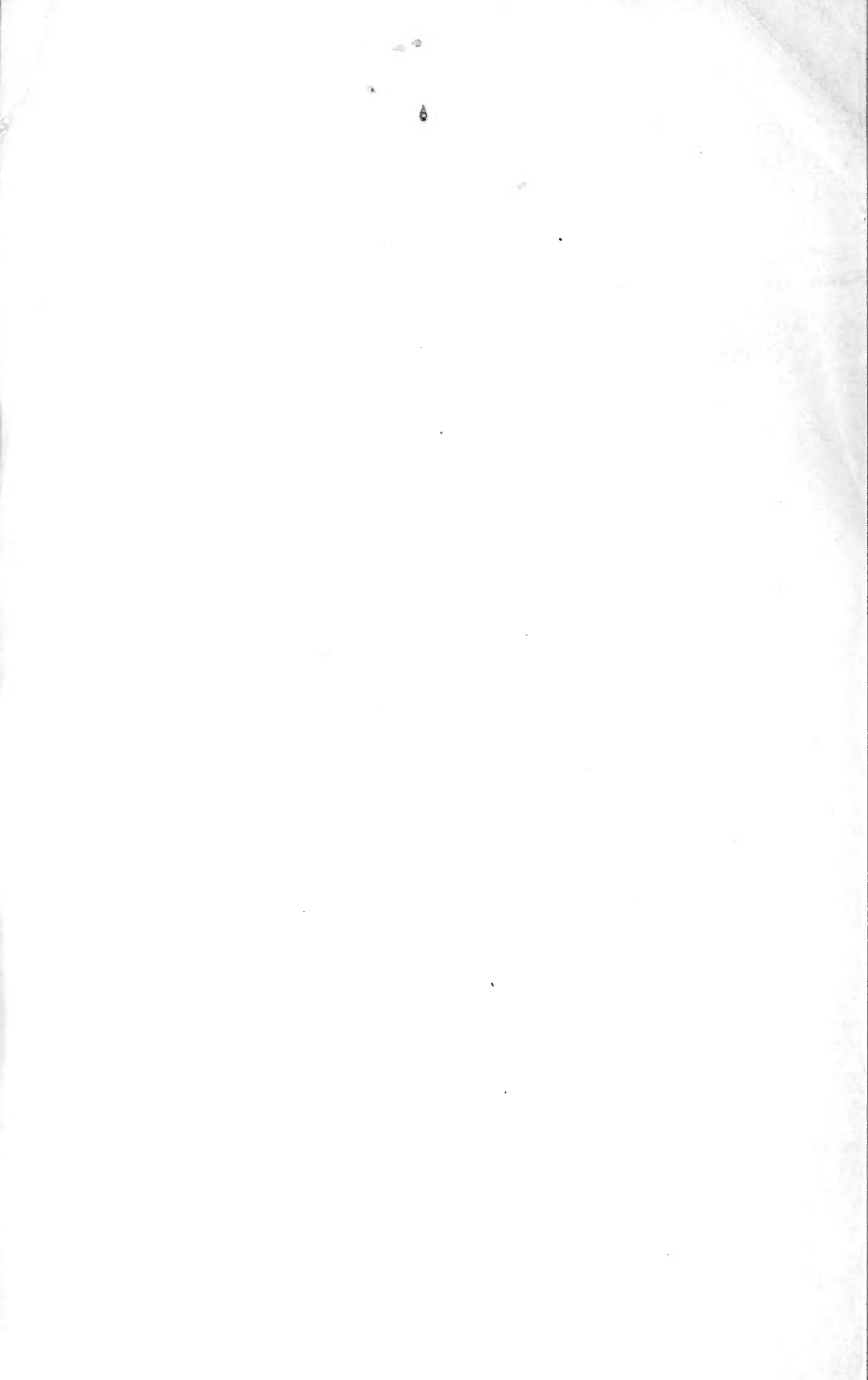




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# UNITED STATES DEPARTMENT OF AGRICULTURE



## DEPARTMENT BULLETIN No. 1251



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### EFFECT OF WINTER RATIONS ON PASTURE GAINS OF 2-YEAR-OLD STEERS.

By E. W. SHEETS and R. H. TUCKWILLER, *Animal Husbandry Division, Bureau of Animal Industry.*

#### I. WINTER RATIONS AND THEIR INFLUENCE ON PASTURE GAINS OF 2-YEAR-OLD STEERS.

#### II. THE COST OF RATIONS FOR WINTERING 2-YEAR-OLD STEERS.

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#### I. WINTER RATIONS AND THEIR INFLUENCE ON PASTURE GAINS OF 2-YEAR-OLD STEERS.

##### THE APPALACHIAN REGION AND ITS PROBLEMS.

The work reported in this bulletin is part of a series of experiments on beef-production problems in the Appalachian Mountain region that have been in progress since December 22, 1914, in cooperation between the Bureau of Animal Industry of the United States Department of Agriculture and the West Virginia Agricultural Experiment Station, on the farm of David Tuckwiller, in Greenbrier County, W. Va. This farm is situated in the southeastern part of the State, in the blue-grass area. The results of this experiment apply not only to West Virginia, but also to the adjacent States having similar conditions, as shown in Figure 1. Some of the methods and results may be utilized to advantage by cattle feeders in other parts of the country.

The topography of most of this region is mountainous. Practically all the region is suitable for grazing. There are a great many valleys and plateaus where the land varies from almost level to gently rolling. Such land is well adapted for pasture and the production

of cultivated crops. While the region is generally cleared of virgin forest, there are large areas of cut-over land. The farms vary in size from less than 100 to more than 1,000 acres. On most farms there is sufficient tillable land for the production of winter feed. Relatively little surplus grain is produced.

Most of the grass-fattened cattle which go annually to eastern markets are produced in this region. The fact that most of them are finished for market on grass alone attests the value of the pastures, which consist largely of bluegrass. The use of grain for finishing cattle is not general, although there are many sections where the practice is followed, particularly in the valleys of some of the larger streams. By far the greater number of farmers who handle beef

cattle grow either stockers and feeders or finish cattle for market from grass alone. Therefore, one of the principal beef-production problems is to determine the best and most economical method of wintering the cattle and the one that will enable them to make the best possible use of the pasture the following summer, when the cheapest gains are made. A common practice in this area has been to winter steers on dry feed, such as hay, corn stover, and wheat straw, and on corn silage to a less extent, in such way that they lose materially in weight. They are then pastured the following summer and sold from grass as stockers, feeders, or finished steers. There are some who hold that it is profitable to permit this loss of weight, which with older steers usually varies from 25 to 100

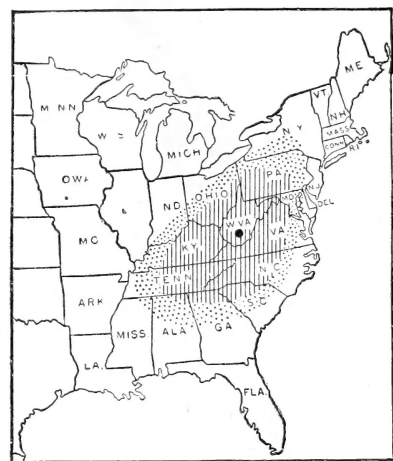


FIG. 1.—Map showing region to which this work applies. The black dot indicates the location of the farm on which the experiment was conducted. The shaded portion represents the area to which the results are applicable, and the dotted portion shows an additional area to which the results apply in part.

pounds. Others believe that cattle wintered on silage, or on a ration of which silage is a part, will not do well on grass the following summer.

#### OBJECTS AND PLAN OF THE WORK.

The experiments as a whole had the following general problems in view:

To ascertain the effect of different wintering rations on subsequent pasture gains.

To determine the most satisfactory and economical method of wintering.

To determine the best method and the cost of raising beef cattle in West Virginia.

Two distinct phases of the problems presented themselves for solution: First, the keeping of grade beef cows to raise calves; second, the wintering of calves, yearlings, and 2-year-olds that are to be pastured the following summer and sold as stockers, feeders, or fat cattle. This bulletin takes up the work with 2-year-olds. The results of the work with cows, calves, and yearlings are published in United States Department of Agriculture Bulletins 1024, 1042, and 870, respectively.

The work was carried on for three years in order to have an average of feeds, cattle, seasons, and other conditions tending to produce variation. A general outline of the experiment, including the rations used for the different lots of steers, is given in Table 1.

