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Agricultural Experiment Station

College of Agriculture, West Virginia University

HENRY G. KNIGHT, Director

Morgantown

EFFECTS OF WINTER RATIONS ON PASTURE GAINS OF TWO-YEAR-OLD STEERS



Looking From Muddy Creek Mountain Across a Branch of the Greenbrier Valley. The Steers Which Were Used as the Basis of This Study Were Fattened on a Pasture at the Foot of the Mountains Shown in the Distance.

By

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R. H. TUCKWILLER, and A. T. STEMPLE

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Effects of Winter Rations on Pasture Gains of Two-Year-Old Steers

The work reported in this bulletin is a part of a series of experiments on beef production problems in the Appalachian Mountain region which 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. The experiments have been conducted

on the David Tuckwiller Farm in Greenbrier County. This farm is situated in the southeastern part of the state in the blue grass area, and the results of this experiment apply not only to West Virginia but also to the adjacent states having similar conditions (See Figure 1). Some of the methods and results may be utilized to advantage by cattle feeders in other parts of the country.



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.

The topography of most of this region is mountainous, and practically all of it 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,

E. W. Sheets and A. T. Stemple represent the Bureau of Animal Industry, United States Department of Agriculture; E. A. Livesay the West Virginia Agricultural Experiment Station; and R. H. Tuckwiller is cooperatively employed by both agencies.

there are large areas of cut-over land. The farms vary in size from less than a hundred acres to more than a thousand acres. On most of the farms there is sufficient tillable land for the production of winter feed. Relatively little surplus grain is purchased.

Most of the cattle which go annually to eastern markets from this section are grass-fattened. The fact that most of them are finished for market on grass alone attests the value of the pastures, which consist largely of blue grass and white clover. The use of grain for finishing cattle is not general, although there are a few sections where the practice is followed, particularly in the valleys of some of the larger streams. 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. 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 a manner that the cattle often lose 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 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.

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.

Kinds of Steers Used

The steers used were long two-year-old grade Shorthorn, Hereford, and Aberdeen-Angus, raised in southern West Virginia. They were considered fair to good feeder steers and were 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.

TABLE 1.—Outline of the Three Years' Work.

Lot Number	Season	Steers ¹	Winter Periods ² Duration Days	Feeds Used	Summer Periods ³ on Pasture Duration Days
1	1919-20	10	127 ²	Mixed hay and ear corn.....	136 ⁵
	1920-21	10	121 ³	Mixed hay and ear corn.....	128 ⁶
	1921-22	10	124 ⁴	Mixed hay and ear corn.....	141 ⁷
2	1919-20	9	127 ²	Corn silage	136 ⁵
	1920-21	10	121 ³	Corn silage	128 ⁶
	1921-22	10	124 ⁴	Corn silage	141 ⁷
3	1919-20	10	127 ²	Corn silage	136 ⁵
	1920-21	10	121 ³	Corn silage	128 ⁶
	1921-22	10	124 ⁴	Corn silage	141 ⁷
4	1919-20	10	127 ²	Corn silage and cottonseed meal.....	136 ⁵
	1920-21	10	121 ³	Corn silage and cottonseed meal.....	128 ⁶
	1921-22	10	124 ⁴	Corn silage and cottonseed meal.....	141 ⁷
5	1919-20	10	127 ²	Corn silage, cottonseed meal and wheat straw	136 ⁵
	1920-21	8	121 ³	Corn silage, cottonseed meal and wheat straw	128 ⁶
	1921-22	10	124 ⁴	Corn silage, cottonseed meal and wheat straw	141 ⁷
6	1919-20	10	127 ²	Corn silage and mixed hay.....	136 ⁵
	1920-21	10	121 ³	Corn silage and mixed hay.....	128 ⁶
	1921-22	10	124 ⁴	Corn silage and mixed hay.....	141 ⁷

¹Owing to accidents one 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.

²December 23 to April 27.

³April 27 to September 2.

⁴December 28 to April 27.

⁵April 25 to September 13.

⁶December 23 to April 25.

⁷The average length of the winter periods is 124 days.

⁸April 27 to September 10.

⁹The average length of the summer periods is 135 days.



Lot 5, April 22, 1920, at the End of the Winter Feeding Period. These Steers Represent the Type (Aberdeen-Angus Breeding Predominated) Used in the First Year's Work.

TABLE 2.—Composition of Feeds Used, as Analyzed by the West Virginia Agricultural Experiment Station,* Compared With Average Analyses of Similar Feeds as Made by the United States Department of Agriculture.

Feed	Sources of Analyses	Moisture Per Cent	Ash Per Cent	Crude Protein Per Cent	Crude Fibre Per Cent	Nitrogen-Free Extract Per Cent	Fat Per Cent
Corn silage	W. Va. Exp. Sta.	72.9	1.8	2.2	6.2	16.1	0.8
	U. S. Dept. Agr.	70.9	1.4	2.4	6.9	17.5	0.9
Mixed hay	W. Va. Exp. Sta.	7.1	4.1	6.3	33.7	47.0	1.8
	U. S. Dept. Agr. ¹	12.7	6.2	10.2	26.2	41.7	3.0
Wheat straw	W. Va. Exp. Sta.	6.9	3.3	3.6	41.6	43.4	1.2
	U. S. Dept. Agr.	9.6	4.2	3.4	38.1	43.4	1.3
Ear corn	W. Va. Exp. Sta.	11.4	1.2	7.2	6.8	72.2	1.2
	U. S. Dept. Agr.	15.6	1.5	8.3	6.8	64.4	3.4
Cottonseed meal	W. Va. Exp. Sta.	7.2	6.4	42.1	8.0	29.0	7.3
	U. S. Dept. Agr. ²	7.1	5.7	41.7	10.0	28.4	7.1

¹Calculated, using one-half red clover hay and one-half timothy hay.

²Choice cottonseed meal.

*Average analyses for the three years.

Feeds Used

Samples of each of the feeds used were taken at different times during the winter periods and analyzed by the experiment station chemists. 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.

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, as a rule, provides in the year following the wheat crop a mixed hay of approximately one-half tim-

othy and one-half clover. The mixed hay used in this work was obtained in this manner, but it averaged about two-thirds timothy and one-third clover.

Character of Pasture

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

The soil is of limestone formation. A good growth of blue grass with white clover was found on most parts of the pasture.

OBJECTS AND PLAN OF THE EXPERIMENT

This experiment had the following general problems in view:

(1) To ascertain the effect of different wintering rations upon subsequent pasture gains; (2) To ascertain facts in regard to the effect of winter gains or losses on two-year-old steers upon subsequent pasture gains; and (3) To ascertain if cattle wintered on corn silage alone, or with the larger part of the ration composed of corn silage, make satisfactory pasture gains.

Under normal climatic conditions there is rainfall enough 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 ten each. In making this division, care was taken to have the lots as nearly uniform as possible in quality,



Lot 1 at the Beginning of the Third Year's Work; Winter Ration: Mixed Hay 15 Pounds, and Ear Corn 2 Pounds.



