FEEDING DAIRY HEIFERS

(Minor Subject).

Thesis presented to the Graduate Committee of the Virginia Polytechnic Institute, in application for the Degree of Master of Science in Agriculture.

By

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FEEDING DAIRY HEIFERS

Forage and Grain Rations for Wintering Dairy Heifers under Virginia Conditions.

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WINTERING DAIRY HEIFERS.

INTRODUCTION.

In this paper we give the results of wintering 15 dairy heifers, divided into three lots (5 heifers each), and fed on three different rations. This is a subject of utmost importance to farmers and dairymen of this state, because every man desires to produce his dairy cows as economically as possible and at the same time produce an animal which is well developed and capable of increasing the productivity of his herd. It is a well known fact that to produce a good thrifty dairy cow one cannot feed a maintenance ration in order to make the cost of production low, but on the other hand, we can select the cheapest ration that will give the desired results.

PURPOSE OF THE EXPERIMENT.

The purpose of this experiment is to determine, firstly, the best one of three rations for the growth and development of dairy heifers; secondly, the most economical of these rations with respect to their productive value; thirdly, a comparison of silage, silage and clover hay, and clover hay as roughages.

DURATION OF THE EXPERIMENT.

This test began November 8, 1915, and ended April 26, 1916. Duration of test, 170 days.

THE HEIFERS.

The heifers were purebreds of the three leading dairy breeds, namely, Holstein Friesian, Jersey, and Guernsey.

There were 15 heifers (ranging from 6 to 12 months of age at beginning of test) on the test, divided into three lots of five each. The divisions were made as near equal as possible in regard to breeds and weights. Lot I was composed of 2 Holstein-Friesians, 2 Jerseys, and 1 Guernsey. Lot II was composed of 3 Holstein-Friesians, 1 Jersey, and 1 Guernsey. Lot III was composed of 3 Holstein-Friesians, and 2 Jerseys. All heifers were in thin condition at the beginning of experiment, but all lots made a satisfactory growth during the feeding period. Heifers were marked, as to lot, by means of neck bands, and each carried an individual ear mark. The appearance of heifers of Lot I was always better than that of Lots II and III. They began to smooth up soon after the experiment began and held this sleek coat throughout the period.

RUN LOT AND FEED PENS.

All heifers ran in the same lot during the day, but at night they were separated into their respective lots and stabled in 3 similar pens where all feed was fed. The area of run lot was small and the drainage only fair. All water obtained from tank in run lot. The feed pens were of ample size; floors of wood; feed mangers were split up into sections so that crowding for feed was eliminated as far as possible; bedding of straw was applied daily and the mangers cleaned whenever there was an accumulation of feed. The latter condition seldom occurred.

WEATHER CONDITIONS.

The winter of 1915-1916 was unusually mild for this section of the state, and very favorable for growth and development.

WEIGHT.

The lots were weighed every two weeks. At the beginning of the feeding period they were weighed on three successive days and the average of these weights taken, then single lot weights were taken at the end of two weeks, and at the end of four weeks, they were again weighed on three successive days. Individual weights were taken the second day of the three day weighing periods. The above method of weighing continued throughout the experiment. Weights for individuals were taken one day every four weeks in order that the experiment could be continued in case a heifer was lost by accident or disease. All weights were taken about the middle of the day and each lot had access to water under exactly the same conditions.

Roughages were weighed on small scales at each feeding time. Concentrates were weighed on a spring balance at each feeding time.

RATIONS FED AND QUALITY OF EACH.

Lot I - Silage and cottonseed meal.

Lot II - Silage, clover hay, cottonseed meal and corn meal.

Lot III- Clover hay and corn meal.

The silage was made from corn that would have yielded 30 to 40 bushels of corn per acre, and was of good quality.

The clover hay was bought from a local dealer at Roanoke, Va., and was of fair quality. Clover had been too ripe at time of cutting, otherwise, the hay was in good condition.

Cottonseed meal - classed as good.

Corn meal - classed as Grade No. 2.

QUANTITY OF FEED FED AND TIME OF FEEDING.

The quantity of feed fed was determined by using Armsby's energy values for growing cattle, and as the lot (5 calves) weights ranged between 2000 and 2100 pounds, the rations were figured for growing cattle weighing 425 pounds.

DAILY RATIONS FOR GROWING CALVES WEIGHING 425 POUNDS.