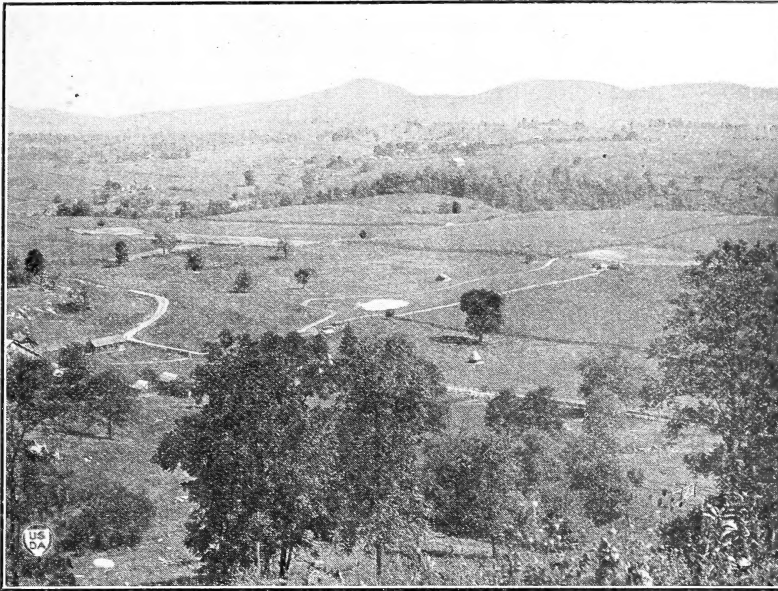


FIG. 2.—Looking from Muddy Creek Mountain across a branch of the Greenbrier Valley. The steers were fattened on a pasture at the foot of the mountains in the upper part of the picture.

TABLE 1.—Outline of the three years' work.

Lot No.	Season.	Steers in lot. <sup>1</sup>	Winter periods. <sup>2</sup>		Summer periods on pasture. <sup>3</sup>
			Duration.	Feed.	
			<i>Days.</i>		<i>Days.</i>
1	1919-20	10	127	Mixed hay and ear corn .....	136
	1920-21	10	121		128
	1921-22	10	124		141
2	1919-20	9	127	Corn silage .....	136
	1920-21	10	121		128
	1921-22	10	124		141
3	1919-20	10	127	Corn silage .....	136
	1920-21	10	121		128
	1921-22	10	124		141
4	1919-20	10	127	Corn silage and cottonseed meal .....	136
	1920-21	10	121		128
	1921-22	10	124		141
5	1919-20	10	127	Corn silage, cottonseed meal, and wheat straw .....	136
	1920-21	8	121		128
	1921-22	10	124		141
6	1919-20	10	127	Corn silage and mixed hay .....	136
	1920-21	10	121		128
	1921-22	10	124		141

<sup>1</sup> Owing to accidents 1 steer died in Lot 2 in the summer of 1919-20 and 2 steers died in Lot 5 in the winter of 1920-21; averages for Lot 2 are based on 29 steers, and for Lot 5 on 28 steers in subsequent tables.

<sup>2</sup> 1919-20, December 23 to April 27, inclusive; 1920-21, December 28 to April 27, inclusive; 1921-22, December 23 to April 25, inclusive. The average length of period is 124 days.

<sup>3</sup> 1919-20, April 28 to September 10, inclusive; 1920-21, April 28 to September 2, inclusive; 1921-22, April 26 to September 13, inclusive. The average length of period is 135 days.

## KIND OF STEERS USED.

The steers used were long 2-year-old grade Shorthorn, Hereford, and Aberdeen-Angus, raised in southern West Virginia. They were good feeder steers, quite uniform in quality and condition. They ranged in weight from 800 to 1,200 pounds and averaged 964 pounds at the beginning of the winter periods.

## FEEDS USED.

Samples of each of the feeds used were taken at different times during the winter periods and sent to the Department of Chemistry, West Virginia Agricultural Experiment Station, Morgantown, W. Va., to be analyzed. The averages of these analyses are given in Table 2. The average analyses of similar feeds, as compiled by the Bureau of Chemistry, United States Department of Agriculture, are shown for comparison.

TABLE 2.—Composition of feeds used, as analyzed by the West Virginia station, compared with average analyses of similar feeds as made by the United States Department of Agriculture.

Feed.	Source of analyses.	Moisture.	Ash.	Crude protein.	Carbohydrates.		Fat.
					Crude fiber.	Nitrogen free extract.	
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Corn silage...	(West Virginia station.....)	72.9	1.8	2.2	6.2	16.1	0.8
	(U. S. Department of Agriculture..)	70.9	1.4	2.4	6.9	17.5	.9
Mixed hay...	(West Virginia station.....)	7.1	4.1	6.3	33.7	47.0	1.8
	(U. S. Department of Agriculture <sup>1</sup> ..)	12.7	6.2	10.2	26.2	41.7	3.0
Wheat straw	(West Virginia station.....)	6.9	3.3	3.6	41.6	43.4	1.2
	(U. S. Department of Agriculture..)	9.6	4.2	3.4	38.1	43.4	1.3
Ear corn.....	(West Virginia station.....)	11.4	1.2	7.2	6.8	72.2	1.2
	(U. S. Department of Agriculture..)	15.6	1.5	8.3	6.8	64.4	3.4
Cotton seed meal.	(West Virginia station.....)	7.2	6.4	42.1	8.0	29.0	7.3
	(U. S. Department of Agriculture. <sup>2</sup> )	7.1	5.7	41.7	10.0	28.4	7.1

<sup>1</sup> Calculated, using half red-clover hay and half timothy hay.

<sup>2</sup> Choice cottonseed meal.

From the analyses it is evident that the feeds used were somewhat below the average in quality. The cottonseed meal was slightly better than the average of that which is graded as "choice" by the Association of Feed Control Officials of the United States. The silage was made from dent corn.

A three-year rotation of crops, consisting of corn, wheat, and hay, is practiced quite generally in southern West Virginia. Timothy is sown with the wheat in the fall and red clover is sown on the same field in the spring. This provides, in the year following the wheat crop, a mixed hay of approximately half timothy and half clover. The mixed hay used in this work was obtained in this manner.

## CHARACTER OF PASTURE.

Each year the steers were turned on to a rather hilly pasture of about 300 acres. A small stream, which flows through the pasture, provides an abundance of fresh water throughout the summer.

The soil is of limestone formation. A good growth of bluegrass with white clover is found on all parts of the pasture. Under normal climatic conditions there is sufficient rainfall to keep the grass growing throughout the season.



## METHOD OF FEEDING AND HANDLING THE STEERS.

In the fall before starting the steers on winter feed they were divided into lots of 10 each. In making this division, care was taken to have the lots as nearly uniform as possible in quality, breeding, size, and condition. The different lots were given the same amount of space in an open barn and were kept under cover all winter. Water was supplied in the stalls at all times and salt was constantly available. The steers were fed twice a day.

The feed, both concentrates and roughage, was carefully weighed at each feeding. The steers were weighed at the beginning and at the end of the winter feeding period, the weights being taken in each case three days in succession and averages taken for their initial and final weights. They were also weighed once every 28 days, in the morning after feeding. Neck straps and disks or ear tags with numbers on them were used, so that ready identification of each individual could be made and records accurately kept.

In the spring of each year, as soon as the grass was good enough, which was usually about April 25, the steers from all the lots were turned into the same pasture with no additional feed. Weights were taken once every 28 days during the first summer. Afterwards the practice was discontinued on account of the loss incident to driving such heavy steers the long distance from the pastures to the scales. During the second summer they were weighed only on the 62d day and during the third summer only on the 44th day.

## QUANTITY OF FEED CONSUMED.

Table 3 shows the total amount of different feeds eaten in the various lots and the average daily ration per steer in each lot during each of the three winters. All lots except Lot 2 were fed to make a small gain in weight. Lot 1 failed to gain in weight in the winter of 1921-22 on account of the poor quality of the mixed hay. They would not eat enough of it to maintain their weight. Lot 2 was fed to lose slightly in weight. This object was not attained the first year. The quantities of feed consumed daily were practically the same throughout the winter periods. Lot 3 was given practically as much silage as the steers would clean up.

TABLE 3.—Average total and daily rations per steer during the three winters.