Lot 1 at the End of the Third Year's Work; Average Gain per Steer, 307 Pounds.



Lot 2 at the Beginning of the Third Year's Work; Winter Ration: Silage 28 Pounds.



Lot 2 at the End of the Third Year's Work; Average Gain per Steer, 378 Pounds.



Lot 3 at the Beginning of the Third Year's Work; Winter Ration: Silage 36 Pounds.



Lot 3 at the End of the Third Year's Work; Average Gain per Steer, 378 Pounds



Lot 4 at the Beginning of the Third Year's Work; Winter Ration: Silage 30 Pounds, Cottonseed Meal 1.5 Pounds.



Lot 4 at the End of the Third Year's Work; Average Gain per Steer, 391 Pounds.



Lot 5 at the Beginning of the Third Year's Work; Winter Rations: Silage 25 Pounds, Straw 6 Pounds, and Cottonseed Meal 1 Pound.



Lot 5 at the End of the Third Year's Work; Average Gain per Steer, 377 Pounds.

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 pens at all times and salt was constantly available. The steers were fed twice a day.

The feed, both concentrates and roughages, 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 the average taken as their initial and final weights. They were also weighed once every 28 days, in the morning after feeding. Neck straps and 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 heavy steers from the pasture to the scales. During the second summer they were weighed only on the 62nd day and during the third summer only on the 44th day, and at the close of



Lot 6 at the Beginning of the Third Year's Work; Winter Ration: Silage 25 Pounds and Mixed Hay 6 Pounds.



Lot 6 at the End of the Third Year's Work; Average Gain per Steer, 362 Pounds.

the experiment. The final winter weights are the same as the initial weights when turned on grass.

WINTER RATIONS AND THEIR INFLUENCE ON PASTURE GAINS

Quantity of Feed Consumed

Table 3 shows the total amount of different feeds eaten by the various lots and the average daily ration per steer in each lot during each of the three winters. All lots, excepting 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. The steers 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 they would clean up.

As Table 4 shows, there was considerable variation in the quantities of dry matter and digestible nutrients contained in and the nutritive ratios of the rations as fed. 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 3.—Average Total and Daily Rations per Steer During Three Winters.

Winter Feed	Total Feed per Steer in Pounds				Daily Feed per Steer in Pounds			
	1919-20	1920-21	1921-22	Av'ge.	1919-20	1920-21	1921-22	Av'ge.
Lot 1:								
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

TABLE 4.—Quantities of Dry Matter, Digestible Nutrients, and Nutritive Ratios of the Rations.

Lot Number	Average Winter Ration per Steer During Three Winters	Pounds Dry Matter	Pounds Digestible Nutrients		Nutritive Ratio	Feed per 1,000 Pounds Live-weight ²
			Protein	Carbohydrate Equivalent ¹		
1	Mixed hay (18.3 pounds).....	17.0	0.63	9.08	.....	19.0
	Ear corn (2.0 pounds).....	1.8	0.07	1.38	.....	2.1
	Total.....	18.8	0.70	10.46	1:14.9	.....
2	Corn silage (28.9 pounds).....	7.8	0.37	4.99	1:13.6	30.1
3	Corn silage (38.7 pounds).....	10.5	0.49	6.67	1:13.6	40.1
4	Corn silage (29.5 pounds).....	8.0	0.38	5.09	.....	30.6
	Cottonseed meal (1.5 pounds)	1.4	0.53	0.61	.....	1.6
	Total.....	9.4	0.91	5.70	1:6.3	.....
5	Corn silage (24.8 pounds).....	6.7	0.32	4.28	.....	25.7
	Wheat straw (5.8 pounds).....	5.4	0.02	2.26	.....	6.0
	Cottonseed meal (1.0 pounds)	0.9	0.35	0.41	.....	1.0
Total.....	13.0	0.69	6.97	1:10.1	.....
6	Corn silage (24.8 pounds).....	6.7	0.32	4.28	.....	25.7
	Mixed hay (7.3 pounds).....	6.8	0.25	3.62	.....	7.6
	Total.....	13.5	0.57	7.92	1:13.9	.....

¹The carbohydrate equivalent is the sum of the digestible carbohydrates plus 2.25 times the digestible fat.

²Based 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 and Daily Gains During Winter and Summer in Pounds.*

Lot Number	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	
					Total	Daily		Total	Daily	Total	Daily
1	Mixed hay and corn	1919-20	927	962	35	0.28	1,269	307	2.26	342	1.30
		1920-21	981	1,036	55	0.45	1,321	285	2.23	340	1.37
		1921-22	980	943	-37	-0.30	1,287	344	2.44	307	1.16
		Average	962	980	18	0.14	1,292	312	2.31	330	1.27
				±6.9			±5.9		±6.6		
2	Corn silage	1919-20	913	950	37	0.29	1,236	286	2.10	323	1.23
		1920-21	981	927	-54	-0.45	1,290	363	2.84	309	1.24
		1921-22	983	977	-6	-0.05	1,361	384	2.72	378	1.43
		Average	961	952	-9	-0.07	1,298	346	2.56	337	1.30
				±8.0			±8.1		±7.2		
3	Corn silage	1919-20	928	1,007	79	0.62	1,246	239	1.76	318	1.21
		1920-21	987	1,033	46	0.38	1,338	305	2.38	351	1.41
		1921-22	981	1,053	72	0.58	1,359	306	2.17	378	1.43
		Average	965	1,031	66	0.53	1,314	283	2.10	349	1.35
				±6.9			±7.3		±8.1		
4	Corn silage and cottonseed meal	1919-20	927	994	67	0.53	1,291	297	2.18	364	1.38
		1920-21	983	998	15	0.12	1,314	316	2.47	331	1.33
		1921-22	982	1,051	69	0.56	1,373	322	2.28	391	1.48
		Average	964	1,014	50	0.40	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	0.73	1,270	250	1.84	343	1.30
		1920-21	987	1,049	62	0.51	1,294	245	1.91	307	1.23
		1921-22	988	1,085	97	0.78	1,365	280	1.99	377	1.42
		Average	966	1,052	86	0.69	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	0.50	1,264	273	2.01	336	1.28
		1920-21	984	1,052	68	0.56	1,295	243	1.90	311	1.25
		1921-22	982	1,028	46	0.37	1,344	316	2.24	362	1.37
		Average	965	1,024	59	0.48	1,301	277	2.05	336	1.30
				±4.9			±7.2		±6.1		

*On account of dropping fractions in the average weights of the steers as given in this table, one cannot always add the weights or gains for the 3 years, divide by 3, and obtain the average given. In no case is there more than one pound of difference.

Diagrams of Gains and Losses

The seven charts, Figures 2, 3, 4, 5, 6, 7, and 8, show the gains and losses of the steers by 28-day periods, except as noted under "Method of Feeding and Handling the Steers," pages 7, 10, and 11. 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 (Figure 8) shows the average gains for three years for each of the six rations.

