The exact losses are shown below.

TABLE VI. LOSSES OF EXPERIMENTAL COWS

Year	Number of cows	Age of cows	Lost when not on National Forest	Found dead on National Forest	Disappeared on National Forest
		yrs.			
1925	100	1	--	--	1
1926	99	2	--	--	3
1927	96	3	2	1	11
1928	82	4	--	--	10
1929	39*	5	1	--	5
Total			3	1	30

*Following 1928, 33 head were sold.

One cow died in calving, one was lost in a bog hole, one was killed by a train, one died on the summer range. Thirty head disappeared from the summer range without a trace. The range was ridden with extreme care, but these cattle were never found either dead or alive. If this test had

been charged with those losses the results would have been so distorted that they could not be other than misleading. The lots were therefore charged with a normal loss rather than with the actual loss.

The general plan of winter feeding has already been given. It was not always practicable to adhere rigidly to that plan. A little supplemental feed was sometimes necessary before the cattle were taken off pasture and put into the winter feed lots. Some extra feed was occasionally necessary late in the spring, especially for cows with calves. The total amount of feed actually consumed exclusive of pasture by the different lots each year is shown in Table VII.

TABLE VII. TOTAL POUNDS OF WINTER FEED PER HEAD

Year	Feed	Lots 1 and 2	Lots 3 and 4	Lots 5 and 6	Lots 7 and 8	Lots 9 and 10
		lb.	*lb.*	*lb.*	*lb.*	*lb.*
First year January 15, 1925 to November 28, 1925	Hay	526	940	1145	1664	1574
	Straw	1152	.....	.....	.....	.....
	Silage	.....	.....	824	.....	.....
	Grain	.....	.....	.....	.....	261
Second year November 28, 1925 to December 20, 1926	Hay	1950	3094	3372	4419	3932
	Straw	1756	.....	.....	.....	.....
	Silage	39	113	2160	113	98
	Grain	.....	.....	.....	.....	320
Third year December 20, 1926 to December 1, 1927	Hay	1487	2512	3379	4387	4114
	Straw	1779	.....	.....	.....	.....
	Silage	374	367	2052	414	392
	Grain	10	7	9	12	314
Fourth year December 1, 1927 to November 28, 1928	Hay	1633	4113	3387	5321	5302
	Straw	3015	80	80	80	80
	Silage	381	258	4097	360	322
	Grain	.....	.....	.....	.....	134

On the basis of amounts of feed and the values given a financial balance sheet was prepared which shows the final outcome as measured in dollars and cents. Again the reader should keep in mind the values for feed and other items on which this table is based. Where the costs of the various items involved are different the final profit or loss must also be different.

Table VIII is worthy of most careful study. The cows which produced their first calves as two-year-olds were uniformly more profitable than those which did not calve until three years of age. This was true not only in the average but with each of the five different methods of feeding. On straw and alfalfa the difference in favor of early calving was $34.25 a head, on a light feed of alfalfa the difference was $21.65, on alfalfa and silage $38.47, on full feed of alfalfa $47.64, and on grain and alfalfa $38.77. The lots which calved as two-year-olds showed an average profit of $13.86 per head, while those which calved as three-year-olds showed an average loss of $22.29, or a total difference of $36.15 per head in favor of the early breeding. It is true that the cows which did not calve as two-year-olds were heavier at the end of the test, but apparently they were not producing more or better calves. This difference was certainly not enough to offset the difference of $36.15 a head in returns. It has already been noted that the cows which calved first as two-year-olds did not produce as many