		D. P.	N.E.V.
Standard		1.30	6.00
Lot I			
Corn silage,	25 lbs.	0.220	4.140
Cottonseed meal,	2 "	0.703	1.684
(N.R. = 1 - 4.472)		0.923	5.824
Lot II			
Corn silage,	12½ lbs.	0.1100	2.0700
Clover hay,	6 "	0.3246	2.0844
Corn meal,	1 "	0.0679	0.8884
Cottonseed meal,	1 "	0.3515	0.8420
(N.R. = 1 - 5.237)		0.8540	5.8848
Lot III.			
Clover hay,	12 lbs.	0.6492	4.1688
Corn meal,	2 "	0.1358	1.7768
(N. R. = 1 - 6)		0.8540	5.9456

Note: The nutrition ratios of the above rations were worked out and are indicated in parentheses under each ration. Salt

was given every week in sufficient quantity to be before the heifers the majority of the time.

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The above rations were fed in two feeding periods, morning and night. One half was fed (per individual) at each period. These rations were fed for a period of 71½ days, or until January 19th, and at this time it was deemed advisable to increase the rations, as the weights on February 4th and 18th showed Lots II and III to be losing slightly. The drop in curves, which will follow, shows this loss at a glance. On January 19th, the rations were each increased one fifth of all constituents, as shown below:

Lot I.

		D. P.	N.E.V.
Corn silage,	30 lbs.	0.2640	4.9680
Cottonseed meal,	2 2/5 lbs.	0.8436	2.0208
(N. R. = 1 - 4.72)		1.1076	6.9888

Lot II.

Corn silage,	15 lbs.	0.1320	2.4840
Clover hay,	7 1/5 "	0.3895	2.5013
Cottonseed meal,	1 1/5 "	0.4218	1.0104
Corn meal,	1 1/5 "	0.0815	1.0661
(N. R. = 1 - 5.237)		1.0248	7.0618

Lot III.

Clover hay,	14 2/5 lbs.	0.7790	5.0026
Corn meal,	2 2/5 "	0.1630	2.1322
(N. R. = 1 - 6.)		0.9420	7.1348

These rations are about right in N. E. V. for cattle weighing 650 pounds, but are low in digestible protein. The first rations were also low in digestible protein. The standard, as given by Armsby, calls for the following for 650 pound cattle: D. P., 1.65, and N. E. V., 7.00.

PRICES OF FEED.

The prices to be used for feed on an experiment of this kind are very difficult to decide. The prices actually paid may have little relation to those being paid by men who read these results. The price of corn fluctuates in different sections of the country probably more than any other feed used in this experiment, and the figures given below may be high for many localities. All prices given are based on an average of prices paid for the feeds during the experiment.

Corn silage,	$4.00 per ton.
Clover hay,	20.00 " "
Cottonseed meal,	35.00 " "
Corn meal,	35.00 " "

RESULTS.

Lot Records.

The results of this experiment are shown in Table I. This table gives the weights of lots at beginning and end of experiment; total gain per lots; average daily gain per individual; total feed consumed; total cost of feed per lot, cost of 100 pounds gain; average cost per heifer for a period of 30 days, and also the average cost per heifer for

entire feeding period.

Lot III made the largest gain, but the cost was exorbitant when compared with Lot I.

Lot I made the second largest gain and the cost for the entire lot was $80.53 against $146.92 for Lot III.

Lot II made the smallest gain and the cost for the feeding period was $113.725.

Table I.

Record of each lot. Nov. 8, 1915 to April 26, 1916. 170 days.

	Lot I	Lot II	Lot III
No. heifers in lot	5	5	5
Rations fed	Silage, cottonseed meal.	Silage, clover hay, cottonseed meal, corn meal.	Clover hay, corn meal
Avg. first weight per lot, lbs.	2035	2090	2010
" last " " " "	2983	3006	2992
Total gain per lot, lbs.	948	916	982
Avg. daily gain (individual), lbs.	1.11	1.07	1.15
Total feed consumed, lbs,			
Silage,	23712.5	11856.25	
Cottonseed meal,	1897	948.5	
Clover hay,		5691	11382
Corn meal,		948.5	1897
Total cost per lot,			
Silage,	$47.42	$23.71	
Cottonseed meal,	33.11	16.555	
Clover hay,		56.905	113.81
Corn meal,		16.555	33.11
Summation	80.53	113.725	146.92
Cost of 100 lbs. gain,	8.49	12.41	14.96
Average cost per heifer,			
Month, (30 days),	$2.82	$4.00	$5.18
Feeding period, (170 days)	$16.10	$22.74	$29.38

RECORD OF TWO INDIVIDUALS OF EACH LOT.