Winter feed.	Total feed per steer.				Daily feed per steer.			
	1919-20	1920-21	1921-22	Average.	1919-20	1920-21	1921-22	Average.
Lot 1:	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Mixed hay .....	2,540	2,403	1,860	2,268	20.0	19.9	15.0	18.3
Ear corn .....	254	242	245	247	2.0	2.0	2.0	2.0
Lot 2:								
Corn silage .....	3,810	3,490	3,487	3,588	30.0	28.8	28.1	28.9
Lot 3:								
Corn silage .....	5,080	4,840	4,478	4,799	40.0	40.0	36.1	38.7
Lot 4:								
Corn silage .....	3,810	3,490	3,683	3,661	30.0	28.8	29.7	29.5
Cottonseed meal .....	190	181	184	185	1.5	1.5	1.5	1.5
Lot 5:								
Corn silage .....	3,125	3,025	3,069	3,076	25.0	25.0	24.7	24.8
Wheat straw .....	734	698	736	725	5.8	5.8	5.9	5.8
Cottonseed meal .....	127	121	123	124	1.0	1.0	1.0	1.0
Lot 6:								
Corn silage .....	3,125	3,025	3,069	3,073	25.0	25.0	24.7	24.8
Mixed hay .....	1,016	968	749	911	8.0	8.0	6.0	7.3

As Table 4 shows, there was considerable variation in the nutritive ratios of the rations as fed as well as in the quantities of dry matter and digestible nutrients therein. The rations containing hay and straw were especially high in dry matter. The rations of silage alone were lowest in digestible protein, while that containing 1.5 pounds of cottonseed meal was considerably the highest. The rations containing cottonseed meal had nutritive ratios considerably narrower than the others.

TABLE 4.—Quantities of dry matter, digestible nutrients, and nutritive ratios of the winter rations.

Lot No.	Daily ration per steer.	Dry matter.	Digestible nutrients.		Nutritive ratio.	Feed per 1,000 pounds live weight. <sup>2</sup>
			Protein.	Carbohydrate equivalent. <sup>1</sup>		
1	Mixed hay (18.3 pounds).....	<i>Pounds.</i> 17.0	<i>Pounds.</i> 0.63	<i>Pounds.</i> 9.08	.....	<i>Pounds.</i> 19.0
	Ear corn (2 pounds).....	1.8	.07	1.38	.....	2.1
	Total.....	18.8	.70	10.46	1 : 14.9	.....
2	Corn silage (28.9 pounds).....	7.8	.37	4.99	1 : 13.5	30.1
	3 Corn silage (38.7 pounds).....	10.5	.49	6.67	1 : 13.5	40.1
4	Corn silage (29.5 pounds).....	8.0	.38	5.09	.....	30.6
	Cottonseed meal (1.5 pounds).....	1.4	.53	.61	.....	1.6
	Total.....	9.4	.91	5.70	1 : 6.3	.....
5	Corn silage (24.8 pounds).....	6.7	.32	4.28	.....	25.7
	Wheat straw (5.8 pounds).....	5.4	.02	2.26	.....	6.0
	Cottonseed meal (1 pound).....	.9	.35	.41	.....	1.0
Total.....	13.0	.69	6.95	1 : 10.1	.....	
6	Corn silage (24.8 pounds).....	6.7	.32	4.28	.....	25.7
	Mixed hay (7.3 pounds).....	6.8	.25	3.62	.....	7.6
	Total.....	13.5	.57	7.90	1 : 13.9	.....

<sup>1</sup> The carbohydrate equivalent is the sum of the digestible carbohydrates plus 2.25 times the digestible fat.

<sup>2</sup> Based on the initial weights of the steers.

#### GAINS DURING WINTER AND SUMMER.

The initial spring and final weights and the gains and losses in weight during each of the three years are shown in Table 5.

TABLE 5.—Average total<sup>1</sup> and daily gains during winter and summer.

Lot No.	Winter feed.	Season.	Initial weight per steer.		Weight per steer at end of winter.		Winter gain or loss per steer.		Weight per steer at end of summer.	Summer gain per steer.		Winter and summer gain per steer.	
			Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.
1	Mixed hay and ear corn.	1919-20	927	962	35	0.28	1,269	287	2.26	342	1.30		
		1920-21	981	1,036	55	.45	1,321	285	2.23	340	1.37		
		1921-22	980	943	-37	-.30	1,287	344	2.44	307	1.16		
		Average.....	963	980	18	.14	1,292	312	2.31	330	1.27		
					±6.9				±5.9		±6.6		
2	Corn silage.....	1919-20	913	950	37	.29	1,236	286	2.10	323	1.23		
		1920-21	981	927	-54	-.45	1,290	363	2.84	309	1.24		
		1921-22	983	977	-6	-.05	1,361	384	2.72	378	1.43		
		Average.....	961	952	-9	-.07	1,295	346	2.56	337	1.30		
					±8.0		±8.1		±7.2				
3	Corn Silage.....	1919-20	928	1,007	79	.62	1,246	239	1.76	318	1.21		
		1920-21	987	1,033	46	.38	1,338	305	2.38	351	1.41		
		1921-22	981	1,053	72	.58	1,359	306	2.17	378	1.43		
		Average.....	965	1,031	66	.53	1,314	283	2.10	349	1.35		
					±6.9		±7.3		±8.1				
4	Corn silage and cottonseed meal.	1919-20	927	991	67	.53	1,291	297	2.18	364	1.38		
		1920-21	983	998	15	.12	1,314	316	2.47	331	1.33		
		1921-22	982	1,051	69	.56	1,373	322	2.28	391	1.48		
		Average.....	964	1,014	50	.40	1,326	312	2.31	362	1.40		
					±6.4		±6.9		±6.6				
5	Corn silage, wheat straw, and cottonseed meal.	1919-20	927	1,020	93	.73	1,270	250	1.84	343	1.30		
		1920-21	987	1,049	62	.51	1,294	245	1.91	307	1.23		
		1921-22	988	1,085	97	.78	1,365	280	1.99	377	1.42		
		Average.....	966	1,052	86	.69	1,310	258	1.91	344	1.33		
					±4.6		±5.7		±6.7				
6	Corn silage and mixed hay.	1919-20	928	991	63	.50	1,264	273	2.01	336	1.28		
		1920-21	984	1,052	68	.56	1,295	243	1.90	311	1.25		
		1921-22	982	1,028	46	.37	1,344	316	2.24	362	1.37		
		Average.....	965	1,024	59	.48	1,301	277	2.05	336	1.30		
					±4.9		±7.2		±6.1				

<sup>1</sup> On account of dropping fractions in the average weights of the steers as given in this table, one can not always add the weights or gains for the three years, divide by 3, and obtain the average given. In no case is there more than 1 or 2 pound's difference.

#### DIAGRAMS OF GAINS AND LOSSES.

The seven charts, Figures 3, 4, 5, 6, 7, 8, and 9 show the gains and losses of the steers by 28-day periods, except as noted under "Method of feeding and handling the steers," page 5. The first six show the effects of the six rations under comparison for the three years they were used, one chart being used for each ration. The seventh chart shows the average gains for three years for each of the six rations.

Horizontal distance on the charts indicates the number of days that the steers were fed during the three winters and pastured during the three summers. The average data on which each monthly period began are given also. The average length of the total period for the three years was 259 days, of which 124 days were in the winter period, and the remaining 135 in the summer period.

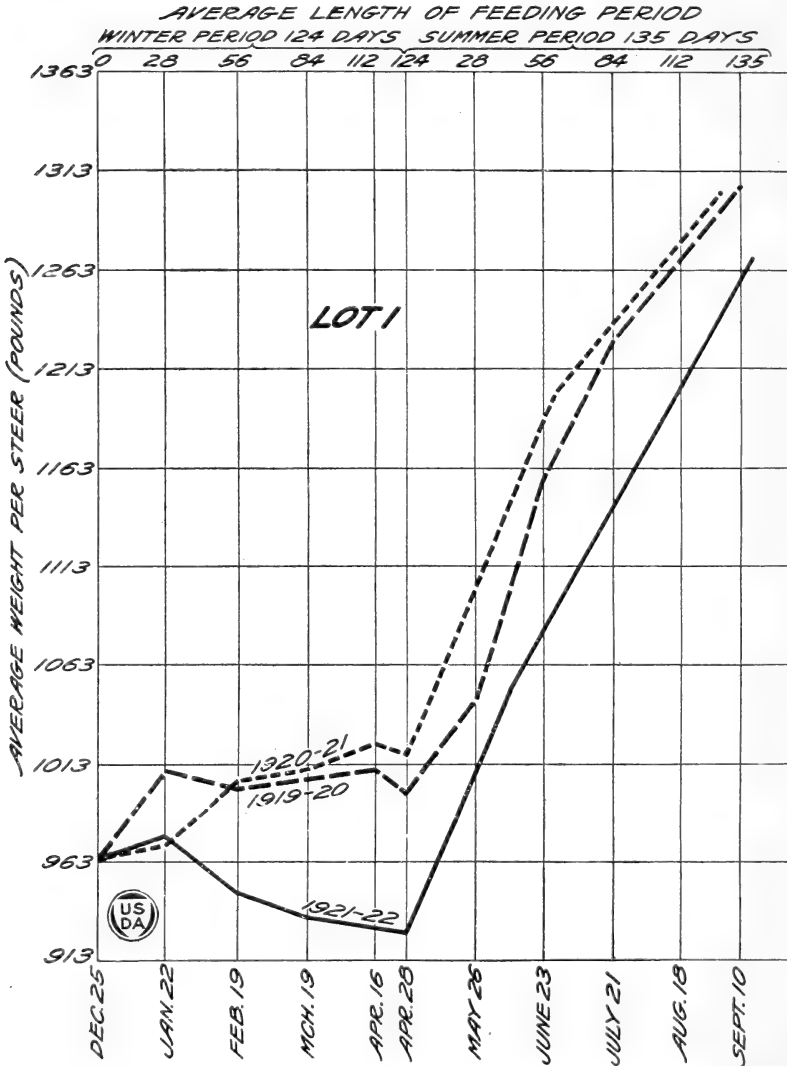


FIG. 3.—Annual results of winter and summer (grass) feeding for Lot 1. These steers were fed the following average ration during the winter: Mixed hay, 13.3 pounds; ear corn, 2 pounds.

