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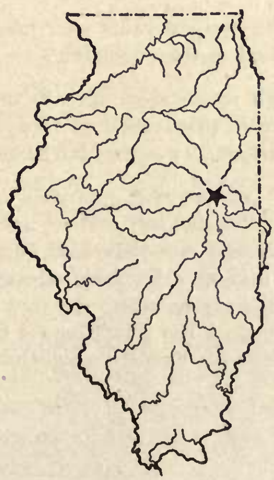
BULLETIN No. 103

COMPARISON OF METHODS OF PREPARING CORN AND CLOVER HAY FOR FATTENING STEERS

By HERBERT W. MUMFORD



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Summary of Bulletin No. 103

Object.—A comparison of the methods of preparing and feeding corn and clover hay to fattening cattle to determine which would return to cattle feeders the largest profits. Also to secure data on the question as to whether or not the cattle feeder can afford to buy nitrogenous concentrates to supplement corn when an abundant supply of clover hay or other nitrogenous roughage is available. Page 43.

Plan.—The test involved 130 two year old one thousand pound choice feeding steers. The steers cost $4.53 per hundred weight in the feed lots. These were divided into ten lots with each of which a different method of preparing corn or clover hay was tested. That is, the ten lots of steers were fed either silage, ear corn, shelled corn, fodder corn, corn meal, or corn and cob meal with clover hay, the latter being chaffed and mingled with the grain part of the ration in two instances. The experiment began November 28, 1903, and ended June 2, 1904, a period of 186 days. Price of feeds used was as follows: Ear corn, 35 cents per 70 pounds; clover hay, $8.00 per ton; gluten meal, $29.00; oil meal (linseed cake), $24.00 per ton. It cost the following amounts to prepare feeds used: Breaking ear corn, 20 cents per ton; shelling corn, 34 cents; grinding corn meal, $1.20; grinding corn and cob meal, $1.44; and chaffing hay, $1.00 per ton. Hogs followed each lot of steers to recover undigested feed. The pork thus produced was taken into account in the financial statement. Page 44.

Rapidity of Gains.—The daily gain per steer varied in the various lots from 2.08 to 2.45 pounds,—the average daily gain per steer of all the lots was 2.25 pounds or 419 pounds per steer for the whole time. Page 53.

Economy of Gains.—The cheapest gains were made where the labor element in preparing feed was reduced to the minimum. Page 62.

Nature of Gains.—High marketable finish in most instances accompanied maximum labor expenditure in preparation of feed, but as high finish was secured in some instances with smaller outlay for labor. Page 73.

Profit and Loss.—The lots fed with relatively small expenditure of labor took the lead in net profits. The ten lots sold for an average of about $6.10 per hundred weight. There was only one other load on the Chicago market on the day of this sale that sold up to $6.10 per hundred weight. The margin between buying and selling price necessary to insure the feeder against loss varied from $.97 to $1.53 per hundred weight. The prices for the finished cattle sold returned margins of from $1.42 to $1.62 per hundred weight not crediting the gains made by the pigs. Page 73.

Conclusions. **Page 79.**

COMPARISON OF METHODS OF PREPARING CORN AND CLOVER HAY FOR FATTENING STEERS

By HERBERT W. MUMFORD, Chief in Animal Husbandry

Introduction

During the past three years the author has made it a point to get into communication with as many Illinois beef producers as possible in order to study their problems and investigate their needs. Judging from the correspondence with these men it seems clear that there is no subject connected with the business that is of greater interest to them than that of how best to utilize the most available feeds of Illinois,—corn and clover hay. It would be impossible to investigate experimentally every method and combination in which these feeds might be used. However a sufficient number of them were tested in the experiment here reported to establish certain underlying principles in the preparation and use of these feeds and the bearing of these methods upon the extent, economy and quality of production.

Object

The principal object of this experiment was to determine which method of preparing and feeding corn and clover hay to fattening cattle would return to cattle feeders, under varying conditions, the largest profits. Obviously, conditions vary to such a large extent that the same method would not be equally successful under all of them. Some methods are very efficient for beef production, but require a large amount of labor and practically eliminate the pork producing factor. Other methods, while not particularly efficient for beef production, make a good showing for combined beef and pork production and require but a minimum amount of labor. Definite data, therefore, are required on the use of these feeds in their various forms that the cattle feeder knowing his conditions may be able to select that form of preparation and such methods of feeding as may best suit his conditions.

It is a fact clearly demonstrated by experiment and the experience of a large number of successful cattle feeders that where the corn crop is supplemented with a roughage only, the use of a nitrogenous one, such as clover or alfalfa hay, is followed with better results than the use of a roughage relatively low in its content of nitrogen like the straws and timothy hay. Three reasons for this fact may be stated. First, that in itself, corn with its own roughage is relatively low in its content of nitrogen. Hence, if other feeds are used as supplements they should be of such composition as properly to balance the ration to meet the demands of the animal body. Second, that clover hay, a roughage relatively rich in nitrogen, is cheaper than timothy hay. Third, that whether or not nitrogenous roughages can fully supplement corn and thus be advantageously used as substitutes for nitrogenous concentrates, they are an available source of protein because largely grown on Illinois farms, hence, should be used in preference to purchased nitrogenous feeds though not necessarily to their exclusion.

Another object of this test was to secure data on the question as to whether or not the cattle feeder can afford to buy nitrogenous concentrates to supplement corn when an abundant supply of clover hay is available and to what extent the answer to this question is dependent upon the price of the feeds involved.

PLAN OF EXPERIMENT

The steers used were purchased in the Chicago market during the months of October and November, 1903. In all, 136 head averaging about 1000 pounds each were purchased. After discarding six steers which lacked in quality and thrift, the ten lots comprising the test were selected. Taking the 130 head as a whole they would grade as choice* feeding cattle.

For the past few years it has been exceedingly difficult to get together either locally or by purchase at the feeding cattle markets a large number of native feeders possessing sufficient uniformity and quality to grade as choice. When it is found desirable to confine selections to native dehorned cattle of one breed, uniform in weight and age, we have a most difficult task; however, all these limitations have been found desirable and practically speaking essential in feeding cattle which are to be sorted into lots for testing efficiency of various rations.

High grade Short-Horn steers were selected, not because they are considered better for beef making purposes, but because high grades of this breed are more numerous in the cattle market and therefore more available to the Experiment Station than those of any of the other beef breeds. These steers averaged about two and one half years of age. Like the majority of high grade Short-Horn

*For description of this grade of feeding cattle see Bulletin No. 78, Illinois Experiment Station.

feeding cattle these steers were of the rugged growthy type,—some of them were too long of leg and rather coarse to be ideal feeders.

They were put into the dry lot immediately upon their arrival at the University farm and all were similarly treated until within a week of the time the experiment began when they were gradually accustomed to the rations to be fed during the test. For this purpose the 130 cattle were divided into ten lots, six of which contained 15 steers each, while four contained 10 steers each. These lots together with the rations each received were as follows:

TABLE 1.—STEERS, PIGS, AND FEEDS USED IN EACH LOT

Lot No.	No. of steers in each lot.	No. of pigs in each lot.*	Feeds and methods of preparation. (Gluten meal fed first half and oil meal second half of experiment).
1	10	1	Silage, corn meal, gluten meal, oil meal† and clover hay.
2	15	8	Ear corn, gluten meal, oil meal and clover hay.
3	15	8	Ear corn and clover hay.
4	15	4	Corn meal, gluten meal, oil meal and clover hay.
5	15	4	Corn meal, gluten meal, oil meal, clover hay,—hay chaffed and mingled with the grain.
6	15	4	Corn and cob meal, gluten meal, oil meal and clover hay.
7	15	4	Corn and cob meal, gluten meal, oil meal, hay,—hay chaffed and mingled with the grain.
8	10	6	Shock corn, ear corn, (according to common practice) and clover hay, oil meal being fed during the latter part of feeding period.
9	10	7	Shelled corn, gluten meal, oil meal and clover hay, (fed in ordinary dirt or mud lot).
10	10	7	Shelled corn, gluten meal, oil meal and clover hay (fed in paved lot in comparison with lot 9).

*The number of pigs in each lot varied somewhat from time to time, as conditions required, but the number here given represents an average number throughout the feeding period.