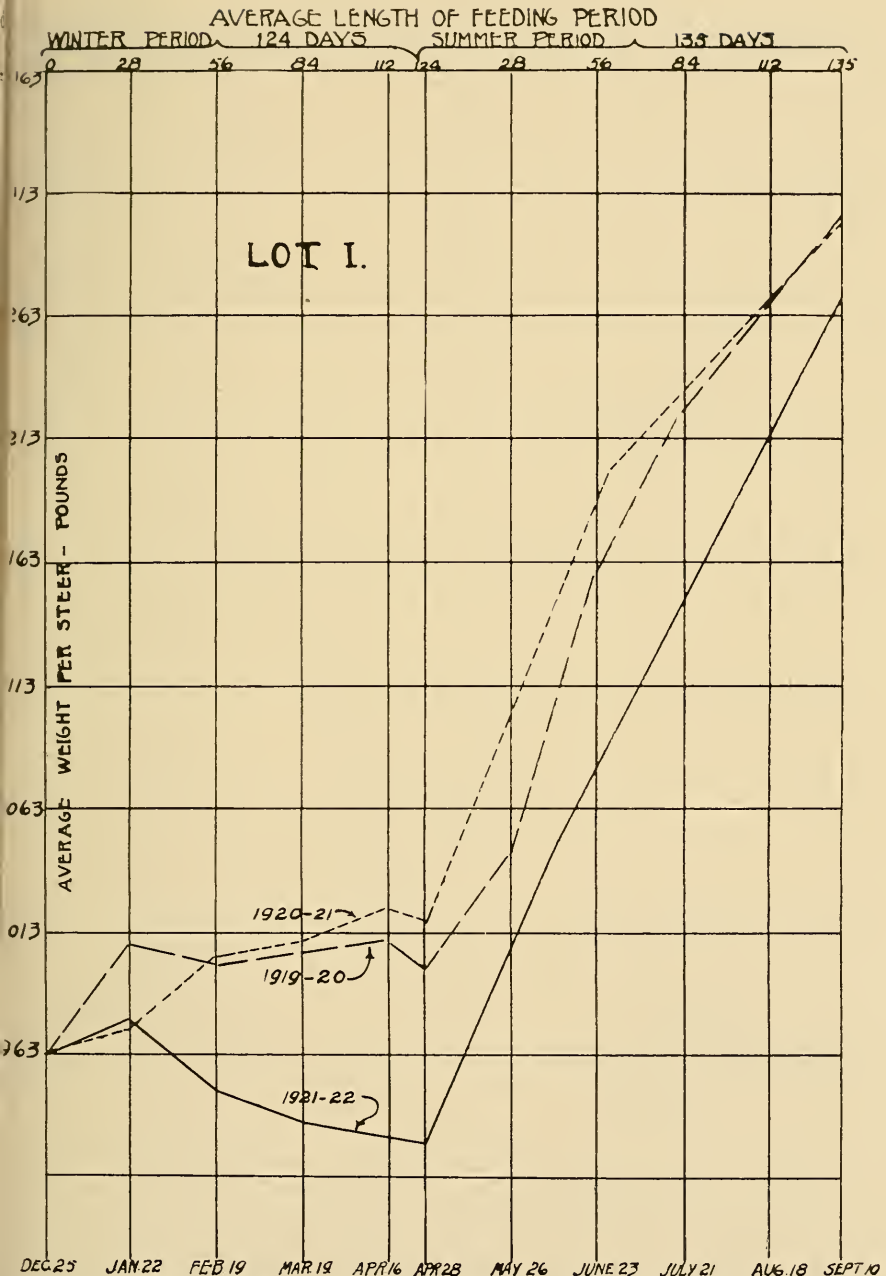


Fig. 2.—Annual Results of Winter and Summer (Grass) Feeding for Lot 1. These Steers Were Fed the Following Average Ration During the Winter: Mixed Hay 18.3 Pounds and Ear Corn 2 Pounds.

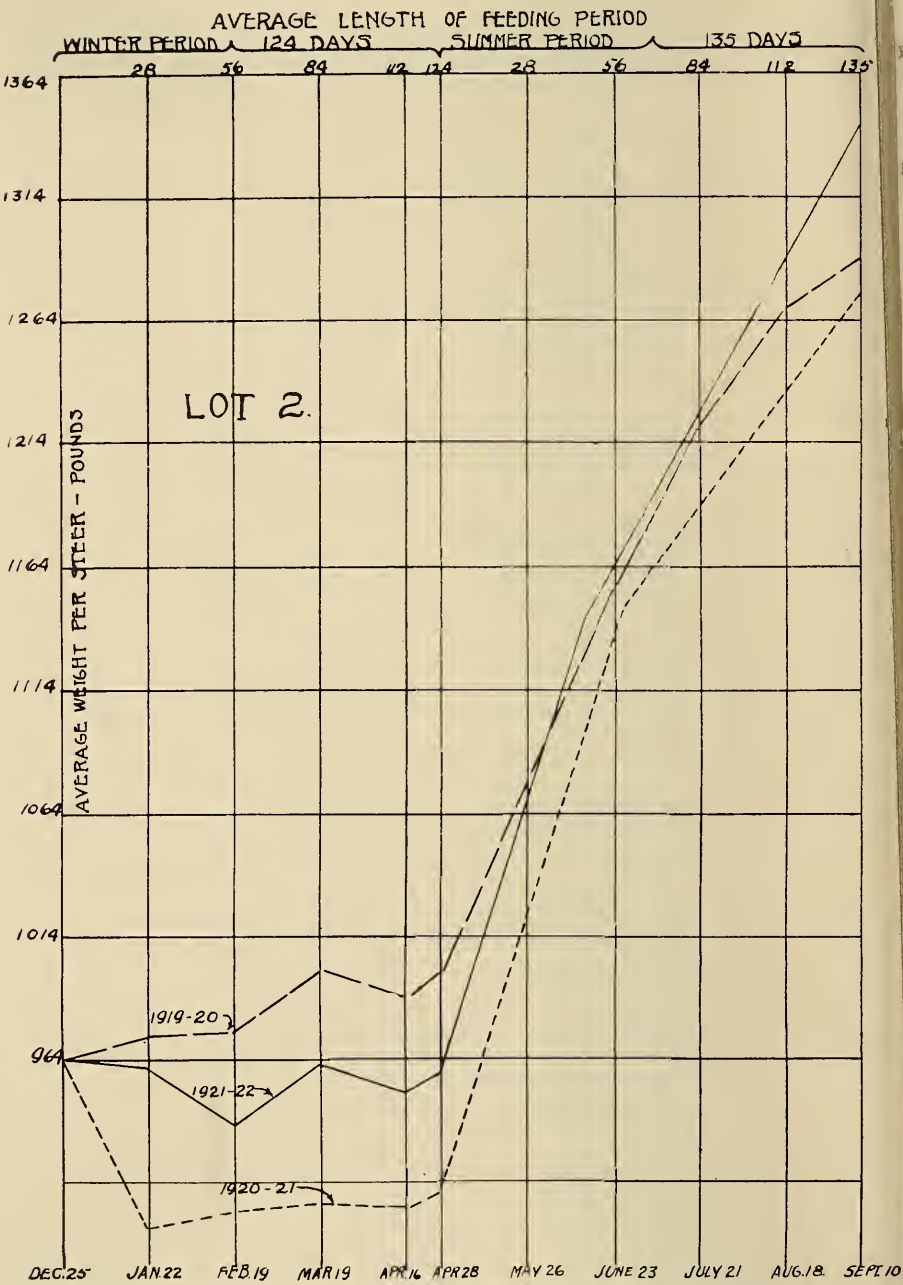


Fig. 3.—Annual Results of Winter and Summer (Grass) Feeding for Lot 2. These Steers Were Fed the Following Average Ration During the Winter: Corn Silage 28.9 Pounds.