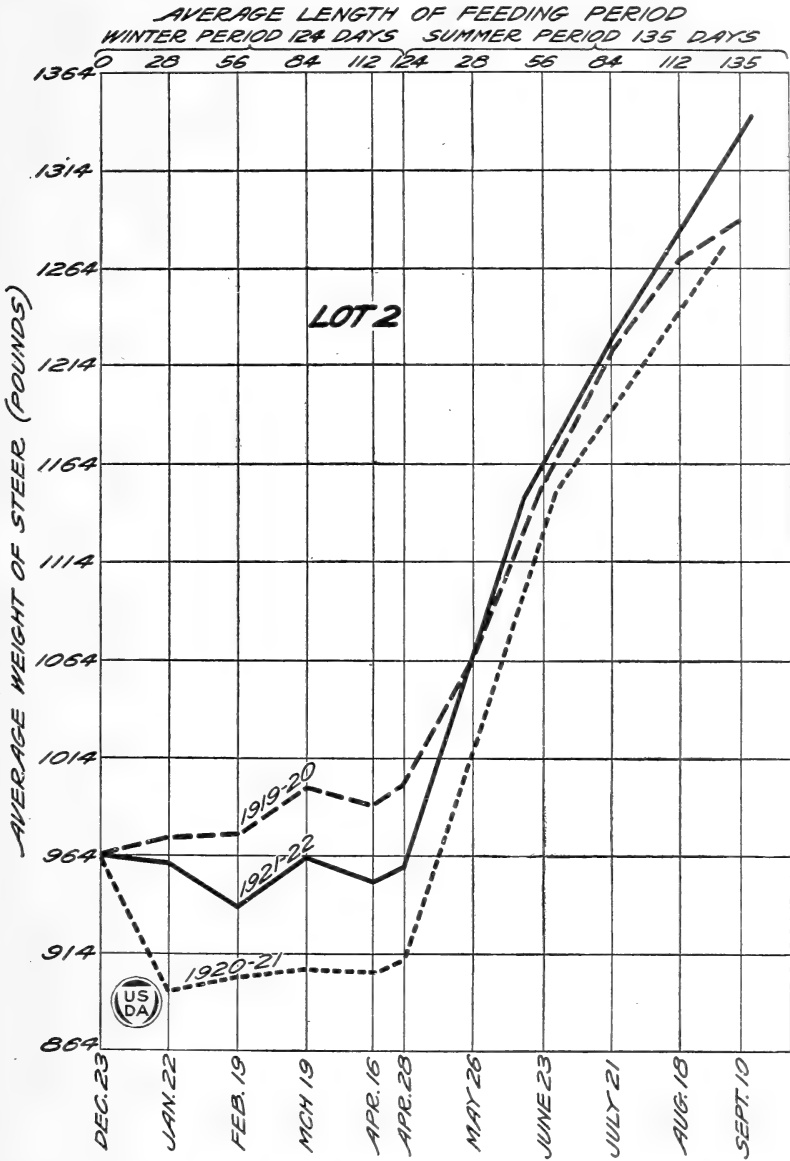


FIG. 4.—Annual results of winter and summer (grass) feeding for Lot 2. These steers were fed the following average ration during the winter: Corn silage, 28.9 pounds.

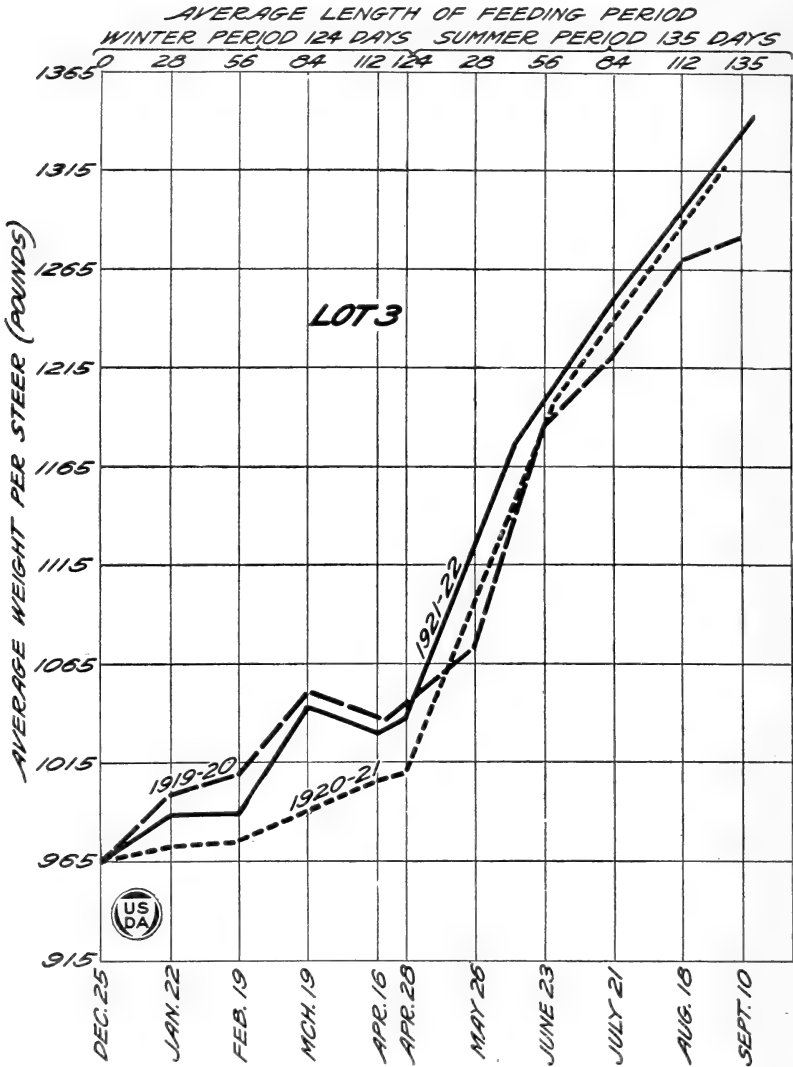


FIG. 5.—Annual results of winter and summer (grass) feeding for Lot 3. These steers were fed the following average ration during the winter: Corn silage, 38.7 pounds.