As the records(as to weight) of two individual Holstein Friesian heifers were kept throughout the experiment, it will be of interest to know the results of these two individuals. These

results will show the value of the different rations upon the Holstein Friesian breed more accurate than the lot results, and also shows the fluctuation between individuals. Table II shows the results of these individuals.

Table II.

Heifer No.	Wt. Nov. 8, 1915. lbs.	Wt. Apr. 26, 1916. lbs.	Total gain. lbs.	Average gain per day. lbs.
		Lot I.		
373	525	850	325	1.91
388	395	610	215	1.265
		average	270	1.585
		Lot II.		
383	545	835	290	1.7
359	580	840	260	1.53
		Average	275	1.615
		Lot III.		
379	510	750	240	1.41
385	600	815	215	1.26
		Average	227.5	1.335

From the table above we find that the two heifers of Lot II made the largest average gains; Lot I ranking second ; and Lot III ranking third.

DISCUSSION OF RESULTS.

The results of Table I show clearly that the ration fed Lot I (silage and cottonseed meal) is the most economical and gave good results. The heifers in Lots I and II did not maintain the average degree of fleshiness as those in Lot III. The large heifers of Lots I and II seemed to take on more flesh than those in Lot III, while the smaller ones did not feed as

well as those in Lot III, i.e., heifers of Lot III were more uniform in condition at the end of the experiment than were the heifers of Lots I and II. This condition explains the reversal in Table II when two of the largest individuals of each lot were compared (as to gain) with the lots as a whole in Table I, and the most plausible explanation is based upon the ash content of each ration. The following is the approximate total ash consumed by each lot during the feeding period: Lot I - received 457.2 lbs. Lot II - received 595.3 pounds, and Lot III, 733.4 pounds. Most authorities state that a greater ~~quantity~~ *percent* of ash is used by a growing animal at the period of development where the highest percentage gain occurs, and I should say that this occurs between birth and one year of age, in case of the dairy heifer. This ash content partly, if not wholly, explains the better growth of the younger heifers in Lot III.

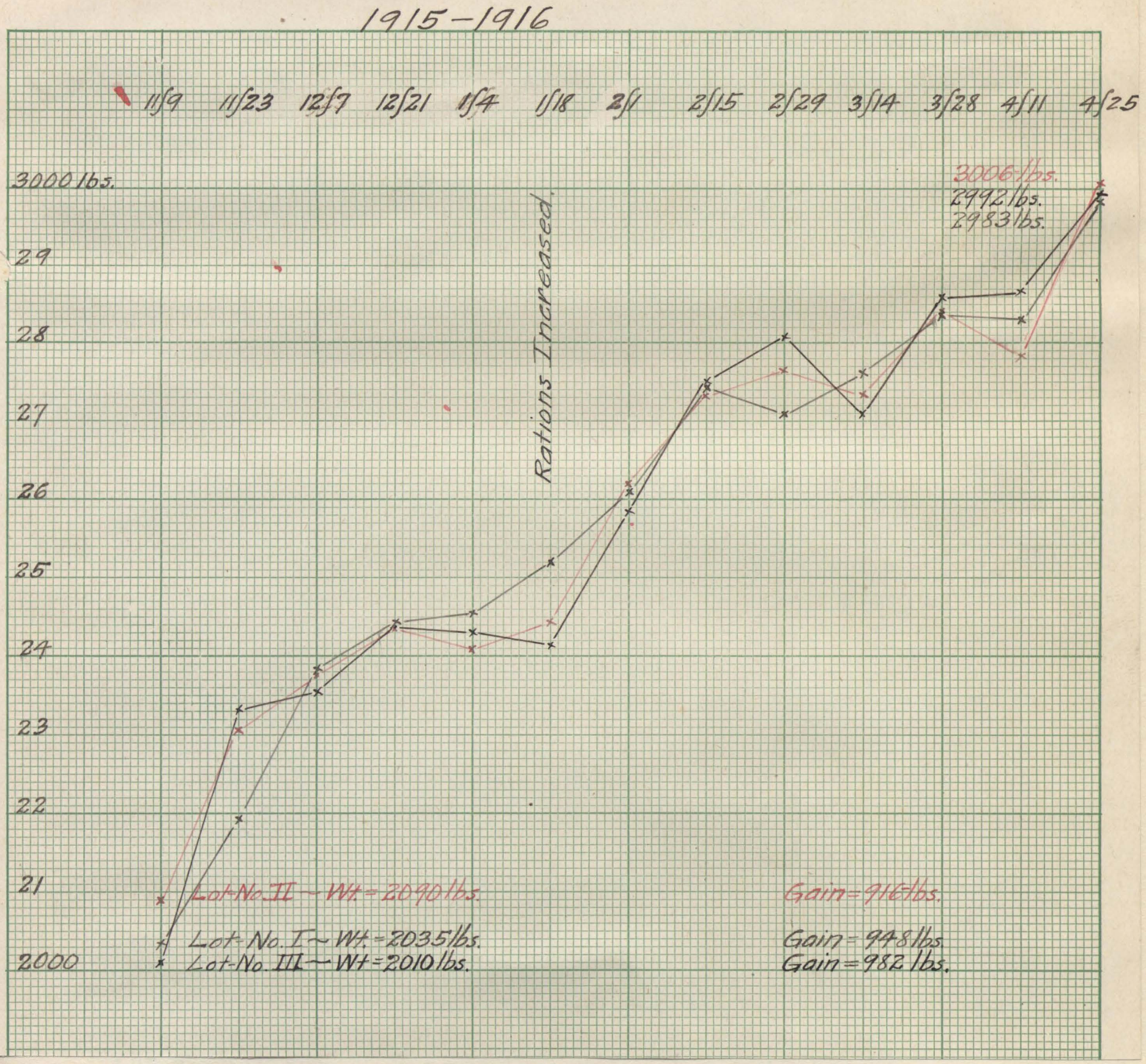
The condition of the coats of heifers in Lot I was smooth and sleek throughout the experiment. There seemed to be very little difference in the coat condition of Lots II and III.