†Old process ground linseed cake, pea size.

Gluten meal was fed during the first half of the feeding period, and old process linseed cake (pea size) during the second half. There was no special reason for the change from gluten meal to linseed cake except to furnish variety. Gluten meal was fed instead of cotton seed meal because it is a corn product, and because cotton seed meal was thoroughly tested in a former experiment* at this Station in which it proved a most excellent supplement to corn. Where not otherwise specified the clover hay was fed uncut in the ordinary manner.

As in previous experiments, pigs were provided to follow the steers to utilize whatever undigested food-stuffs passed through the steers. For the purpose of testing the efficiency of feeds for combined beef and pork production it is believed best to put a sufficient number of pigs behind the steers to consume the droppings available for pork production. It is obvious that to get the greatest returns from the droppings and still determine the relative amount of pork that the undigested food in the droppings of each lot of steers would make, the number of pigs should be kept as small as possible, as under this system a minimum amount of food found in the droppings is used for the mere maintenance of the animal. This was the plan followed in determining the number of pigs used with each lot of cattle involved in this experiment. The regulation of the number of pigs with each lot of steers was attended with considerable difficulty owing to the variation in the nature of the concentrates fed the cattle and the consequent variation in amount of feed available to the pigs. The common practice of Illinois cattle feeders is to put in from one to two pigs per steer and feed corn in addition to the droppings in amounts determined by the appetites of the pigs.

The feed racks were so constructed and the feeding done in such manner that practically the only grain available for hog food had first passed through the steers. Results of former feeding experiments made it possible to determine approximately the percentage of corn fed in various forms to the steers that would eventually be available in the droppings for hog food. Bulletin 83, Illinois Experiment Station.

These data were helpful, but notwithstanding this fact, frequent changes were found to be necessary during the first few weeks in order to provide each lot with the proper number. The hogs used were fairly thrifty shoats of miscellaneous, and in some instances indifferent breeding, from six months to one year of age. They averaged about 110 pounds in weight at the beginning of the experiment. The matter of the hogs following the steers will be more fully discussed in the later pages of this bulletin.

*Bulletin No. 90.

Great care was exercised in making up the various lots of steers and the pigs following same that none should have the advantage over others at the beginning so far as age, quality, or condition was concerned. All will recognize the importance of such even division, but few will appreciate the difficulties attending it. All critics agree that the lots were very uniform, and evenly graded and that whatever differences occurred during the progress of the experiment were occasioned by differences in the rations fed.

As the shelter, feed lots, and water supply provided for the steers during this experiment were the same as those used in the Market Grade Experiment, the following statement taken from Bulletin No. 90 will cover these points.

SHELTER, FEED LOTS, AND WATER SUPPLY

"The shelter provided for the various lots of steers used in this experiment consisted of a low shed open to the south, very similar to the open sheds in common use for cattle feeding in the corn belt. It could hardly be said that the feed lots were like those commonly seen in Illinois, for, with the exception of feed lot No. 9 they were all paved with brick. It is impossible to get two feed lots in which conditions would be precisely the same without some provision for keeping the cattle out of the mud. As the feed lots were small, 36x48 feet, with a 12-foot shed running along the north side, making the total size 36x60 feet, paving with brick seemed the most practicable system. The lots were not paved under the sheds, where the ground was protected from all surface water. The sheds were kept well bedded, but no attempt was made to bed the pavement. The lots were frequently cleaned, and in wet weather the consistency of the manure on the pavement was such that it could have been handled more advantageously had litter of some sort been freely mingled with it. The price of bedding at the time prohibited its use for this purpose. During the day the steers had access to pure fresh water stored in galvanized steel tanks into which it was drawn from the University plant. Late in the evening of each day during the coldest weather the water was all drawn from the tanks by means of a convenient device in the bottom of each and carried away in a tile provided for that purpose."

A detailed description of the Station experimental feed lots accompanied with drawings and cuts will be published in circular form at an early date and will be supplied to all who send requests for it.

PRELIMINARY FEEDING

The preliminary feeding lasted one week, beginning with November 21, during which time the steers were gradually started on rations similar to those subsequently fed in the experiment.

During this preliminary feeding a large proportion of the ration of all the steers was roughage, a comparatively light grain ration being fed; the latter amounted approximately to 4.5 pounds daily to each steer at the end of the preliminary feeding period, while the former was approximately double that amount. Taking the whole of the preliminary feeding period into account the proportion of grain to roughage fed was as 1 :2.7. The average daily gain of each steer for the seven days was 3.21 pounds. The grain consumed per pound of increase in live weight was 1.69 pounds and of roughage 4.64 pounds. The actual cost of gains per hundred weight on the entire 130 steers during the preliminary feeding (Nov. 21-28) was $2.98. "Such results are to be anticipated when well shrunk, thin feeding steers are placed in the feed lot and permitted the luxury of more liberal feeding."*

METHOD OF FEEDING STEERS

The experiment proper began November 28, 1903, and from that date throughout the experiment the steers were fed grain and roughage twice daily, grain being fed before the roughage. During the winter months, they received their grain at seven a. m. and at four p. m., the roughage being fed as soon as the feeding of the grain was finished. Grain and hay, except where the latter was chaffed, were fed in separate racks. As the season advanced the morning ration was fed earlier and the evening ration later in the day.

Both the steers and the pigs were weighed every two weeks. The initial weights were secured by taking the average of the weights on November 27, 28, and 29, considering this average as the proper weight for the middle day, November 28. In securing the weights at the beginning of the experiment and all subsequent weights, the steers were weighed before their morning feed of grain and roughage, water having been withheld since the night before.

QUALITY AND COST OF FEEDS

The gluten and linseed meal were both of good grades; the former was the "Cream" brand, the latter "Old Process," pea size. With the exception of an occasional bale the clover hay used graded No. 1. The corn graded No. 1 Yellow. The corn used was 82.25 percent grain and 17.75 percent cob. The feeds used were prepared at the University cattle feeding plant. That is to say, the shelling and grinding of corn and chaffing of the hay were all accomplished on the University farm. Both the corn meal and the corn

*Bulletin 83, Illinois Experiment Station, page 548.

and cob meal were finely ground. The shock (fodder) corn and silage used were grown in the same field on the University farm and the plots reserved for use were selected with the greatest care that the quality and proportion of grain to stover should be the same in each instance. The corn yielded 42.69 bushels per acre. Eighty pounds to the bushel of ears is taken as the basis as the corn was weighed when first husked. The stover yielded 1.31 tons per acre. On this basis 56.6 percent of the total crop was grain and 43.4 percent stover.

Taking into account depreciation in machinery by wear and the actual labor involved, the records show that it cost the following amounts to prepare feeds used:

	Per ton
Breaking ear corn for lots 2 and 3 $.010 per cwt. or........	$ .20
Shelling corn for lots 9 and 10 $.017 per cwt. or...........	.34
Grinding corn meal for lots 4 and 5 $.060 per cwt. or.......	1.20
Grinding corn and cob meal for lots 6 and 7 $.072 per cwt. or..	1.44
Chaffing hay by running through ensilage machine $.050 per cwt. or..	1.00

PRICE OF FEEDS INCLUDING COST OF PREPARATION

	Per ton
Ear corn, $.35 per bu., or..............................	$10.00
Broken ear corn......................................	10.20
Oil meal (ground linseed cake, pea size).................	24.00
Gluten meal..	29.00
Clover hay...	8.00
Chaffed clover hay...................................	9.00
Shelled corn including cost of shelling..................	12.48
Corn meal including cost of grinding (and of shelling the corn before grinding)..............................	13.34
Corn and cob meal including cost of grinding............	11.44
Shock (fodder) corn including cost of hauling to feed lots..	5.40
Silage...	2.75

The following table is presented because many cattle feeders will be interested in knowing just how much and what kind of grain and how much and what kind of roughage the steers received daily by periods during the various stages of the fattening process.