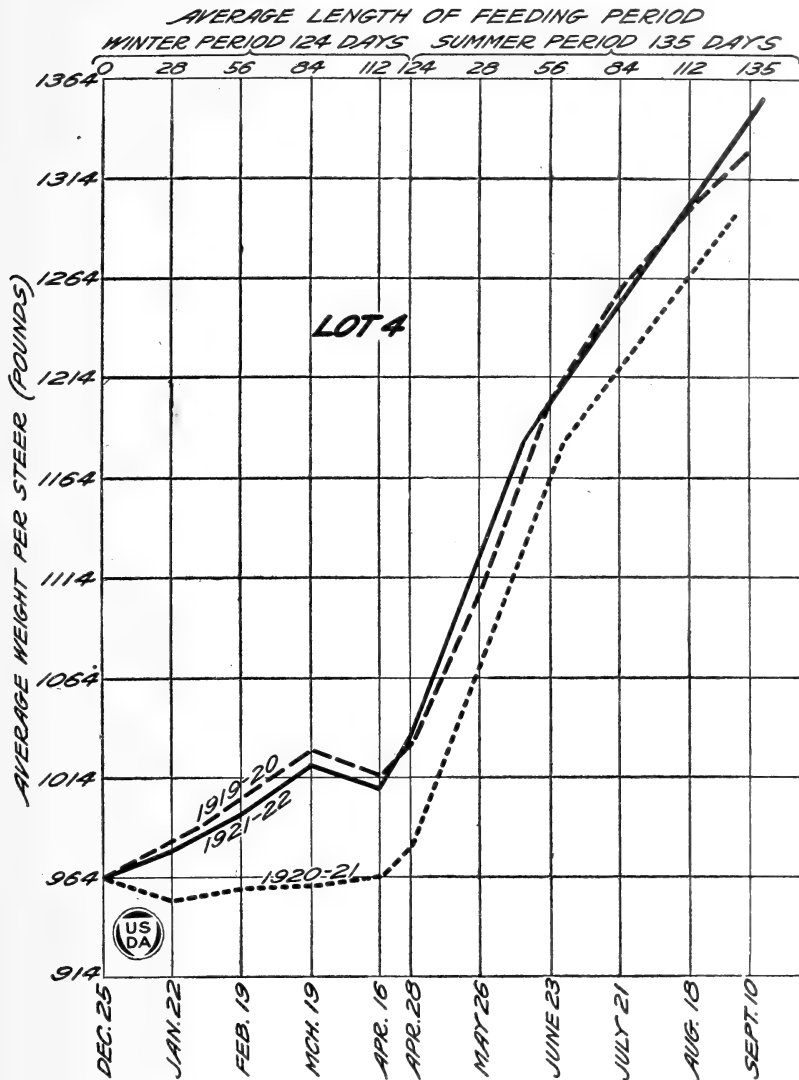


FIG. 6.—Annual results of winter and summer (grass) feeding for Lot 4. These steers were fed the following average ration during the winter: Corn silage, 29.5 pounds; cottonseed meal, 1.5 pounds.

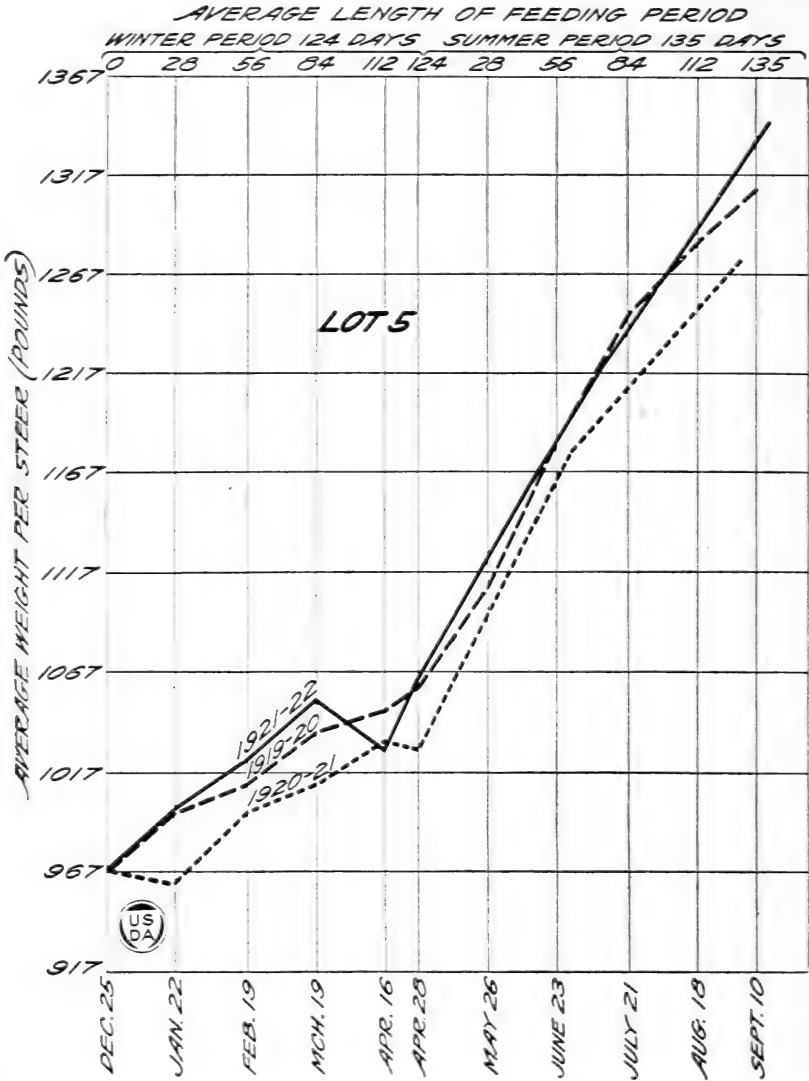


FIG. 7.—Annual results of winter and summer (grass) feeding for Lot 5. These steers were fed the following average ration during the winter: Corn silage, 24.5 pounds; wheat straw, 5.5 pounds; cottonseed meal, 1 pound.



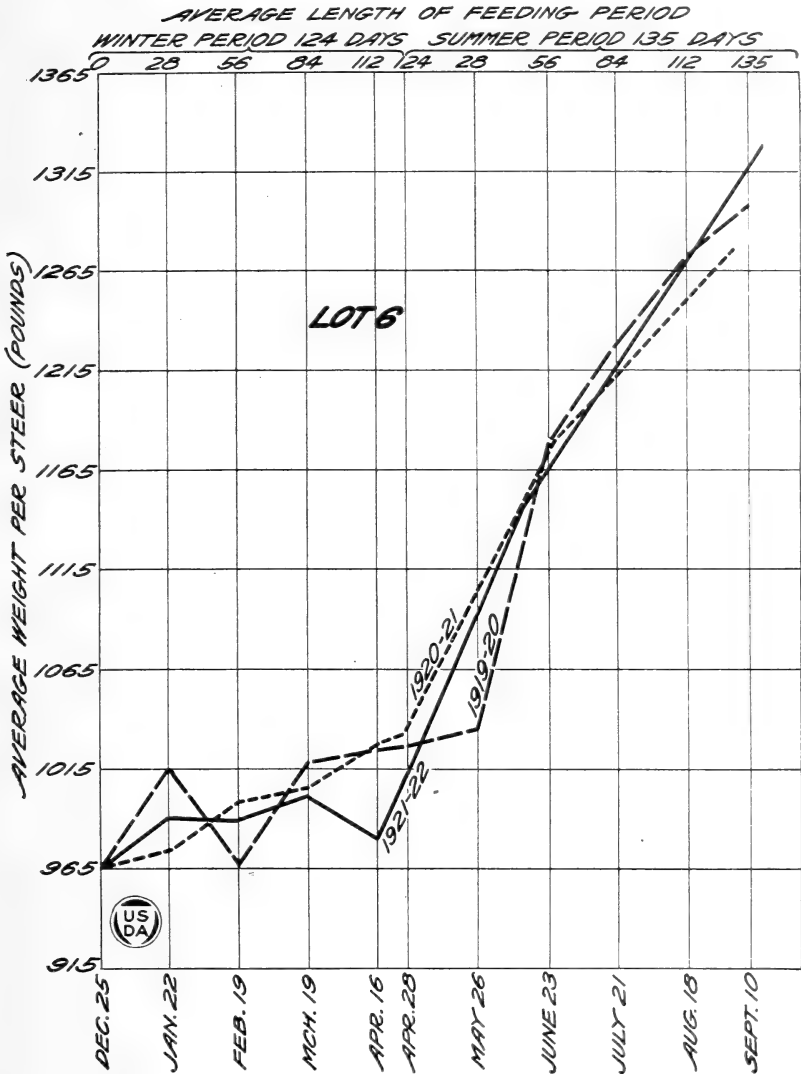


FIG. 8.—Annual results of winter and summer (grass) feeding for Lot 6. These steers were fed the following average ration during the winter: Corn silage, 24.8 pounds; mixed hay, 7.3 pounds.