TABLE VIII. PROFIT OR LOSS PER HEAD, JANUARY 15, 1925 TO NOVEMBER 28, 1928

Lot	Method of wintering	Age at first calf	Total cost	Total credits*	Profit	Loss
		yrs.				
1	Straw with light feed of alfalfa	2	$125.56	$175.00	$49.44	.....
2	Straw with light feed of alfalfa	3	134.81	150.00	15.19	.....
3	Light feed of alfalfa	2	144.75	166.67	21.92	.....
4	Light feed of alfalfa	3	149.73	150.00	.27	.....
5	Full feed of silage and alfalfa	2	180.25	176.28	.....	$ 3.97
6	Full feed of silage and alfalfa	3	189.11	146.67	.....	42.44
7	Full feed of alfalfa	2	174.02	185.56	11.54	.....
8	Full feed of alfalfa	3	180.38	144.28	.....	36.10
9	Full feed of alfalfa with light barley ration	2	187.06	177.44	.....	9.62
10	Full feed of alfalfa with light barley ration	3	198.39	150.00	.....	48.39
Lots 1, 3, 5, 7, 9 Average		2	162.33	176.19	13.86	.....
Lots 2, 4, 6, 8, 10 Average		3	170.48	148.19	.....	22.29

*Including the final value of the cow at $70.

calves the two following years. The final analysis of costs, however, shows that in spite of this difference they were still much more profitable.

The table shows not only a difference in income between those which were bred to calve as two-year-olds and those which were bred to calve as three-year-olds, but also a difference in cost, due chiefly to interest charges. The cows are charged with interest each year on the amount which they had actually cost at that time less the income produced. For example, Lot 2 had cost at the beginning of the third year of the test $80.57. Lot 1 had cost practically the same figure, or $81.10, but had produced a $40.00 calf so that the net amount invested in this lot was only $41.10 per head. As time passed these differences increased. By the close of the test the cows in Lot 1 had cost $125.56 but had paid back $105.00, so that there was only $20.56 invested in them. At the other extreme was Lot 10, which had cost a total of $198.39 a head and had paid back $80.00, so that the investment in that lot was $118.39 a head. Necessarily the interest on this lot was much higher than on those lots where the total investment was less. The final difference of $36.15 in profit between the lots that began calving as two-year-olds and the lots that began calving as three-year-olds was therefore due to $28.00 more income accompanied by $8.15 less cost.

In comparing the various feeds used for wintering, the following facts are shown: Lots 1 and 2 were fed approximately one-half as much hay as lots 3 and 4. For each pound the hay consumption was reduced, however, one and one-half pounds of straw were consumed. Since these two groups made about the same growth and showed similar performance in calving, it is fairly safe to say that straw can be substituted for a substantial portion

of the alfalfa at the rate of one and one-half pounds of straw for each pound of hay. The larger profit shown by lots 1 and 2 as compared with lots 3 and 4 is not due to any material difference in the performance of the cows but merely to the fact that straw at $1.00 a ton was distinctly cheaper than alfalfa at $8.00 a ton.

Lots 3 and 4 on light feed of alfalfa were fed approximately two-thirds as much hay as lots 7 and 8, which were given all they could eat throughout each winter. The full feed of alfalfa produced slightly heavier and fatter cows. Lot 7 made the best calving record of any of the lots, but Lot 8 made the poorest. On the average the cattle on full feed of alfalfa showed a total income of only $6.59 a head more than cattle that had consumed only two-thirds as much hay. It is quite safe to state, therefore, that cows wintered on two-thirds as much alfalfa as they might eat will produce practically the same income as cows which are given all the alfalfa they will eat.

The lots on silage and alfalfa produced practically the same income as those on a full feed of straight alfalfa. Since each pound of silage fed reduced the alfalfa hay consumption approximately one-half pound, one pound of silage is worth one-half as much as one pound of hay. The silage was charged at $6.00 a ton and the alfalfa at $8.00, however; hence the silage lots show the heaviest loss, due, of course, not to any inferiority of the feed but to the fact that the price charged was more than its actual feeding value.

The barley fed to lots 9 and 10 was a distinct disappointment in all respects. These lots on barley failed to produce any more income than the lots on hay or hay and silage. The use of 1,029 pounds of barley only reduced the hay consumption 869 pounds. The barley did make the cows heavier and fatter but that had no apparent advantage. In fact, on ranges where theft is prevalent high condition may be a distinct disadvantage. At any rate, the loss from these lots was very heavy.

In conclusion it may be said of the methods of feeding: first, that breeding heifers fed to the limit of their appetite were not only expensive but failed to produce any more income than those fed more limited rations; second, only those cows fed on limited amounts of cheap feeds showed a profit.