TABLE 2.—DAILY RATION PER STEER BY PERIODS (POUNDS)

Lot No.	Feeds.	Periods *					
		1	2	3	4	5	6
1	Corn meal	3.05	7.95	9.94	11.42	14.04	19.81
	Gluten meal	2.43	3.20	3.20	1.29		
	Oil meal				1.82	3.00	3.00
	Silage	28.32	30.00	28.18	22.96	19.94	14.46
	Clover hay	12.12	8.36	6.23	6.00	6.11	5.87
2	Ear corn	9.84	18.13	20.66	21.72	23.20	24.14
	Gluten meal	2.43	3.07	3.07	1.34		
	Oil meal				1.72	3.00	3.00
	Clover hay	13.33	9.83	7.82	6.70	6.66	5.46
3	Ear corn	9.84	19.01	21.87	23.48	24.64	25.23
	Clover hay	14.66	11.02	8.20	6.70	6.66	5.66
4	Corn meal	7.86	14.36	16.48	17.68	20.45	20.46
	Gluten meal	2.43	3.07	3.07	1.32		
	Oil meal				1.72	3.00	2.93
	Clover hay	13.33	9.83	8.05	7.93	8.00	6.96
5	Corn meal	7.86	14.64	16.48	17.68	20.47	20.65
	Gluten meal	2.43	3.07	3.07	1.32		
	Oil meal				1.72	3.00	3.00
	Chaffed hay	13.33	10.09	8.09	7.98	8.00	7.04
6	Corn and cob meal	9.80	18.35	20.66	21.95	23.68	25.96
	Gluten meal	2.43	3.07	3.07	1.32		
	Oil meal				1.72	3.00	3.00
	Clover hay	13.33	9.83	8.15	6.70	6.66	5.69
7	Corn and cob meal	9.80	18.35	20.66	21.95	24.64	24.99
	Gluten meal	2.43	3.07	3.07	1.32		
	Oil meal				1.72	3.00	3.00
	Clover hay	13.33	10.09	8.23	6.70	6.66	5.47
8	Ear corn			4.39	21.57	23.02	24.94
	Oil meal				1.78	3.00	3.00
	Shock corn	24.59	33.77	35.38	3.93		
	Clover hay	12.02	7.71	6.39	6.36	6.09	5.80
9	Shelled corn	7.93	14.45	16.55	17.52	19.54	20.72
	Gluten meal	2.51	3.20	3.20	1.29		
	Oil meal				1.82	3.00	3.00
	Clover hay	13.40	10.08	8.31	8.00	8.00	7.64
10	Shelled corn	7.93	14.45	16.55	17.52	19.86	20.72
	Gluten meal	2.51	3.20	3.20	1.29		
	Oil meal				1.82	3.00	3.00
	Clover hay	13.40	10.08	8.31	8.00	8.00	7.64

* Period 1 extended from November 28 to December 26, 1903; period 2, December 26, 1903, to January 23, 1904; period 3, January 23 to February 20; period 4, February 20 to March 19; period 5, March 19 to April 16; period 6, April 16 to June 1.

Since the average weights of the steers in the various lots were similar at the beginning of the experiment and as the gains made by the various lots were not greatly different, the discussion of the points brought out in Tables 2 and 3 will follow Table 3.

In general, however, there is so much variation in the weights of fattening cattle that from the student's standpoint at least, the amounts of feed fed daily per thousand pounds of live weight should be carefully studied. Table 3 is, therefore, of interest.

TABLE 3.—DAILY RATION PER THOUSAND POUNDS LIVE WEIGHT BY PERIODS

Lot No.	Feeds.	Periods.*					
		1	2	3	4	5	6
1	Corn meal	2.87	7.21	8.40	9.22	10.82	10.22
	Gluten meal	2.29	2.91	2.70	1.04		
	Oil meal				1.47	2.31	2.12
	Silage	22.67	27.25	23.60	18.26	15.36	10.22
	Clover hay	11.39	7.60	5.26	4.85	4.70	4.14
2	Ear corn	9.01	15.83	17.06	17.13	17.57	16.85
	Gluten meal	2.22	2.53	2.48	1.06		
	Oil meal				1.34	2.27	2.09
	Clover hay	12.22	8 60	6.55	5.28	5.05	3.81
3	Ear corn, broken	9.30	17.47	19.04	19.57	19.82	18.83
	Clover hay	13.85	10.12	7.13	5.58	5.36	4.21
4	Corn meal	7.56	13.23	14.33	14.52	16.12	14.87
	Gluten meal	2.34	2 83	2.66	1.08		
	Oil meal				1.41	2.36	2.16
	Clover hay	12.79	9.06	6.99	6.51	6.31	5.17
5	Corn meal	7.21	12.78	13.95	14.09	15.87	14.68
	Gluten meal	2.24	2.68	2.59	1.05		
	Oil meal				1.37	2.33	2.13
	Chaffed hay	12.27	8.81	6.85	6.36	6.20	5.01
6	Corn and cob meal	9.17	16.58	17.32	17.54	18.24	17.02
	Gluten meal	2.28	2.77	2.57	1.06		
	Oil meal				1.37	2.31	2.16
	Clover hay	12.49	8.89	6.83	5.35	5.14	4.10
7	Corn and cob meal	9.27	16.74	17.23	17.75	19.01	17.75
	Gluten meal	2.30	2.79	2.55	1.06		
	Oil meal				1.39	2.31	2.13
	Clover hay	12.62	9.21	6.86	5.42	5.14	3.88
8	Ear corn			3.79	17.99	18.09	18.26
	Oil meal				1.48	2.35	2.19
	Shock corn	22.75	30.36	30.60	3.27		
	Clover hay	11.12	6.93	5.53	5.39	4.78	4.25
9	Shelled corn	7.47	12.82	14.17	14.61	15.58	15.27
	Gluten meal	2.36	2.84	2.74	1.07		
	Oil meal				1.52	2.39	2.21
	Clover hay	12.64	8.95	7.12	6.66	6.38	5.24
10	Shelled corn	7.48	12.88	14.28	14.59	15.67	15.47
	Gluten meal	2.37	2.85	2.76	1.06		
	Oil meal				1.52	2.37	2.24
	Clover hay	12.65	8.99	7.17	6.65	6.04	5.59

* Period 1 extended from November 28 to December 26, 1903; period 2, December 26, 1903, to January 23, 1904; period 3, January 23 to February 20; period 4, February 20 to March 19; period 5, March 19 to April 16; period 6, April 16 to June 1.

From the beginning of the experiment up to the time the steers were on full feed all the lots were given approximately the same amount of corn per thousand pounds live weight. This precaution was taken to avoid the possibility of larger gains and greater efficiency of feed being caused by the varying amounts of feed rather than the character of the ration fed to the several lots. This proved an expeditious way of handling the experiment and seemed to meet the requirements of the steers in enabling them to make satisfactory gains both as to rapidity and economy. Again, when the steers were on full feed and the amounts fed were governed by the appetites of the steers the amount of corn fed per thousand pounds live weight of steers was fully as uniform in the various lots as it had been previous to that time. The apparent exceptions to this uniformity in the amount of corn fed in lots 3 and 8, which lots received more corn per thousand pounds live weight than did the other lots, is accounted for by the fact that lot 3 received corn only as a concentrate and lot 8, corn only until the last ninety days. Experience has proved that to get the best results from silage fed to two year old steers during the fattening period they should not receive large amounts. This amount of silage did not make the amount of corn fed per day per thousand pounds weight of steers equal to that given the other lots. This deficiency was made up by the use of corn meal.

Ear corn was taken as a basis of the amount fed. The percentage of corn in the silage was known as was also the percentage of ear corn in the shock corn fed.

The table shows that during the first period the proportion of concentrates to roughage in the ration was about as 1 :1.3 with the exception of lot 1. If silage be considered a roughage, then the proportion of concentrates to roughages in lot 1 is as 1 :6.47; but if it be considered one half a concentrate and one half a roughage, corresponding approximately to the relative weights of grain and stover, then the proportions are about the same as in the other lots. From the first period on, the proportion of grain was gradually increased, while the proportion of roughage was gradually decreased. The following tabulation for lots 2 and 3 will reinforce the thought:

	Period.	Concentrate, pounds.	Roughage, pounds.	Proportion.
Lot 2..........	1	11.23	12.22	1 : 1.09
	2	18.36	8.60	1 : 0.46
	3	19.54	6.55	1 : 0.33
	4	19.53	5.28	1 : 0.27
	5	19.84	5.05	1 : 0.25
	6	18.94	3.81	1 : 0.20

	Period.	Concentrate, pounds.	Roughage, pounds.	Proportion.
Lot 3.....	1	9.30	13.85	1 : 1.49
	2	17.47	10.12	1 : 0.57
	3	19.04	7.13	1 : 0.37
	4	19.57	5.58	1 : 0.27
	5	19.82	5.36	1 : 0.26
	6	18.83	4.21	1 : 0.22

This tabulation also shows that at the last period the grain ration was about five times that of the roughage portion, or as 1 :0.20.