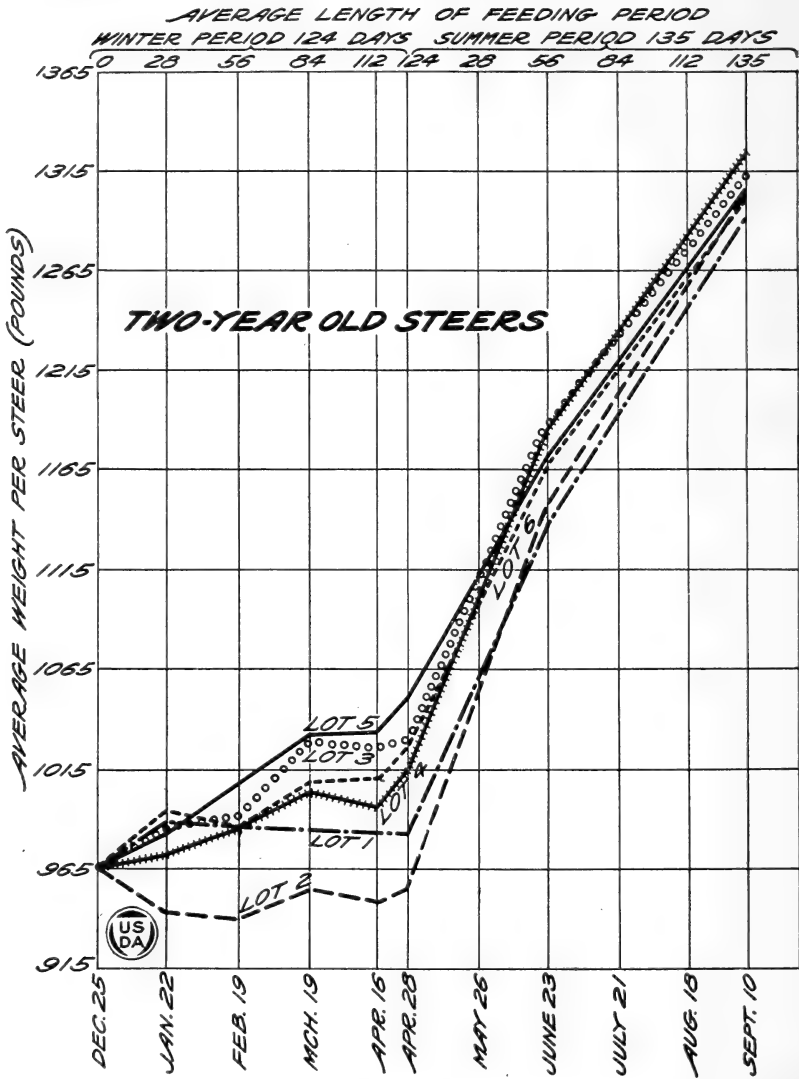


FIG. 9.—The average annual results of three years' winter and summer (grass) feeding for the six lots of steers.

Vertical distance on the chart represents changes in live weights of the steers. The weights corresponding to each of the horizontal lines are given along the left side of the chart. As the average initial weight of each lot varied from year to year, the average initial weight per steer for three years is used as a basis in each chart for showing the gains made by each lot each year.

Much of the difference caused by the winter feeding was overcome during the summer. On April 28 there was a difference of 95 pounds between the highest and lowest lots; on June 23, 50 pounds; and on September 10, 33 pounds.

## CORRELATIONS.

On account of the variations in the average gains of the six lots during the three years, as shown in Table 5, the correlations between the winter, summer, midsummer, and total gains of all the steers, based on the losses and gains of each steer, have been calculated to substantiate the conclusions indicated by the average gains of each lot for three years. Consequently, Figures 9a, 9b, 9c, and 9d are presented to show the positions of the individual steers, when they are plotted according to their winter, summer, midsummer, and total variations in weight. Accordingly, the following results have been obtained:

	Winter gain.	Summer gain.	Total gain.
Mean.....	Pounds. 44.0	Pounds. 297.7	Pounds. 341.7
Standard deviation.....	60.1	62.7	57.6

## CORRELATIONS.

Winter-summer.....	-0.572 ± 0.034
Winter-midsummer.....	- .480 ± .038
Winter-total.....	+ .429 ± .041
Summer-total.....	+ .493 ± .038

## REGRESSIONS.

Midsummer/winter.....	-0.384
Total/winter.....	.407
Total/summer.....	.453
Summer/winter.....	.593

According to the regressions, 100 pounds advantage in weight at the end of the winter is reduced to 61.6 pounds after 54 days on grass and to 40.7 pounds after 136 days on grass. In other words, during the first 54 days on grass, 38.4 pounds is lost of 100 pounds advantage as compared with 21.3 pounds lost during the rest of the summer period of 82 days, making a total loss of 59.3 pounds for the whole summer period.

<sup>1</sup>The sum of the mean winter and summer gain is 341.7, while the mean for the total gain is 342.2, the discrepancy being due in all probability to the grouping of the gains in classes of 10 pounds range.

II. COST OF RATIONS FOR WINTERING 2-YEAR-OLD STEERS.

Whether to purchase steers in the fall and carry them through the winter largely on roughage or to purchase them in the spring is a question which the thoughtful cattle grazer tries to answer. No matter what the answer may be on any particular farm or in any particular section of the country, the fact remains that cattle are generally higher in price and are worth more in the spring just before the grass season opens than they were at the close of the pasture

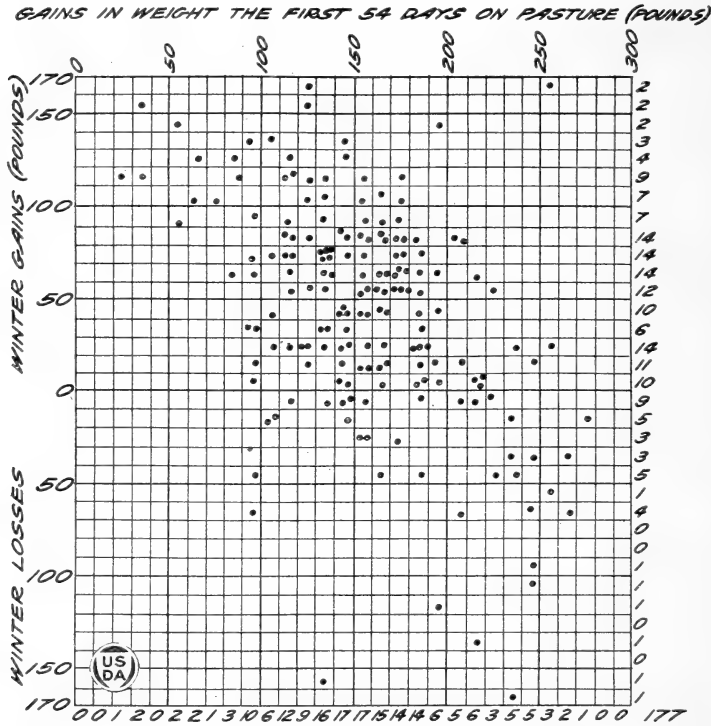


FIG. 9 a.—Showing the correlation between the winter losses and gains and the gains for the first 54 days (average for three years) on pasture, based on the individual steers.

period the preceding fall. This increase in value is due to the cost of wintering and the demand for cattle to make use of grass in the spring. In the following discussion the various winter rations are compared to determine which is the cheapest per day, and especially which produces a pound of gain most cheaply, when the cost of grazing and the gain on grass are added to the cost of wintering and winter gain. For this purpose it is necessary to fix the prices for feeds on the farm. It is felt, however, that this is the most questionable and unsatisfactory part of such experimental work, especially for the last few years, during which unusual fluctuations have occurred in feed prices. On account of these fluctuations, and also for simplicity

in making the various calculations, an average of the feed prices for the three years is used, as follows:

Corn silage.....	per ton..	\$6. 00
Cottonseed meal.....	do.....	50. 00
Mixed hay.....	do.....	18. 00
Wheat straw.....	do.....	7. 00
Ear corn.....	per bushel..	. 70
Pasture.....	per day..	. 10

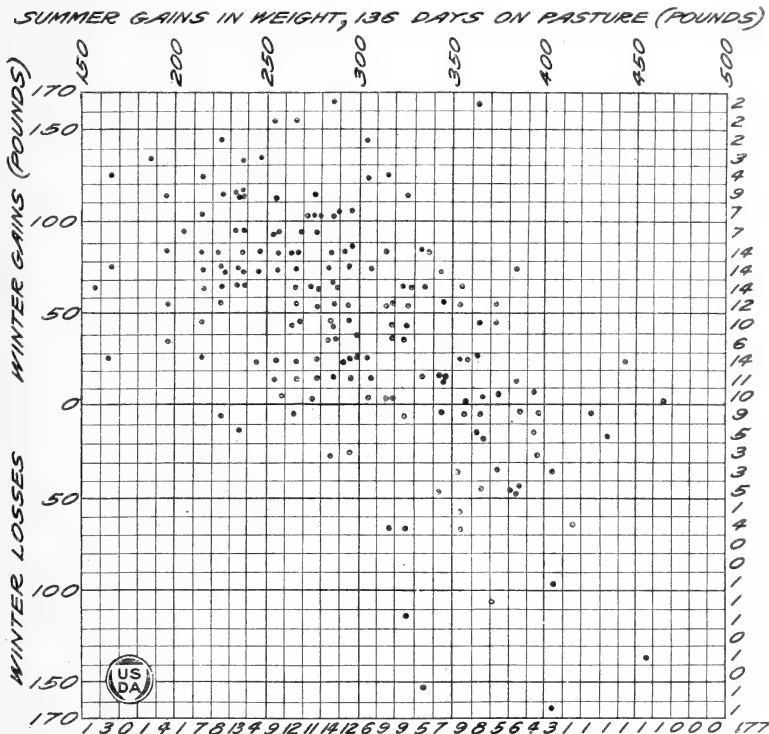


Fig. 9 b.—Showing the correlation between the winter losses and gains and the gains on pasture the following summer, based on the individual steers.