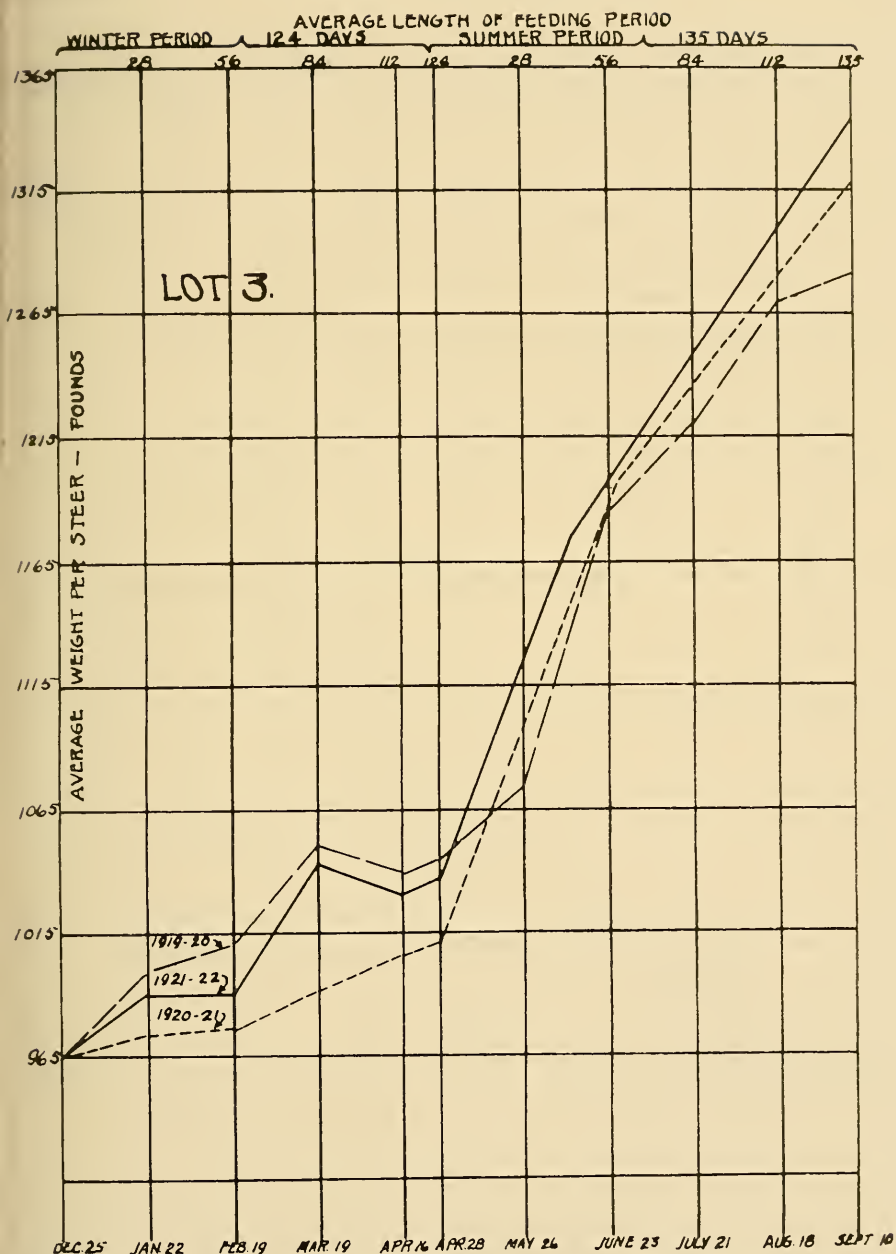


Fig. 4.—Annual Results of Winter and Summer (Grass) Feeding for Lot 3. These Steers Were Fed the Following Average Ration During the Winter: Corn Silage 38.7 Pounds.