It is worthy of note that at no time during the experiment did the amount of corn fed per steer per day much exceed one third of a bushel and yet during period 5, when the steers received the heaviest grain ration, they weighed an average of 1350 pounds each. It is also noticeable that there was a gradual increase in the amount of concentrates fed up to and including the fifth month. If a steer is on full feed when he is getting a maximum grain ration and not till then, it might be said that it took four months to get these steers on full feed. Reference to Table 2, however, will show that the steers were practically on full feed during the third month.

The average weight of the steers at the beginning of the experiment and the average daily gain per steer were so uniform that the relation between the amount of feed fed daily per thousand pounds weight of cattle would not be materially different from the relation between the amounts fed per steer per day in the various lots.

TABLE 4.—EXTENT AND RAPIDITY OF GAINS IN POUNDS FOR EACH LOT

Lot No.	Form in which corn was fed.	Average weight per steer.		Average gain during experiment, 186 days.	
		Beginning of experiment.	Close of experiment.	Total per steer.	Per steer per day.
1	Silage and corn meal	1014.66	1450.50	435.84	2.34
2	Ear corn	1045.30	1479.00	433.70	2.33
3	Ear corn (without nitrogenous concentrates)	1009.73	1396.00	386.27	2.08
4	Corn meal	998.80	1441.66	442.86	2.38
5	Corn meal (hay chaffed)	1038.86	1473.00	434.14	2.33
6	Corn and cob meal	1022.63	1454.66	432.03	2.32
7	Corn and cob meal (hay chaffed)	1000.06	1456.00	455.94	2.45
8	Shock corn and ear corn	1037.50	1425.00	387.50	2.08
9	Shelled corn (mud lot)	1027.33	1402.50	375.17	2.02
10	Shelled corn	1029.50	1400.50	370.87	1.99
Gen'l ave.	....	1021.69	1440.69	419.00	2.25

Table 4 shows the average weight of each steer in each lot at the beginning and end of the experiment, the average total and the average daily gain per steer throughout the experiment.

It will be observed that at the beginning of the experiment the average weights of the steers in the different lots were as nearly uniform as could be expected considering the large number of steers involved, the greatest variation being between lot 4 and lot 2. The former had the smallest average weight, viz., 998 pounds, while the average in lot 2 was 1045 pounds. This difference is of less consequence than differences in quality, thrift, and condition in which respect the various lots were markedly similar.

Before drawing final conclusions from the data presented in this table the reader should bear in mind that no attempt is made here to show which feed was the most *efficient* for beef or pork production or for combined beef and pork production, but simply the influence of the various feeds upon *rapidity* of *gains* during a six months' feeding period. The data presented in this table indicate that the feeding of corn meal or corn and cob meal is not necessarily conducive to more rapid gains than the feeding of ear corn when each is supplemented as in lots 4, 5, 6, 7, and 2. The variation in the average daily gains in these lots, together with lot 1, is so slight that we would not be warranted in saying that one feed or ration is superior to another in producing rapid gains. In comparing the gains of these lots with those of lots 3 and 8, however, there is a sufficiently wide difference to make it safe to conclude that supplementing corn with such nitrogenous concentrates as gluten meal and oil meal has a marked influence in promoting rapid gains, or in other words in producing a "quick finish." This fact is emphasized by comparing the gains made in lots 2 and 3. Corn was fed in the same form in both these lots. In lot 2 the ear corn was supplemented with gluten meal and oil meal and the average daily gain per steer was 2.33 pounds, while in lot 3 where no gluten meal and oil meal was fed to supplement the corn the average daily gain per steer was only 2.08. This fact will be further discussed under Table 5.

The relatively low daily gain per steer in lots 9 and 10, in both of which lots the corn was fed in the form of shelled corn, indicates that the feeding of shelled corn is not favorable to securing rapid gains when fed to two year old cattle in the dry lot. It should be observed that slightly larger gains were made by the steers in lot 9 (the mud lot) than by those in lot 10 (the paved lot). This is probably due to a number of factors: (a) The steers in the mud lot as well as those in the paved lot were provided at all times with a dry comfortable shed in which to lie down and they made use of this shed more freely than did the steers fed on the paved lots. (b) The weather was such during a large part of the feeding period that the mud lot was frozen and was a mud lot only in name. (c) By close observation it was discovered that lot 10 did not have as good facilities for getting water as did the other lots. How important a factor in influencing the gains the latter circumstance may have been we are of course unable to say. As soon as this apparent handicap to lot 10 was discovered, watering facilities similar to those in other lots were provided.

However, it should be said that it was during this time that the mud lot was in the worst condition and relatively larger gains in the paved lots would be anticipated. The results of chaffing and mingling the hay with the grain before feeding in lots 5 and 7 appear somewhat contradictory as compared with lots 4 and 6 respectively. The feeding of chaffed hay with the corn meal seems adverse to large gains as compared with feeding clover hay in the ordinary way. In feeding chaffed hay with corn and cob meal the effect seems to be favorable to the use of chaffed hay for securing rapid gains. These differences, however, are so slight that it is safe to say that the mere chaffing of the hay and mingling it with the grain has but little, if any, influence on securing rapid gains.

TABLE 5.—DAILY GAIN PER STEER IN POUNDS FOR EACH LOT BY PERIODS

PERIODS (28 DAYS EACH)

Lot No.	Form in which corn was fed.	1	2	3	4	5	6*	
		Nov. 28-Dec. 26.	Dec. 26-Jan. 23.	Jan. 23-Feb. 20.	Feb. 20-Mar. 19.	Mar. 19-Apr. 16.	Apr. 16-June 1.	Nov. 28, June 1, 186 days.
1	Silage and corn meal..	1.87	2.82	2.66	1.68	2.79	2.28	2.34
2	Ear corn..............	1.09	3.49	2.48	2.00	2.21	2 54	2.33
3	Ear corn (without nitrogenous concentrates	1.31	2.32	1.98	2.45	1.56	2.54	2.08
4	Corn meal.............	1.35	2.80	2.60	1.88	2.42	2 79	2.38
5	Corn meal (hay chaffed)	1.49	3.02	1.48	2.25	2 54	2.88	2.33
6	Corn and cob meal.....	1.57	3.35	1.63	2.54	1.76	2.79	2.32
7	Corn and cob meal (hay chaffed)..............	2.16	3.98	1.31	1.88	2.57	2.67	2.45
8	Shock corn and ear corn	1.52	1.71	2.14	1.82	2.13	2.75	2.08
9	Shelled corn (mud lot).	1.79	2.77	1.57	1.36	2.07	2.34	2.02
10	Shelled corn..........	1.61	2 73	1.88	.89	2.20	2.40	1.99
Gen'l ave.	....	1.56	2.90	1.96	1.94	2.21	2.64	2.25

* Period 6 has 46 days.

Table 5 shows the average daily gain per steer by periods for each lot and all the lots and the average daily gains of the steers in each lot for the whole time. It will be seen that each of the periods was twenty-eight days in length except the last which extended over forty-six days. Experience in dealing with periodical weighings of cattle has shown that they are subject to large variations in weight from slight or even unaccountable reasons. Because of this, the fattening period is divided into periods of four weeks or longer notwithstanding the weights of the cattle were taken every two weeks. Since the cattle were fed 186 days it was necessary to have the last period either longer or shorter than the normal four weeks' period. The same reason that led to the use of the four weeks' period instead of a shorter one obtained in making the last period one of forty-six instead of twenty-eight days in duration.

It has frequently happened that for some reason small gains in weight were made by one or possibly all the lots during a two weeks' or longer period. The weights at the end of the period immediately following are likely to show that the steers have made relatively large gains during the latter period. It is evident therefore, that the weights for any given period are likely to be misleading and may not be an accurate index of the actual progress the steers are making. When the period extends over four weeks the chances for making misleading conclusions from data showing average or total gains of the various lots or the relative efficiency of feed for a given period are greatly reduced.