When one wishes to determine which ration should be used in a particular feeding operation, it is suggested that he apply local prices to the average amounts of the feeds consumed per steer, as given in Table 4.

COST PER POUND OF GAIN.

Table 6 shows the cost of winter feed, summer pasture, and the cost per pound of total gain. The cost of the winter feed is considerably more than the cost of summer feed, yet the gain is made chiefly in summer. This explains why feeder steers cost so much more in the spring than in the fall. It is considered that the cost of labor and other expenses are balanced by the manure produced.

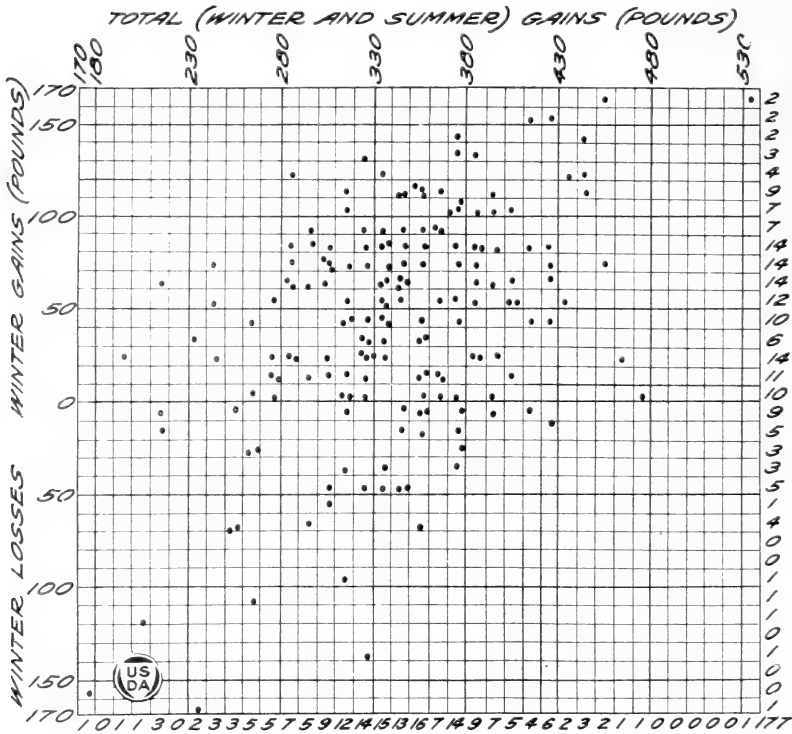


FIG. 9 c.—Showing the correlation between the winter losses and gains and the total gains for winter and summer periods, based on the individual steers.

TABLE 6.—Costs of feed per steer and per pound of gain.

Lot No.	Winter feed.	Season.	Winter and summer gain per steer.	Cost of feed per steer.			Cost of feed per pound of gain.
				Winter.	Summer.	Total.	
			<i>Pounds.</i>				<i>Cents.</i>
1	Mixed hay and ear corn.....	1919-20	342	\$25.40	\$13.60	\$39.00	11.4
		1920-21	340	24.05	12.80	36.85	10.8
		1921-22	307	19.19	14.10	33.29	10.8
	Average.....		330	22.88	13.50	36.38	11.0
2	Corn silage.....	1919-20	323	11.43	13.60	25.03	7.7
		1920-21	309	10.47	12.80	23.27	7.5
		1921-22	378	10.46	14.10	24.56	6.5
	Average.....		337	10.78	13.50	24.28	7.2
3	Corn silage.....	1919-20	318	15.24	13.60	28.84	9.1
		1920-21	351	14.52	12.80	27.32	7.8
		1921-22	378	13.43	14.10	27.53	7.3
	Average.....		349	14.40	13.50	27.90	8.0
4	Corn silage and cottonseed meal....	1919-20	364	16.19	13.60	29.79	8.2
		1920-21	331	15.01	12.80	27.81	8.4
		1921-22	391	15.65	14.10	29.75	7.6
	Average.....		362	15.62	13.50	29.12	8.0
5	Corn silage, wheat straw, and cottonseed meal.....	1919-20	343	15.11	13.60	28.71	8.4
		1920-21	307	11.53	12.80	27.33	8.9
		1921-22	377	14.86	14.10	28.96	7.7
	Average.....		344	14.85	13.50	28.35	8.2
6	Corn silage and mixed hay.....	1919-20	336	18.51	13.60	32.11	9.6
		1920-21	311	17.78	12.80	30.58	9.8
		1921-22	362	15.95	14.10	30.05	8.3
	Average.....		336	17.41	13.50	30.91	9.2

While the steers of Lot 1 made the least gain during the year, their gain cost the most per pound. Lot 2, which made practically the same gain as Lot 6, produced their gain at considerably less cost than any other lot. Lots 3, 4, and 5, which made the greatest gains, were next to Lot 2 in cheapness. The cost of gain in Lot 6 was intermediate between that of Lot 1 and of Lots 2, 3, and 5.

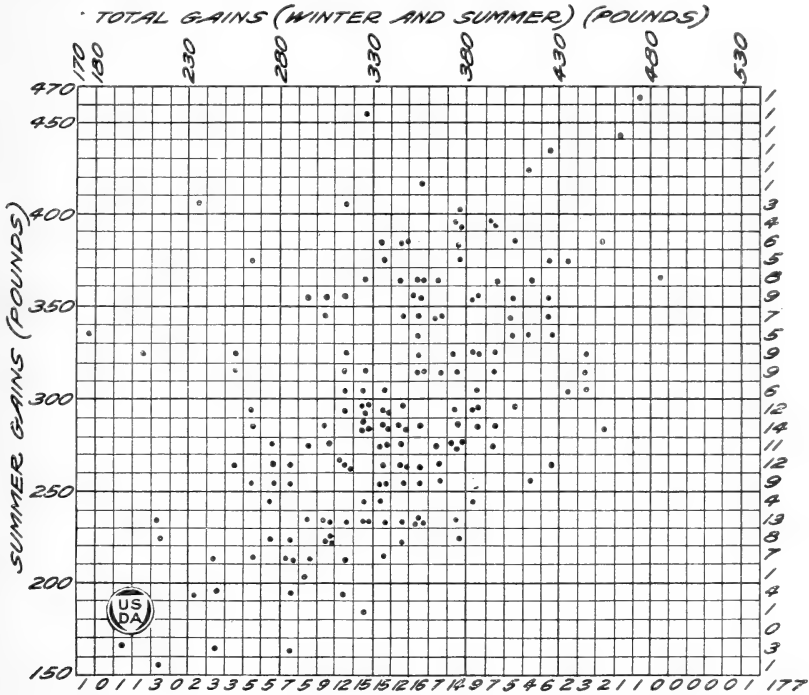


FIG. 9 d.—Showing the correlation between the gains of the summer and the total gains for the winter and summer periods, based on the individual steers.

TABLE 7.—Summary of average costs and gains per steer.

Item.	Lot 1.	Lot 2.	Lot 3.	Lot 4.	Lot 5.	Lot 6.
Winter rations per steer.....pounds..	{ Hay, 18 Corn, 2	Silage, 29	Silage, 39	Silage, 29 C.S.M. 1.5	Silage, 25 Straw, 6 C.S.M. 1	Silage, 25 Hay, 7
Initial weight per steer.....do.....	963	961	965	964	966	965
Winter gain or loss (-).....do.....	18	-9	66	50	86	59
Cost per day of winter feeds.....do.....	\$0.19	\$0.09	\$0.12	\$0.13	\$0.12	\$0.14
Summer gain.....pounds.....	312	346	283	312	258	277
Winter and summer gain.....do.....	330	337	349	362	344	336
Cost of feed per pound of winter and summer gain.....do.....	\$0.11	\$0.07	\$0.08	\$0.08	\$0.08	\$0.09
Final farm weight.....pounds.....	1,292	1,298	1,314	1,326	1,310	1,301
Shrinkage per steer (first 2 years).....do.....	71	75	75	75	61	80
Dressing percentage (first 2 years).....per cent.....	55.6	56.9	57.0	57.1	56.3	57.6

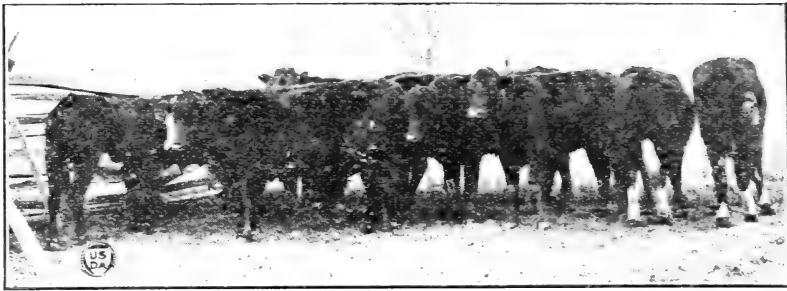


FIG. 10.—Lot 5 at the end of the first winter feeding period (April 22, 1920). They represent the type of steers used in the first year's work. Aberdeen-Angus breeding predominated.