Considering the value of silage, silage and clover hay, and clover hay as roughages, we again find silage having the greatest productive value. The additional cost in both Lots II and III over Lot I is brought about by the roughage (clover hay) alone, as the value of the concentrates fed is equal for all lots.

GROWTH CURVES.

The following curves show the relative gains made by each lot at intervals of two weeks. Notice the drop in curves for Lots II and III just prior to January 19th, or the

time rations were increased. Lot I did not lose at these weighings, but the growth was checked to a certain extent.



PHOTOGRAPHS.

The photographs which follow give a good idea as to the condition of heifers at the beginning and end of feeding period.

Lot I. Weight = 2035 pounds. (Beginning of experiment).

Lot I. Weight = 2983 lbs. (End of experiment.

Gain = 948 lbs.

Lot II. Weight = 2090 lbs. (Beginning of experiment).

Lot II. Weight = 3006 lbs. (End of experiment).

Gain = 916 lbs.

Lot III. Weight = 2010 pounds. (Beginning of experiment).

Lot III. Weight 2992 lbs. (end of experiment).

Gain, 982 pounds.

Lot I. Heifer No. 373. Weight 525 lbs. (Beginning of experiment).

Lot I. Heifer No. 373. (Weight 850 lbs. (End of experiment)
Gain, 325 lbs.

Lot I. Heifer No. 388. Weight 395 lbs. (Beginning of experiment).

Lot I. Heifer No. 388. Weight 610 lbs. (End of experiment).
Gain, 215 lbs.