There must of course, be a reason for these occasional abnormal weights. As has been intimated it is possible at times to account for such variations in weight; at other times no reason can be assigned. In referring to the above table it is noticeable that the gains by periods in some lots are approximately the same throughout the feeding period, while in other lots wide variation is shown. From the data tabulated above it can not be said that uniform gains throughout the feeding period necessarily indicate large average daily gains, for we find that the widest variation to be found between the gains for the various periods occurring in any one lot is found in lot 7 between periods 2 and 3. It is true, however, that in lot 1, the lot that stood second for average daily gains throughout the experiment, the largest variation between periods in this lot was the smallest found in any of the lots. In making such a study, however, we should not stop with these two instances. The steers in lots 3 and 8 made relatively small average daily gains and it will be seen that the variation in average daily gains was relatively small. Again the average daily gains throughout the experiment in lots 2 and 6 were relatively large, while the variation in gains in different periods were relatively large.

In lot 10 the average daily gain of each steer was the smallest of the lots, while the variation in gains by periods was great. These facts lead to the conclusion that uniformity of gains throughout the feeding period do not necessarily indicate large gains, nor do small gains invariably follow wide variations. Nor can it be said that feeding corn in the form of meal is more conducive to uniform gains than the feeding of whole corn. There is but little difference in this respect.

It has been claimed and taught by many experimenters, and indeed the results of many experiments have indicated, that the rate of gain grows smaller toward the close of the fattening period. It will be of interest therefore to study the results of this test with that point in view. The general average in the above table shows that the smallest daily gain was made during the first month, the largest during the second month. From the second to the fifth month the rate of increase was practically constant, but gradually increased during the fifth and sixth periods. Studying the individual lots, we find the smallest gains were made during the first month except in lots 1, 5, 7, 9, and 10, and in these the gains were slightly smaller during either the third or fourth period than during the first. The largest gains were in the second period in all lots except Nos. 3 and 8, in which the heaviest gains were made in the final period. In other words, the cattle were gaining faster when marketed than at any other time during the test excepting the second month. Nor was this continued gain secured at the expense of good finish, as the cattle were said by most of the buyers and by all of the beef experts who saw them in the coolers to be as fat as prime beef need be. As evidence on this point we publish copy of a letter received from the S. & S. Co., Chicago.

CHICAGO, U. S. A., July 7, 1904.

Professor H. W. Mumford, Dep't of Animal Husbandry, University of Illinois, Urbana, Ill.

DEAR SIR: In further reply to your letter of June 14th, beg to advise that we now have a report from our representatives in London covering shipment of cattle fed by you and purchased by us at Chicago Stock Yards. We give you below an extract of their letter:

"It is a long time since we have seen such a quantity of good beef in one lot. If there is any fault to be found it is in the fact that the beef was, if anything, a little too ripe for this season of the year. The beef found a ready sale and brought considerably over the market price. We call this beef excellent both as regards quality and general condition."

This letter was written by our agents in London, England, and we trust that the report is satisfactory to you.

Yours very truly,

(Signed) S. & S.Co., *Per J. E. Maurer.*

It is an important point to consider that the gains during the last six weeks of the experiment were larger than during any similar period throughout the test. It will be observed by referring to the table that during the second four weeks' period the average daily gains for all the steers were slightly higher than during the last six weeks' period. But if this high gaining period is made comparable with the last period by averaging with it the gains for the two weeks preceding or following, we find that the gains for the last period are better. In taking periodical weighings of experimental live stock it is frequently observed, as has elsewhere been noted, that a high gaining period is preceded by a low gaining period and where such is the case the apparent gains can hardly be looked upon as normal for that period. This is clearly shown in the weights exhibited for periods one and two.

If, however, the average daily gains of periods five and six are examined it can be readily seen that the relatively large gains for the latter are not due to abnormally low gains for the preceding period. The reason for these large gains must be sought elsewhere.

TABLE 6.—PORK MADE FROM DROPPINGS IN THE VARIOUS LOTS

Lot No.	Form in which corn was fed.	Number of pigs per steer.	Lb. pork per steer.	Pork per 100 lb. corn as fed to steers.	Percent cost of feed given steers paid for by gain† of hogs following.
1	Silage and corn meal..	.10	6.30	.19*	.94
2	Ear corn	.53	62.60	1.68	9.70
3	Ear corn (without nitrogenous concentrates)...............	.53	74.13	1.89	14.05
4	Corn meal..	.27	20.66	.67	3.00
5	Corn meal (hay chaffed)	.27	20.02	.65	2.86
6	Corn and cob meal.....	.27	18.00	.46	2.60
7	Corn and cob meal (hay chaffed)..	.27	24.00	.63	3.34
8	Shock corn and ear corn................ ..	.60	73.50	1.81	12.72
9	Shelled corn (mud lot)	.70	85.80	2.79	12.86
10	Shelled corn.	.70	111.50	3.61	16.67

*Computed on basis of ear corn in silage and shock corn.

†Gain on hogs valued at $5.00 per hundred weight.

Table 6 shows in a striking manner the importance of the pig as a factor in cattle feeding operations. It illustrates clearly that in deciding upon the feeds used and their method of preparation for fattening cattle that not only efficiency of rations for producing gains on cattle, but also the probable gains on pigs following cattle should likewise receive careful consideration. This latter factor in cattle feeding has received much attention at this Station as reported in Bulletins Nos. 73, 83, and 90. The accompanying data add materially to the records there reported.

The most striking points of importance brought out in the table are the relatively small amount of pork produced from the droppings of the silage-corn-meal-fed steers;—the large gains made by the pigs following the shelled-corn-fed steers;—and the fact that the pigs following the ear-corn-fed (without nitrogenous concentrates) steers made larger gains than did those in lot 2 where ear corn was so supplemented.

That only 6.3 pounds pork were made per steer in lot 1 is remarkable, especially so when we consider that during the latter part of the feeding period lot 1 received considerable corn meal in addition to the silage fed. It is reasonable to expect therefore, that the gains on pigs in this lot should have been more nearly like those of lots 4 and 5 than they are. At least two causes may have operated in producing the results recorded. First, since there was only one pig following lot 1, the individuality of the pig would play a very important part in the extent of gains made on a given amount of feed. In this instance there is not much ground for assuming that the single pig used was not up to the average in thrift and gaining capacity as compared with other pigs used in the experiment. When the gain per pig in the various lots is considered we discover that the variation is much less than the gain in pork for each steer, which would of course be the natural outcome where pigs are thrifty and gaining, as they were in this case. The gain on the pig in the silage lot was practically as good as the average of those in lot 6 and not greatly inferior to those of lots 4 and 5. The most rapid gain per pig is noted in the lots fed shelled corn, though it is not distinctly greater than in lots 2 and 3 (ear corn), or lot 8 (shock corn). Previous tests have, without exception, shown that where hogs are limited to the droppings of silage fed steers they get very little benefit from them. For example in Bulletin No. 73 of this Station the writer concluded that "Lot 1, the silage-fed steers, should be credited with the production of 87 pounds of pork in 88 days." In the experiment referred to 28.75 tons of silage were fed and as has been shown 87 pounds of pork were credited in the financial statement. In the experiment now involved, 21.45 tons silage were fed and 63 pounds of pork are credited. This shows that lot 1 has undoubtedly been credited with sufficient pork to cover the benefit the pigs would get from the droppings of steers fed this quantity of silage, and whatever pork is credited to lot 1 in addition to this amount should be credited as a result of the feeding of the corn meal. From this and other experiments it has been determined that for each 100 pounds of corn meal fed to steers approximately .65 of a pound of pork is made by pigs following steers so fed. The records of this experiment show that 22,104 pounds of corn meal were fed lot 1 in addition to the silage. Hence if we were to credit lot 1 with pork produced on this basis, 143 pounds should be added to that already credited. This would make the total pork produced in lot 1, 206 pounds, and the total beef and pork or meat produced 4565 pounds or 456.5 pounds beef and pork per steer. As shown subsequently in Table 10 this would still be less than that made in lots 2, 3, 4, 7, 8, 9, and 10.