FIG. 11.—Lot 1 at the beginning of the third year's work. Winter ration: Mixed hay, 15 pounds; ear corn, 2 pounds.



FIG. 12.—Lot 1 at the end of the third year's work. Average gain per steer, 307 pounds.



FIG. 13.—Lot 2 at the beginning of the third year's work. Winter ration: Silage, 28 pounds.



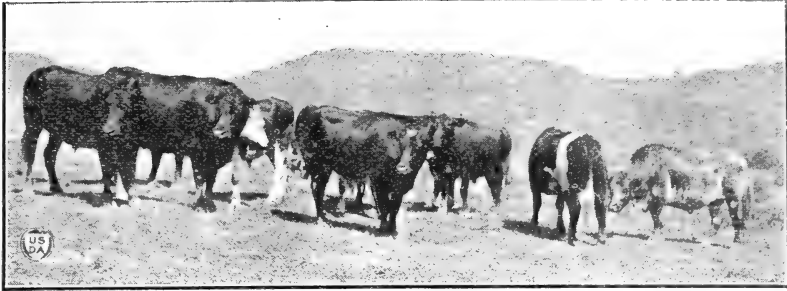


FIG. 14.—Lot 2 at the end of the third year's work. Average gain per steer, 378 pounds.



FIG. 15.—Lot 3 at the beginning of the third year's work. Winter ration: Silage, 36 pounds.



FIG. 16.—Lot 3 at the end of the third year's work. Average gain per steer, 378 pounds.



FIG. 17.—Lot 4 at the beginning of the third year's work. Winter ration: Silage, 30 pounds; cottonseed meal, 1.5 pounds.



FIG. 18.—Lot 4 at the end of the third year's work. Average gain per steer, 391 pounds.

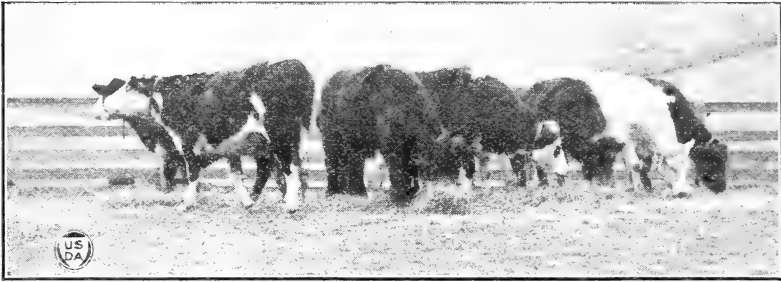


FIG. 19.—Lot 5 at the beginning of the third year's work. Winter ration: Silage, 25 pounds; straw, 6 pounds; cottonseed meal, 1 pound.



FIG. 20.—Lot 5 at the end of the third year's work. Average gain per steer, 377 pounds.



FIG. 21.—Lot 6 at the beginning of the third year's work. Winter ration: Silage, 25 pounds; mixed hay, 6 pounds.

## SHRINKAGE IN TRANSIT AND DRESSING PERCENTAGE.

The shrinkage in transit, commonly called "drift" in the Appalachian region, and the dressing percentages are given in Table 8 for the first two years. Owing to conditions incident to marketing the cattle, the data at the end of the third summer were not obtained. The steers were marketed in Jersey City each year. They were shipped either on the same day or on the day after the final farm weights were taken. The trip to Jersey City usually occupied about three days, the cattle being unloaded in transit once for feed and

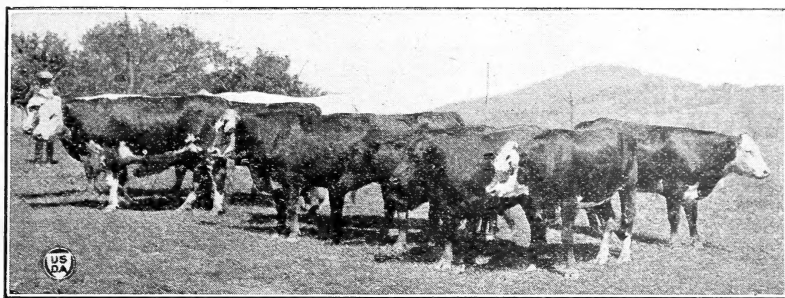


FIG. 22.—Lot 6 at the end of the third year's work. Average gain per steer, 362 pounds.

water. They were sold and slaughtered soon after reaching market. Variations in shrinkage and dressing percentage of the several lots are not considered to be sufficiently large for drawing conclusions relative to the methods of winter feeding. However, it should be noted that Lot 4, which made the largest gain for the year, dressed highest, and that Lot 1, which made the least gain, dressed lowest.

TABLE 8.—Market weight, shrinkage in transit, and dressing percentage per steer for the first and second years' work.

Lot No.	Winter feed.	Season.	Market weight.			Dressed weight.			
			Pounds.	Shrinkage, or "drift," in transit.	Per cent.	Pounds.	Farm weight dressing percentage.	Market weight dressing percentage.	
1	Mixed hay and ear corn.	{	1919-20	1,203	66	5.2	673	53.0	55.9
			1920-21	1,244	77	5.8	687	52.0	55.2
		Average.....		1,223	71	5.5	680	52.5	55.6
2	Corn silage.....	{	1919-20	1,174	62	5.0	668	54.0	56.9
			1920-21	1,202	88	6.8	685	53.1	57.0
		Average.....		1,189	75	5.9	676	53.5	56.9
3	Corn silage.....	{	1919-20	1,187	59	4.7	677	54.3	57.0
			1920-21	1,246	92	6.9	709	53.0	56.9
		Average.....		1,216	75	5.8	693	53.6	57.0
4	Corn silage and cottonseed meal.....	{	1919-20	1,225	66	5.1	704	54.5	57.5
			1920-21	1,229	85	6.5	699	53.2	56.9
		Average.....		1,227	75	5.8	701	53.8	57.1
5	Corn silage, wheat straw, and cottonseed meal.....	{	1919-20	1,223	47	3.7	681	53.6	55.7
			1920-21	1,215	79	6.1	694	53.6	57.1
		Average.....		1,220	61	4.8	687	53.6	56.3
6	Corn silage and mixed hay.....	{	1919-20	1,187	77	6.1	679	53.7	57.2
			1920-21	1,211	84	6.5	684	52.8	56.5
		Average.....		1,199	80	6.3	681	53.2	56.8

## CONCLUSIONS.

On the whole, the steers which made larger winter gains also made larger total gains for the year when fattened on grass the following summer (correlation, +0.43).

The steers which made only slight gains or lost weight during the winter made greater summer gains on pasture than steers which made larger winter gains (correlation between winter and summer gains, -0.57).

Consequently, differences in weight of steers at the end of the winter, due to rations fed, are gradually minimized during the time of summer fattening on grass. (An advantage of 100 pounds at the end of winter falls to one of only 41 pounds after 136 days on grass.)



FIG. 23.—The six lots of steers in September, 1922, at the lower corner of their pasture. They are about to be driven 5 miles to be loaded and shipped to Jersey City.

Since differences in weight due to winter feeding are gradually minimized, but not wholly overcome, during the summer season of fattening on grass, it is important that cattle to be marketed early should gain considerably more weight during the winter than if they are to be marketed late. (An advantage of 100 pounds at the end of winter falls to one of 62 pounds after 54 days on grass.)

There is so little difference between the gains made by the steers in the different lots at the end of the summer grazing period that any conclusion as to the best winter ration must take into consideration the cost of the ration.

Succulent rations of silage alone, or silage, cottonseed meal and straw, or silage and mixed hay, as used in this experiment, are cheaper and produce greater gains for the year than a dry ration of mixed hay and ear corn.