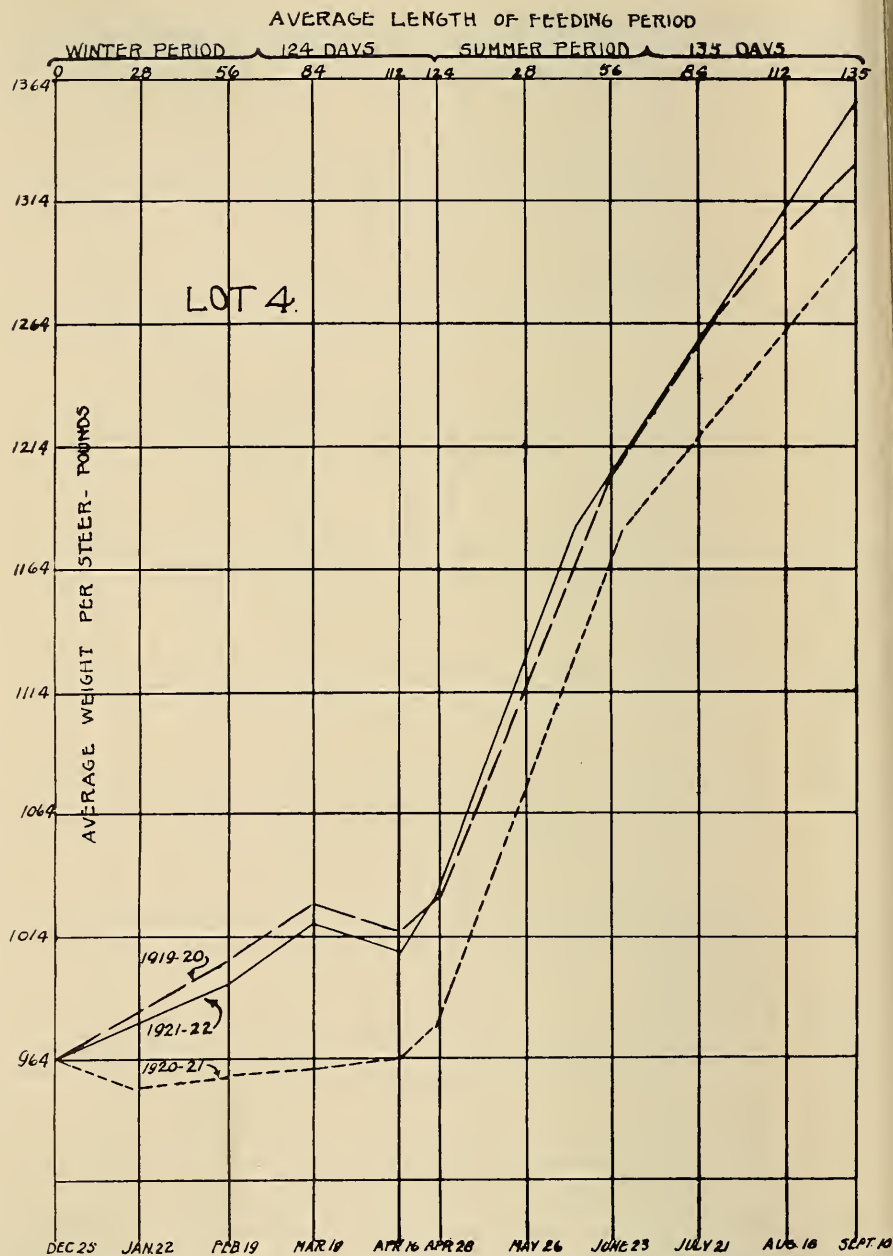


Fig. 5.—Annual Results of Winter and Summer (Grass) Feeding for Lot 4. These Steers Were Fed the Following Average Ration During the Winter: Corn Silage 29.5 Pounds and Cottonseed Meal 1.5 Pounds.

AVERAGE LENGTH OF FEEDING PERIOD

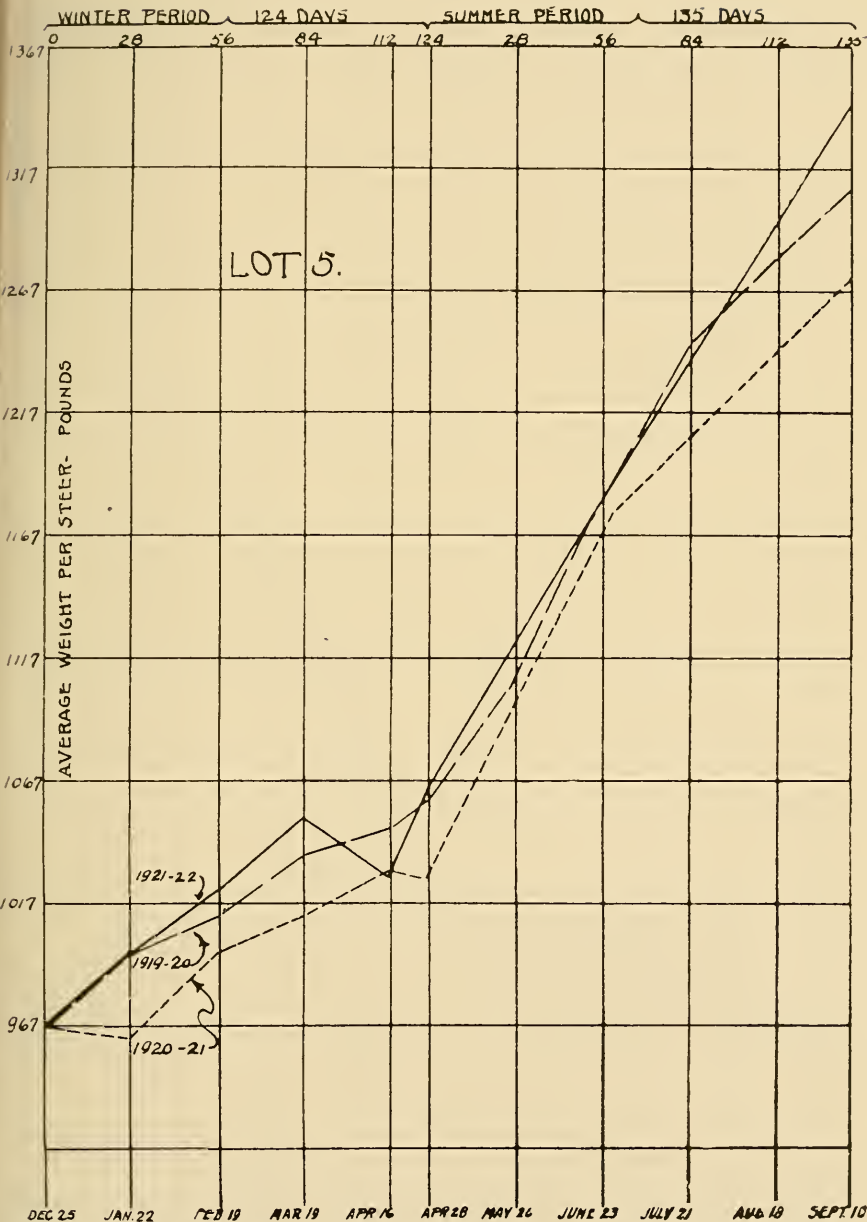


Fig. 6.—Annual Results of Winter and Summer (Grass) Feeding for Lot 5. These Steers Were Fed the Following Average Ration During the Winter: Corn Silage 24.8 Pounds, Wheat Straw .5.8 Pounds, and Cottonseed Meal 1.0 Pounds.