In the above discussion we have assumed that the first cause suggested was wholly responsible for the small amount of pork produced in lot 1 and hence have given this lot full benefit of the doubt. However, it is possible that a secondary cause may have been operative, viz., that the silage and corn meal ration, which is elsewhere shown to be a very efficient ration for beef production, must necessarily be proportionately less valuable as a pork producer because of less feed available to the pigs in the droppings of the steers. This possible cause would not in itself be sufficient to account for the small amount of pork produced by the pig following this lot.

Referring to the amount of pork made per steer it will be seen that the largest gains on pigs were made where shelled corn was fed to the steers. This is true not only where the steers were fed on a brick pavement, but also in the mud lot. Observation revealed the fact that the steers in lots 9 and 10 consumed their ration of corn in much less time than did those in the other lots. From this fact we assume the steers did not masticate their corn as thoroughly in these lots as did those in which corn was fed in other forms. It should be noted that 25.7 pounds more pork per steer was made where the steers were fed on the pavement in lot 10 than in lot 9, the mud lot. This is easily explained by the fact that the pigs could recover practically all the waste in lot 10, while the condition of the mud lot (9) was such at times that the pigs had but little chance to recover the waste.

A fact of considerable importance is to be gathered from comparing the gains made by the pigs following lots 2 and 3 where the difference in the rations fed was that in lot 2 the ear corn was supplemented by a nitrogenous supplement and in lot 3 it was not. It has been frequently stated that it pays to feed oil meal or other nitrogenous concentrates if for no other reason than the benefit that the hogs receive from following steers so fed. The data presented in Table 6 indicate that as far as this experiment is concerned more pork was made per steer where the corn was not supplemented. Careful examination of this and data elsewhere presented in this bulletin leads to the conclusion that the corn supplemented with a nitrogenous concentrate is more efficient for beef production than where fed alone. If this is true, should we not reasonably expect that there would be less waste in the droppings in lot 2 than in lot 3, and accordingly less gain on the pigs?

The most accurate method of arriving at the influences of feeds and their preparation when used for cattle feeding upon the amount of pork produced by hogs following is by means of calculating the gains of pigs on the basis of the corn fed to the steers. By this method, we find that the greatest gain in pork per 100 pounds of corn fed the steers occurred in the shelled-corn fed lots; that it was considerably less in the lots fed shock corn and ear corn respectively; that it was only one fourth to one third as much in the meal fed lots as in those fed ear or shock corn; and that by far the smallest amount in the silage fed lot.

The question is frequently asked, "What percentage of the cost of the feed given the steers may be charged up to the hogs following them?" Sufficient data has already been presented to show that the answer to this question depends very largely upon the form in which the corn is fed to the steers. In this test figuring the gains on the hogs worth five dollars per hundred weight the percentages of the cost of feed paid for by gains on hogs following the various lots are shown in the last right hand column in Table 6.

It should be borne in mind that at no time during the test did the hogs get other feed than that secured from the droppings of the steers and that the steers did not get as heavy grain rations for as long a time as is the usual practice among cattle feeders. This leads to the conclusion that gains of hogs and value of same reported here should be looked upon as the minimum pork product to be anticipated in cattle feeding operations. As will be seen by reference to the table the variation in percentages is large,—from .94 to 16.67.

TABLE 7.—ECONOMY OF GAINS AS MEASURED BY FEED CONSUMED, DRY MATTER* CONSUMED, AND GAINS MADE

Lot No.	Form in which corn was fed.	Pounds, dry matter per steer.			Dry matter per lb. gain.	
		In concentrates.	In roughage.	Total dry matter.	On steers.	Steers and pigs.
1	Silage, corn meal......	2460.78	2050.03†	4510.82	10.35	10.20
2	Ear corn	3792.19	1269.21	5061.40	11.67	10.64
3	Ear corn (without nitrogenous concentrates)	3466.37	1346.56	4812.93	12.46	10.46
4	Corn meal.............	3225.07	1395.72	4620.79	10.43	9.96
5	Corn meal (hay chaffed)	3241.65	1407.30	4648.95	10.71	10.23
6	Corn and cob meal.....	3790.73	1286.71	5077.44	11.75	11.29
7	Corn and cob meal (hay chaffed)	3870.57	1284.70	5155.27	11.31	10.75
8	Shock corn, ear corn ..	2474.81	2726.22†	5201.03	13.42	11.29
9	Shelled corn (mud lot)	3226.55	1429.07	4655.62	12.41	10.09
10	Shelled corn...........	3234.74	1432.88	4667.62	12.58	9.67
Gen'l ave.	....	. ...	....	4853.90	11.58	10.38

*Dry Matter.—The portion of a feed remaining after the water or moisture contained therein has been driven off by heat. Ordinary concentrated feeds contain about 10 to 11 percent moisture.
†Silage and shock corn were here considered as roughage.

A superficial study of the data in Table 7 showing the dry matter fed in concentrates and roughages in the various lots would lead to the conclusion that there were wide differences existing in the proportion of each fed. This, however, was not the case. This point is fully discussed under Table 2 of this bulletin.

On the basis of the total digestible nutrients fed throughout the experiment to the various lots the nutritive ratio is:

Lot 1	1 : 7.96
Lot 2	1 : 7.79
Lot 3	1 :10.43
Lot 4	1 : 7.80
Lot 5	1 : 7.81
Lot 6	1 : 8.79
Lot 7	1 : 8.86
Lot 8	1 : 9.25
Lot 9	1 : 6.97
Lot 10	1 : 6.98

All these ratios are too wide as compared with the standard nutritive ratio for fattening steers, a variation from the standard which is common in the corn belt where the effort is to use as much corn as possible. It should be remembered that this experiment was outlined with reference to testing various methods of feeding as practiced in the corn belt rather than to determine the effect of balancing rations in fattening steers. However, it is interesting to note what influence, if any, the composition or nutritive ratio of these various feeds had upon their efficiency. In other words, did the more nearly balanced rations prove most efficient? By referring to the nutritive ratios of the rations used in the various lots it will be seen that more nearly balanced rations were fed to the steers in lots 9, 10, 4, and 5 than in the remaining lots. It will be seen that from these lots and these only the cob was withheld. It is obvious that the elimination of the cob has a tendency to make the ration more highly concentrated. It is clear therefore, that the effect of balancing the ration upon the efficiency of the feeds for beef production can not well be determined from a comparison of the dry matter required to produce a pound of gain in these and the other lots. This can best be done by comparing the amounts of dry matter required to produce gains on steers in lots 2 and 3 where the corn was fed as ear corn in both instances and where a nitrogenous concentrate was added to the ration of lot 2 and not to lot 3. This made considerable difference in the nutritive rations fed. Referring to Table 7 it is seen that it took considerably less dry matter to produce a pound of gain where the ration was more nearly balanced. It is reasonably safe therefore to conclude that, in general, we may say that where other conditions remain the same, rations which approach the standard as to composition are more likely to show high efficiency for producing gain than those which vary widely from such standards. This by no means proves that the use of a nearly balanced ration will be followed by greater profits in cattle feeding than one which varies widely from the standard, especially when the feeds available for compounding the balanced ration are relatively expensive and those used in compounding the ration widely at variance to the standard are relatively cheap. As a matter of common knowledge this is the situation which confronts the Illinois cattle feeder. The financial aspect of this subject will appear in the discussion under a subsequent table.

It is frequently true that the best method of making a critical study of the relative efficiency of feeds is to compare the number of pounds of dry matter required for producing a pound of gain in each instance. The investigation here reported is a good example of an instance in which it would be obviously misleading to make such a comparison in all the lots. For example, the dry matter in corn and cob meal or ear corn required to produce a pound of gain would not be comparable with the dry matter required in corn meal or shelled corn to produce the same gain. The figures are given, however, to make it possible for the student to compare on the basis of dry matter fed, the efficiency of the rations which are comparable. That is to say, the dry matter in shelled corn is comparable with that in corn meal. In this instance we see that it requires over 12 pounds of dry matter to produce a pound of gain on the steers where shelled corn is fed and about 10.5 pounds where corn meal is used. This shows that corn meal is considerably more efficient for beef production than shelled corn. However, for combined beef and pork production shelled corn is fully up to corn meal in efficiency as is shown in the last column of Table 7.