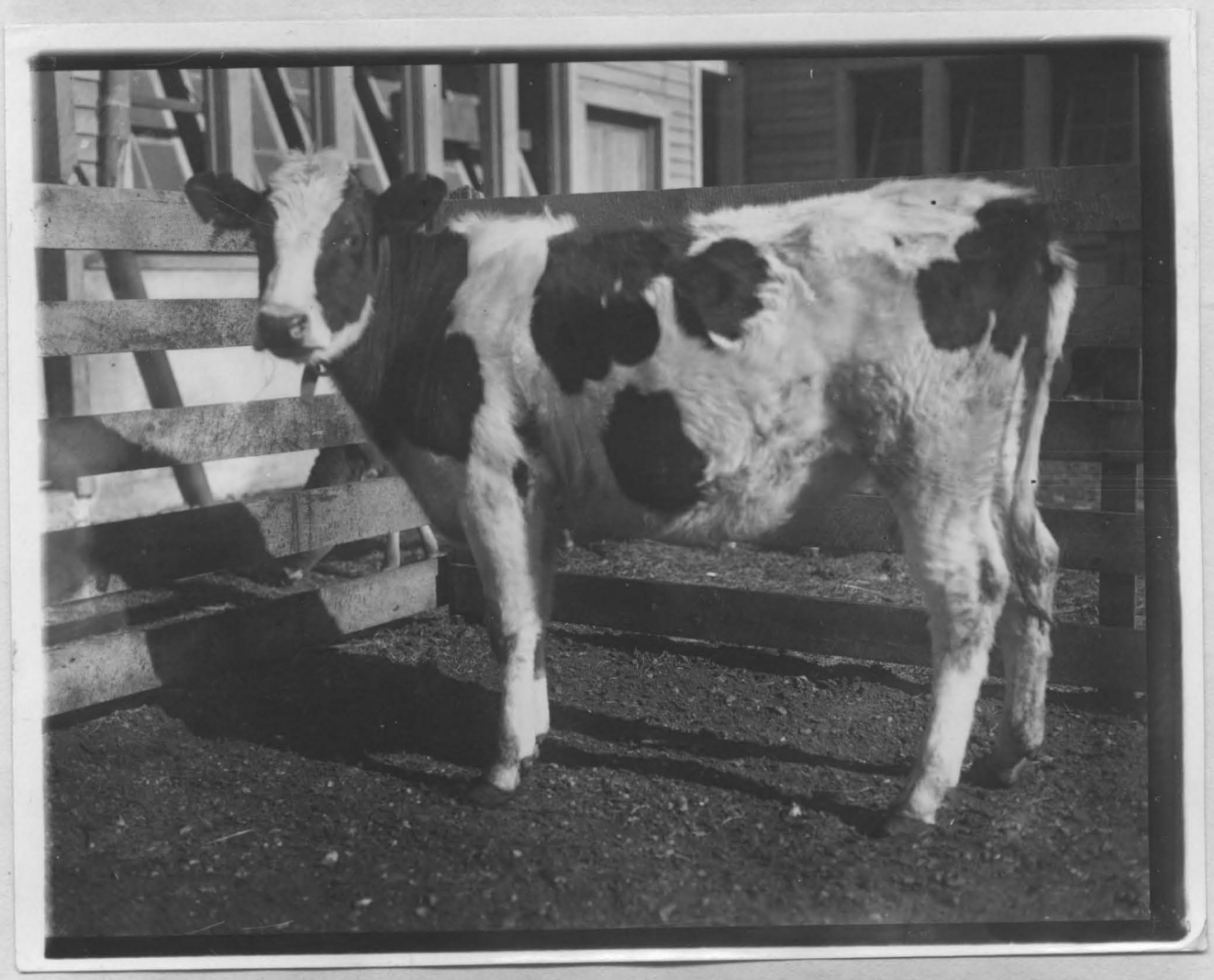
Lot II. Heifer No. 383. Weight, 545 lbs. (beginning of experiment.

Lot II. Heifer No. 383. Weight, 835 lbs. (end of experiment).
Gain, 290 lbs.

Lot II. Heifer No. 359. Weight, 580 lbs. (Beginning of experiment.)

Lot II. Heifer No. 359. Weight, 840 lbs. (end of experiment)

Gain, 260 lbs.



Lot III. Heifer No. 379. Weight, 510 lbs. (Beginning of experiment.)

Lot III. Heifer No. 379. Weight, 750 lbs. (end of experiment.)

Gain, 240 lbs.

Lot III. Heifer No. 385. Weight, 600 lbs. (Beginning of experiment.)

Lot III. Heifer No. 385. Weight, 815 lbs. (End of experiment.)

Gain, 215 lbs.

SUMMARY.

1. Lot I, fed corn silage and cottonseed meal, made the most economical growth and the heifers were in just as thrifty condition as either Lot II or III at the close of the experiment. Coats and general appearance of heifers of Lot I were at all times superior to either of the other lots.

2. Lot II, fed corn silage, clover hay, cottonseed meal, and corn meal, made the smallest gain and no advantage was obtained by mixing the rations, so far as could be seen.

3. While Lot III - fed clover hay and corn meal - made a somewhat larger gain than Lot I, the cost was almost double.

4. Silage proved to be the most economic roughage for growing dairy heifers. The increased cost of feed in Lots II and III over Lot I was all brought about by the clover hay, as all concentrates were of equal value and fed in equal quantities.

5. Small quantities of mineral matter could be added to the silage and cottonseed meal ration for calves up to twelve months of age, at a very small cost, and should produce good results.