AVERAGE LENGTH OF FEEDING PERIOD

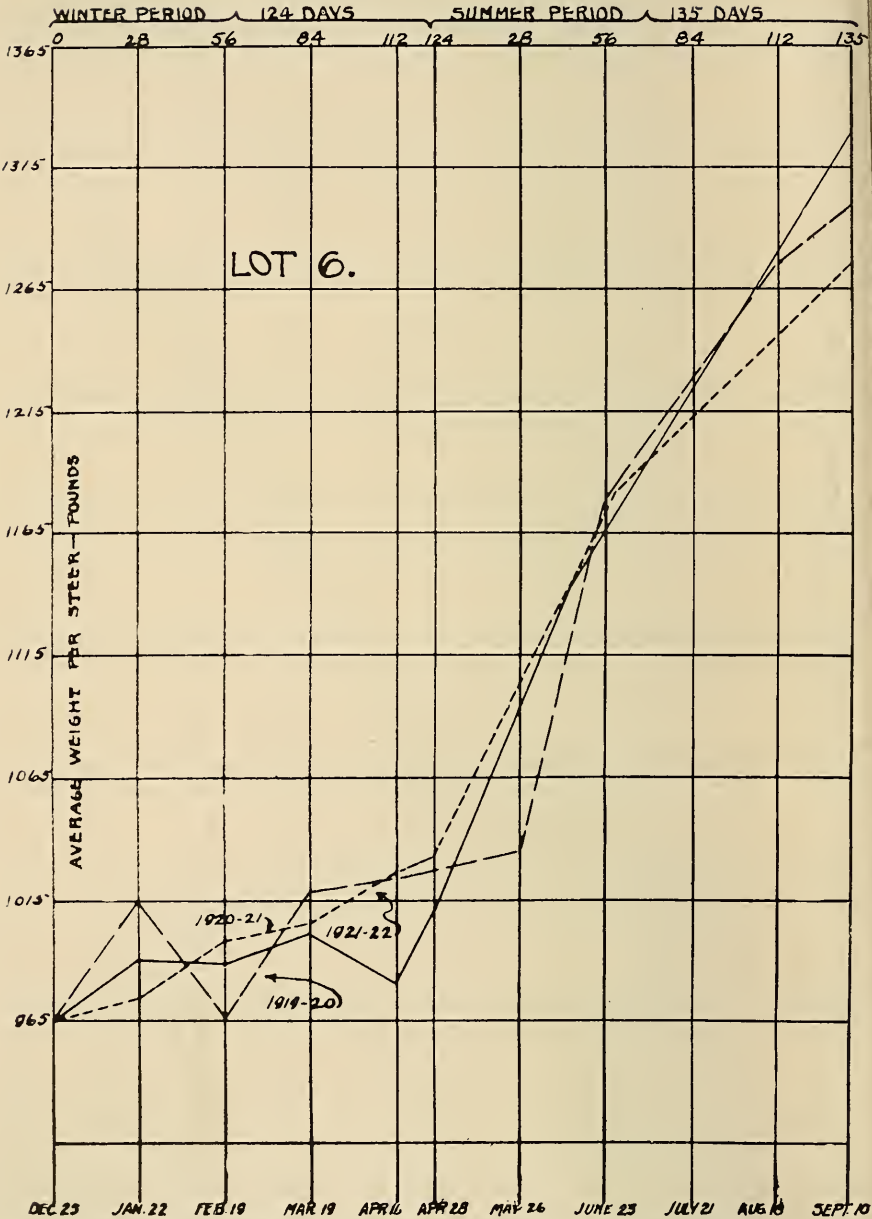


Fig. 7.—Annual Results of Winter and Summer (Grass) Feeding for Lot 6. These Steers Were Fed the Following Average Ration During the Winter: Corn Silage 24.8 Pounds and Mixed Hay 7.3 Pounds.

AVERAGE LENGTH OF FEEDING PERIOD

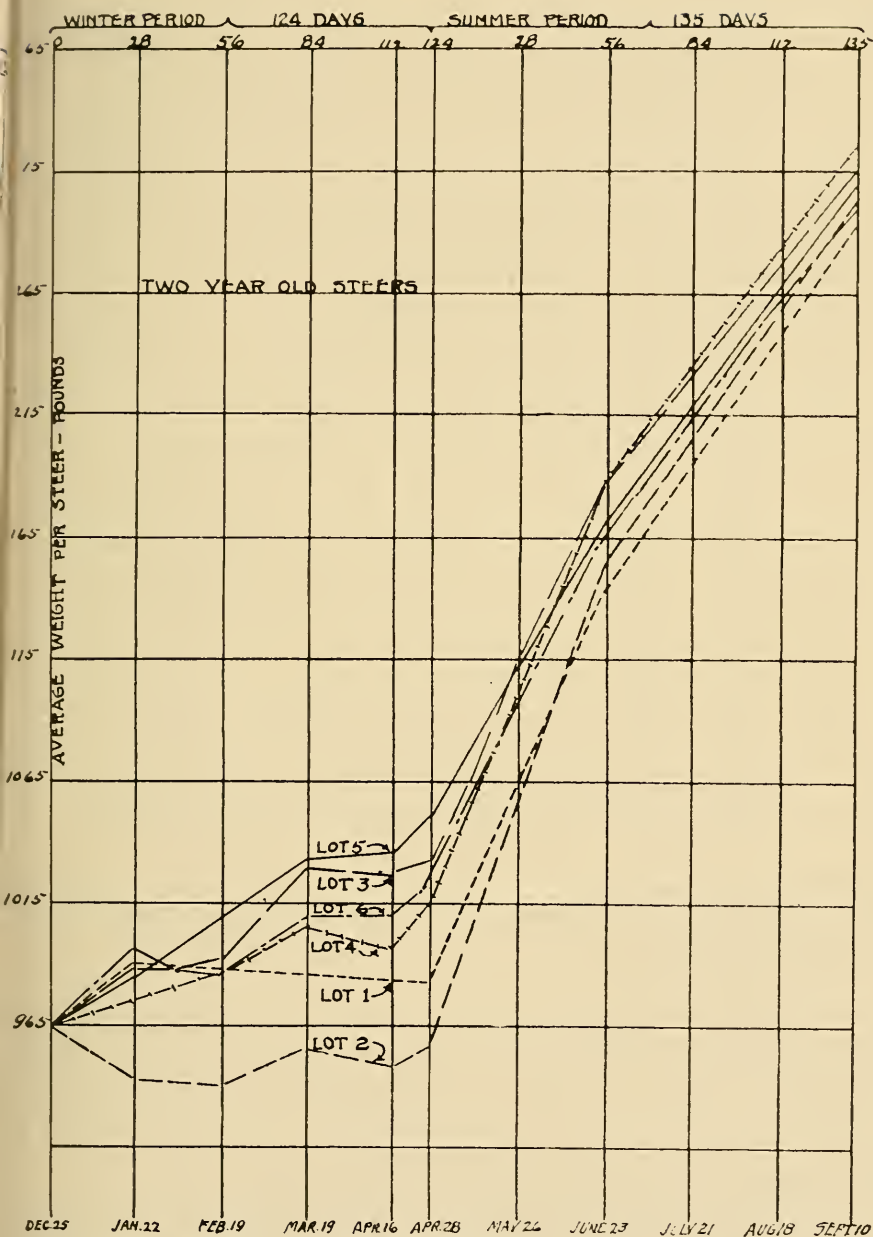


Fig. 8.—The Average Annual Results of Three Years Winter and Summer (Grass) Feeding for the Six Lots of Steers.