The corn and cob meal fed was 17.75 percent cob. If we deduct the amount of cobs consumed by lot 6 from their total feed and calculate the efficiency of their feed on the basis of the corn meal consumed as in lot 4, it is found that 10.37 pounds of dry matter were used per pound gain by lot 6 as compared with 10.43 pounds by lot 4. In other words, the cob added slightly to the nutritive value of the ration. In the same manner a comparison may be made between lots 5 and 7. Calculating the efficiency of the feed after deducting the cob, on the basis of the dry matter required to produce a pound of gain on the steers in lot 7, it is found that it required 9.978 pounds of dry matter to produce a pound of gain. This is directly comparable with lot 5 with which lot it required 10.71 pounds dry matter to produce a pound of gain. This indicates that the presence of the cob in the ration in this instance was an advantage. That the cob added nothing to the profitableness of the rations is shown by a comparison of the profits in lots 4, 5, 6, and 7 in Table 11.

After deducting the amount of cobs consumed by lot 2 from their total feed, and calculating the efficiency of their feed on the basis of the shelled corn consumed as in lot 10, it is found that 10.304 pounds dry matter were used per pound gain on the steers in lot 2 as compared with 12.58 pounds by lot 10 (shelled corn). This shows forcibly that ear corn is much more efficient for beef production than is shelled corn. It further goes to show that ear corn is as efficient for beef production as is corn meal, in which case in lot 4, it took 10.43 pounds and in lot 5 (not strictly comparable with lot 2 because of feeding chaffed hay) 10.71 pounds dry matter to produce a pound of gain on the steers.

Few have questioned that reducing ear corn to the form of corn and cob meal adds to its efficiency for beef production. The results of this experiment indicate that, where other factors are similar, the mere changing of the mechanical condition of the ear corn does not add to its efficiency. For example, in lot 2 where ear corn was fed, it required 11.67 pounds dry matter to produce a pound of gain on the steers, while in lot 6, where corn and cob meal was fed, it required

11.75 pounds, and in lot 7, (not comparable with lot 2 because of feeding chaffed hay), 11.31 pounds. The amounts are so nearly alike that it could not be said that corn prepared in one form is more efficient for producing gains on two years old steers than in the other. But as would be expected, where the amount of pork made by the hogs following these two lots is taken into consideration, it throws the balance very decidedly on the side of the ear corn. The importance of this point will be more fully recognized when the financial aspect of the experiment is considered. To summarize then, it may be said that the presence of the cob in ground corn, as in the case of corn and cob meal, appears to increase slightly the efficiency of the corn for beef production, and that ear corn is nearly, if not quite, as efficient for beef production as corn and cob meal.

A given amount of corn and cob meal produced considerably less beef and pork combined than did ear corn as shown by a comparison of lots 2 and 6. In comparing lots 2 and 7 corn and cob meal is more efficient than ear corn, but it is not safe to conclude that this is due wholly to grinding because in lot 7, in case of corn and cob meal, the hay was chaffed and mingled with the grain which was not done in lot 2. Corn meal proved much more efficient for beef production than shelled corn in this test, while for combined beef and pork production, they appear to be about equally efficient. Corn meal however, is no more efficient for beef production than is ear corn and the latter is much more efficient for beef production than shelled corn.

TABLE 8.—POUNDS GAIN ON STEERS AND STEERS AND HOGS PER BUSHEL (SHELLED BASIS) SUPPLEMENTED CORN FED

Lot No.	Pounds oil and gluten meal fed per bu. corn.	Pounds clover hay fed per bu. corn.	Pounds gain on steers per bu. corn fed.	Pounds gain on steers and hogs per bu. corn fed.
1	10.121	24.681†	7.93	8.04
2	9.996	27.241	7.92	9.06
3	0.000	27.452	6.69	7.98
4	9.878	29.698	8.02	8.39
5	9.850	29.778	7.82	8.19
6	9.979	27.613	7.88	8.21
7	9.748	26.948	8.13	8.55
8	4.549*	22.547†	6.41	7.72
9	10.115	30.512	6.82	8.38
10	10.120	30.502	6.72	8.74

*Oil meal fed during the latter part of feeding period only.

†The roughage accompanying the corn was fed in these lots in addition to the clover hay.

In the accompanying data cattle feeders can see at a glance the efficiency of the various rations where a bushel (56 pounds) of shelled corn is taken as the basis. In every instance corn was supplemented with clover hay and in every instance but lot 3 with a nitrogenous supplement. Thus when it is said that a certain number of pounds of beef, or of beef and pork combined, is made from a bushel of corn it should be noted that the amounts of oil meal, gluten meal, and clover hay recorded in the tables were also fed.

TABLE 9.—POUNDS DRY MATTER PER POUND GAIN ON STEERS BY PERIODS

Lot No.	By periods.						
	Nov. 28 to Dec. 26.	Dec. 26 to Jan. 23.	Jan. 23 to Feb. 20	Feb. 20 to Mar. 19.	Mar. 19 to Apr. 16.	Apr. 16 to June 1.	Ave. Nov. 28 to June 1.
1	11.273	8.242	8.584	13.552	8.723	12.496	10.348
2	19.609	7.760	11.144	13.789	12.894	11.474	11.671
3	16.119	11.218	13.240	10.728	17.360	10.825	12.460
4	15.187	8.490	9.292	13.301	11.303	9.277	10.431
5	13.676	8.012	16.366	11.138	10.780	9.485	10.708
6	14.087	8.150	17.095	10.937	16.437	10.334	11.753
7	10.238	6.912	21.334	14.745	11.589	11.193	11.309
8	16.069	15.197	13.867	15.497	13.131	10.948	13.422
9	11.496	8.732	15.601	18.418	12.800	11.841	12.408
10	12.826	8.847	13.075	27.995	12.202	11.555	12.581
Gen'l Ave.	13.755	8.616	13.297	13.470	12.428	10.751	11.584

The purpose of the above table is to enable the reader to tell at a glance the amount of dry matter required for one pound of gain during any period of the experiment. Referring to the lower line of the tabulation we see that on the average the greatest expenditure of feed for the gain secured was in the first month, the smallest in the second month, an increased amount being required during the third and fourth months, with a gradual decrease from the fourth month to the end of the experiment. The most expensive gains, therefore, were not made during the last weeks of the fattening period, as is often the case in finishing steers. This is probably due to the method of feeding the cattle, by which the grain was given in gradually increasing amounts with a corresponding decrease in roughage to the end of the fattening period. By this method the small final gains which result from heavy grain feeding at the beginning of a six months' period are avoided.

It will be noticed, both in the general average and in the data for each lot that there is considerable variation in the amount of dry matter used per pound gain in the different periods of the test. It will be observed in Tables 3 and 4 that while the amount of grain was gradually increased and the roughage gradually diminished, the rate of gain of the cattle fluctuated from period to period. The efficiency of the animal may vary at different periods, due to the excretion of varying proportions of the digested nutrients of the feed consumed. On account of the possible number and complexity of factors involved in producing these fluctuations it is impracticable to assume that any single cause contributed largely in producing them.

FINANCIAL STATEMENT

Since the practice of buying feeders in the Chicago market is becoming more common the following figures will be of interest. The average price of the cattle when purchased in Chicago last fall was $4.267; the cost of the cattle in the experimental feed lots at Champaign just as they came from the cars and before being allowed to fill was $4.654 per cwt. The latter figure is secured by adding to the original cost of the feeders the expenses occasioned by freight, shrinkage in weight in transit, commissions and an occasional small bill for hay at the yards. Thus it will be seen that taking shrunk weights at feed lots the cattle cost $.387 per cwt. more than in Chicago. Of this expense $.257 per cwt. was occasioned by shrinkage, $.0817 by freight, $.0438 by commission and $.004 by feed bills. In this statement no mention is made of the expenses of the buyer, because these vary so much with the distance from market and the number of cattle handled.