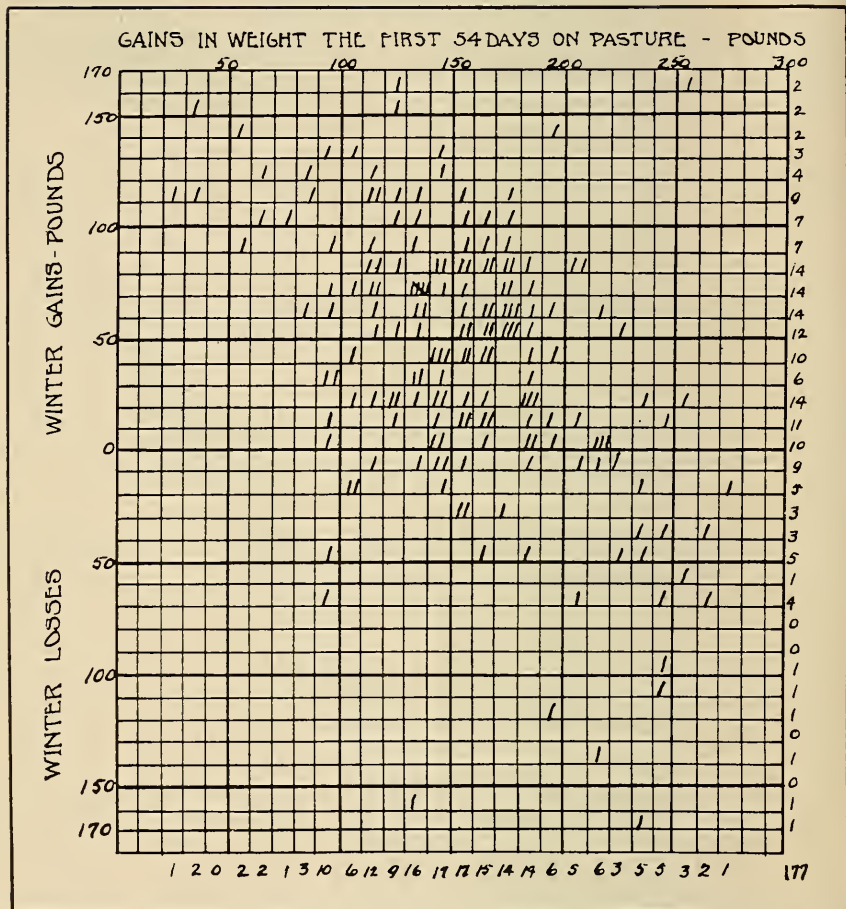


Fig. 9.—Correlation Between the Winter Losses and Gains and the Gains for the First 54 Days (Average for Three Years) on Pasture, Based on the Individual Steers.

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 date on which each monthly period began is also given. 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.

Vertical distance on the charts represents changes in live weights of the steers. The weights corresponding to each of the horizontal

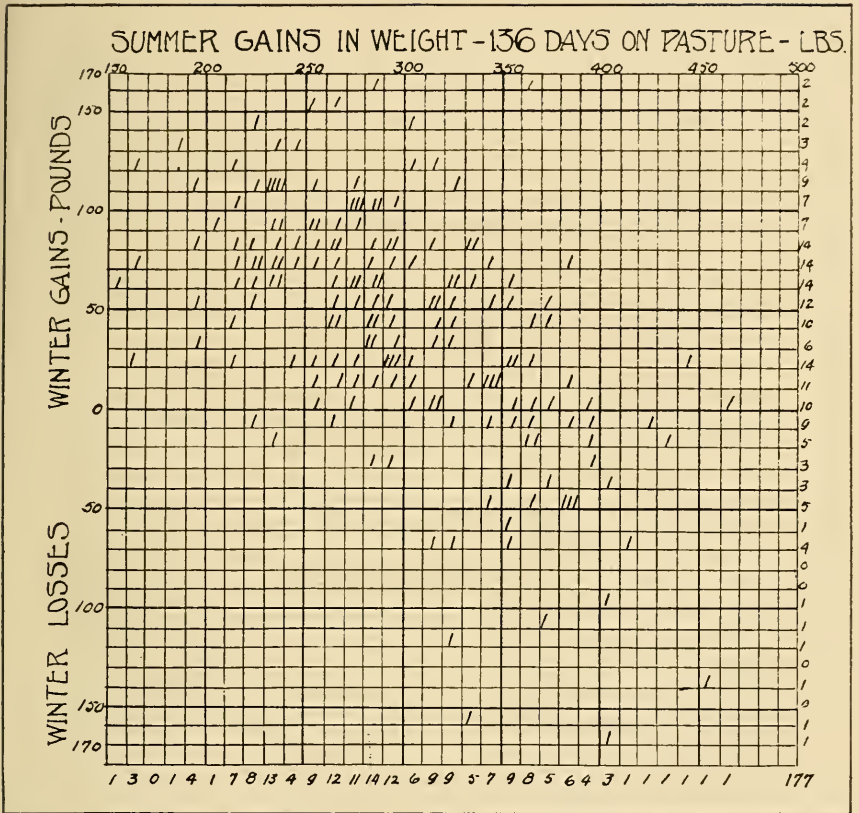


Fig. 10.—Correlation Between the Winter Losses and Gains and the Gains on Pasture the Following Summer, Based on the Individual Steers.

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, page 14, the correlations between the winter, summer, midsummer, and total gains of all the

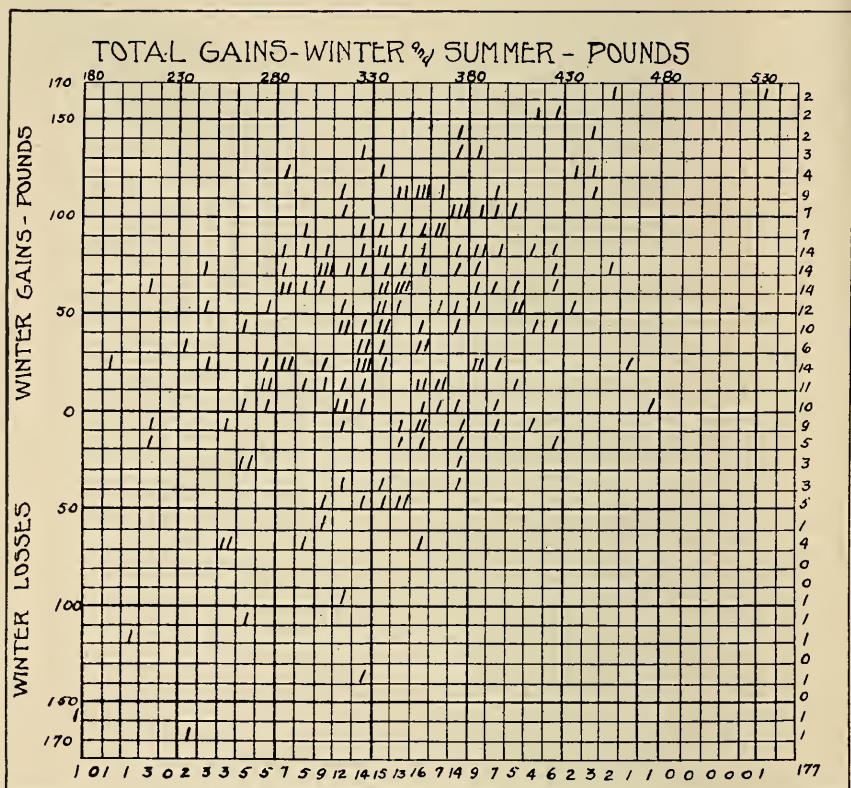


Fig. 11.—Correlation Between the Winter Losses and Gains and the Total Gains for Winter and Summer Periods, Based on the Individual Steers.

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 9, 10, 11, and 12 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 (Pounds)	Summer Gain (Pounds)	Total Gain (Pounds)
Mean	44.0	297.7	342.2*
Standard Deviation	60.1	62.7	57.6

Correlations

Winter-summer	-.572	±0.034
Winter-midsummer	-.480	±0.038
Winter-total	+.429	±0.041
Summer-total	+.493	±0.038

Regressions

Midsummer/winter	=.616
Total/winter	=.407
Total/summer	=.453
Summer/winter	=.593

*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.

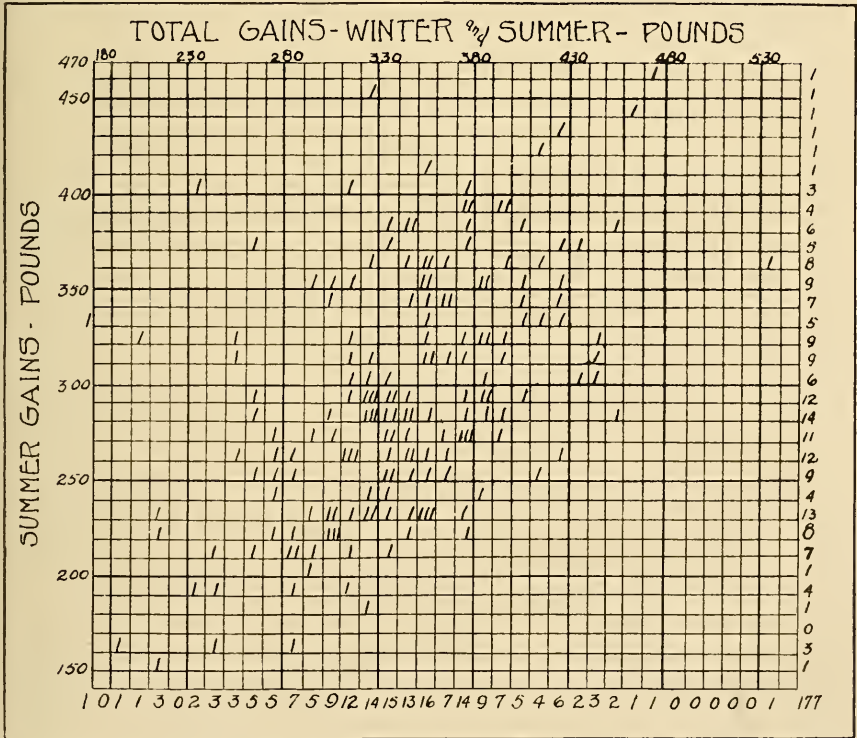


Fig. 12.—Correlation Between the Gains of the Summer Periods and the Total Gains for the Winter and Summer Periods, Based on the Individual Steers.

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.

COST OF RATIONS FOR WINTERING TWO-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 after some one else has wintered them is a question which the thoughtful cattle grazier 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 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 produced a pound of gain most cheaply. For this purpose it is necessary to fix the price 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	per ton	50.00
Mixed hay	per ton	18.00
Wheat straw	per ton	6.50
Ear corn	per bushel	0.70
Pasture	per day	0.10

TABLE 6.—Average Winter Gains or Losses, Summer Gains, Cost of Feed per Steer, and Cost per Pound of Gain.

Lot	Winter Feed	Season	Winter Gain or Loss Per Steer in Pounds	Summer Gain per Steer in Pounds	Cost of Feed per Steer			Cost of Feed in Cents per Pound of Gain
					Winter	Summer	Total	
1	Mixed hay and ear corn	1919-20	35	307	\$25.40	\$13.60	\$39.00	11.4
		1920-21	55	285	24.05	12.80	36.85	10.8
		1921-22	—37	344	19.19	14.10	33.29	10.8
		Average	18	312	22.88	13.50	36.38	11.1
2	Corn silage	1919-20	37	286	11.43	13.60	25.03	7.7
		1920-21	—54	363	10.47	12.80	23.27	7.5
		1921-22	—6	384	10.46	14.10	24.56	6.5
		Average	—9	346	10.78	13.50	24.28	7.2
3	Corn silage	1919-20	79	239	15.24	13.60	28.84	9.1
		1920-21	46	305	14.52	12.80	27.32	7.8
		1921-22	72	306	13.43	14.10	27.32	7.8
		Average	66	283	14.40	13.50	27.90	8.0
4	Corn silage and cottonseed meal	1919-20	67	297	16.19	13.60	29.79	8.2
		1920-21	15	316	15.01	12.80	27.81	8.4
		1921-22	69	322	15.65	14.10	29.75	7.6
		Average	50	312	15.62	13.50	29.12	8.0
5	Corn silage, wheat straw and cottonseed meal	1919-20	93	250	15.11	13.60	28.71	8.4
		1920-21	62	245	14.53	12.80	27.33	8.9
		1921-22	97	280	14.86	14.10	28.96	7.7
		Average	86	258	14.85	13.50	28.35	8.2
6	Corn silage and mixed hay	1919-20	63	273	18.51	13.60	32.11	9.6
		1920-21	68	243	17.78	12.80	30.58	9.8
		1921-22	46	316	15.95	14.10	30.05	8.3
		Average	59	277	17.41	13.50	30.91	9.2

When one wishes to determine which ration should be used in a particular operation, it is suggested that he apply local prices to the average amounts of the feeds consumed per steer as given in Table 4, page 13.

Cost per Pound of Gain.

Table 6 shows the cost of winter feed and 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.

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.



The Six Lots of Steers in September, 1922, at the Lower Corner of Their Pasture. They Are About to be Driven Five Miles to be Loaded and Shipped to Jersey City.

TABLE 7.—Summary of Average Costs and Gains per Steer.

Items	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6
Rations per steer, feed and 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, pounds.....	963	961	965	964	966	965
Winter gain or loss, pounds.....	17	—10	66	50	85	59
Cost per day of winter feeds.....	\$0.19	\$0.09	\$0.12	\$0.13	\$0.12	\$0.14
Summer gain, pounds.....	312	347	283	312	259	277
Winter and summer gain, pounds.....	329	337	349	362	344	336
Cost of feed per pound of winter and summer gain	\$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
Drift per steer, first two years, pounds.....	71	75	75	75	61	80
Dressing percentage, first two years.....	55.6	56.9	57.0	57.1	56.3	56.8

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. Conditions incident to marketing the cattle prevented obtaining these data at the end of the third summer. 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 required about three days, the cattle being unloaded in transit once for feed and 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 Year's Work.

Lot Number	Winter Feed	Season	Market Weight in Pounds	Shrinkage or Drift During Transit in Pounds	Percentage of Drift	Dressed Weight in 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	57.4
		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	4.9	687	53.6	56.3
6	Corn silage and mixed hay	1919-20	1,187	77	6.1	697	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

1.—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 $+0.43$).

2.—The steers which made only slight gains or lost in 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).

3.—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).

4.—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 considerable 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).

5.—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.

6.—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.

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