It should be borne in mind that the cattle were not placed in the experiment immediately upon their arrival at the experimental cattle feeding plant, but were kept for some time in the feed lots to accustom them to their new surroundings and submit them to a period of preliminary feeding, and furthermore to give them an opportunity to fill. It was not the purpose to permit the fill to figure in the average daily gains of the various lots. The gains reported therefore, are by no means as large as they would have been if the fill were averaged in. The financial aspect of this fact can be appreciated when we note that while the steers cost an average of $4.654 per cwt. delivered in the feed lots, by securing the fill and the apparent large gains at the start for feed consumed, the cattle cost only $4.531 per cwt. at the time the experiment proper began.

In submitting the following financial statement therefore, we have used $4.53 per cwt. as the initial cost of the steers. These figures indicate that in this instance $.26 per cwt. should be added to the Chicago price if it is desired to determine the cost of the steers in the feed lot.

ITEMIZED FINANCIAL STATEMENT

Lot, 1, 10 Steers.

To 10 Steers, 10,146 lb. at $4.53 per cwt.	$ 459.61
11.052 tons corn meal at $13.34 per ton	146.43
1.418 tons gluten meal at $29.00 per ton	41.12
1.364 tons O. P. linseed cake, pea size, $24.00 per ton	32.73
21.447 tons silage at $2.75 per ton	58.98
6 784 tons of clover hay at $8.00 per ton	54.27
Freight Champaign to Chicago, commission, yardage, feed and other expenses	24.80
Total expenditures	$ 818.94

By 10 Steers, 14,240 lb. at $6.10 per cwt.	$ 868.64
By 63 lb. Pork at $5.00 per cwt.	3.15
Total receipts	$ 871.79
Total expenditures	818.94
Total profit	52.85
Profit per steer	5.28

Lot 2, 15 Steers.

To 15 Steers, 15,680 lb. at $4.53 per cwt.	$ 710.30
27.98 tons ear corn at $10.20 per ton	285.40
2.081 tons gluten meal at $29.00 per ton	60.34
2.027 tons O. P. linseed cake, pea size, at $24.00 per ton	48.64
11.195 tons clover hay at $8.00 per ton	89.56
Freight Champaign to Chicago, commission, yardage, feed and other expenses	37.26
Total expenditures	$1231.50

By 15 Steers, 21,660 lb. at $6.15 per cwt	$1332.09
By 939 lb. Pork at $5.00 per cwt	46.95
Total receipts	$1379.04
Total expenditures	1231.50
Total profit	$ 147.54
Profit per steer	9.84

Lot 3, 15 Steers.

To 15 Steers, 15,146 lb. at $4.53 per cwt	$ 686.11
29.464 tons ear corn at $10.20 per ton	353.00
11.88 tons clover hay at $8.00 per ton	95.04
Freight Champaign to Chicago, commission, yardage, feed and other expenses	37.26
Total expenditures	$1118.94

By 15 Steers, 20, 330 lb., at $5.95 per cwt.	$ 1209.64
By 1112 lb. Pork, at $5.00 per cwt.	55.60
Total receipts	$ 1265.60
Total expenditures	1118.94
Total profits	$ 146 30
Profit per steer	9.75

Lot 4, 15 Steers.

To 15 Steers, 14,980 lb. at $4.53 per cwt		$ 678.59
23.197 tons corn meal at $13.34 per ton		309.44
2.077 tons gluten meal at $29.00 per ton		60.23
2.015 tons O. P. linseed cake, pea size at $24.00 per ton		48.36
12.302 tons clover hay at $8.00 per ton		98.42
Freight Champaign to Chicago, commission, yardage, feed and other expenses		37.41
Total expenditures		$1232.45
By 15 Steers, 21,250 lb. at $6.15 per cwt	$1306.87	
By 310 lb. Pork at $5.00 per cwt	15.50	
Total receipts	$1322.37	
Total expenditures	1232.45	
Total profit	$ 89.92	
Profit per steer	5.99	

Lot 5, 15 steers.

To 15 Steers, 15, 583 lb. at $4.53 per cwt		$ 705.91
23.328 tons corn meal at $13.34 per ton		311.19
2.077 tons gluten meal at $29.00 per ton		60.03
2.026 tons O. P. linseed cake, pea size, at $24.00 per ton		48.62
12.405 tons clover hay (chaffed) at $9.00 per ton		111.64
Freight Champaign to Chicago, commission, yardage, feed and other expenses		37.41
Total expenditures		$1274.80
By 15 Steers, 21,580 lb. at $6.15 per cwt	$1327.17	
By 304 lb. Pork at $5.00 per cwt	15.20	
Total receipts	$1342.37	
Total expenditures	1274.80	
Total profit	$ 67.57	
Profit per steer	4.50	

Lot 6, 15 Steers.

To 15 Steers, 15,340 lb. at $4.53 per cwt		$ 694.90
27.985 tons corn and cob meal at $11.44 per ton		320.14
2.077 tons gluten meal at $29.00 per ton		60.23
2.025 tons O. P. linseed cake, pea size, at $24.00 per ton		48.60
11.350 tons clover hay at $8.00 per ton		90.80
Freight Champaign to Chicago, commission, yardage, feed and other expenses		37.25
Total expenditures		$1251.92
By 15 Steers, 21,370 lb. at $6.10 per cwt	$1303.57	
By 270 lb. Pork at $5.00 per cwt	13 50	
Total receipts	$1317.07	
Total expenditures	1251.92	
Total profit	$ 65.15	
Profit per steer	4 34	

Lot 7, 15 steers.

To 15 Steers, 15,002 lb. at $4.53 per cwt	$ 679.59
28.655 tons corn and cob meal at $11.44 per ton	327.81
2.077 tons gluten meal at $29.00 per ton	60.03
2.026 tons O. P. linseed cake, pea size, at $24.00 per ton	48.62
11.342 tons clover hay (chaffed) at $9.00 per ton	102.08
Freight Champaign to Chicago, commission, yardage, feed and other expenses	37.17
Total expenditures	$1255.30

By 15 steers, 21,530 lb. at $6.15 per cwt	$1324.10
By 360 lb. Pork at $5.00 per cwt	18.00
Total receipts	$1342.10
Total expenditures	1255.30
Total profit	$ 86.80
Profit per steer	5.78

Lot 8, 10 steers.

To 10 steers 10,375 lb. at $4.53 per cwt	$ 469.98
12.594 tons ear corn at $10.20 per ton	128.46
1.359 tons O. P. linseed cake, pea size, at $24.00 per ton	32 61
13.672 tons shock corn at $5.40 per ton	73.85
6.735 tons clover hay at $8.00 per ton	53.88
Freight Champaign to Chicago, commission, yardage, feed and other expenses	24.81
Total expenditures	$ 783.61

By 10 steers, 13 960 lb. at $6.05 per cwt	$844.58
By 735 lb. Pork at $5.00 per cwt.	36.75
Total receipts	$881.33
Total expenditures	783 61
Total profit	$ 97.72
Profit per steer	$ 9.77

Lot 9, 10 Steers.

To 10 Steers, 10,273 lb. at $4.53 per cwt	$465.37
15.402 tons of shelled corn at $12.48 per ton	192.21
1.427 tons gluten meal at $29.00 per ton	41.38
1.365 tons O. P. linseed cake, pea size, at $24.00 per ton	32.76
8.392 tons clover hay at $8.00 per ton	67.13
Freight, Champaign to Chicago, commission, yardage, feed and other expenses	25.03
Total expenditures	$823 88

By 10 Steers, 13,820 lb. at $5.95 per cwt	$822.29
By 858 lb. Pork at $5.00 per cwt	42.90
Total receipts	$865.19
Total expenditures	823.88
Total profit	$ 41.31
Profit per steer	4.13

Lot 10, 10 Steers.

To 10 Steers, 10,295 lb. at $4.53 per cwt	$466.36
15.449 tons shelled corn at $12.48 per ton	192.80
1.427 tons gluten meal at $29.00 per ton	41.38
1.365 tons O. P. linseed cake, pea size, at $24.00 per ton	32.76
8.415 tons clover hay at $8.00 per ton	67.32
Freight, Champaign to Chicago, commission, yardage, feed and other expenses	24.83
Total expenditures	$825.45

By 10 Steers, 13,620 lb. at $6.05 per cwt	$824.01
By 1115 lb. Pork at $5.00 per cwt	55.75
Total receipts	$879.76
Total expenditures	825.45
Total profit	$ 54.31
Profit per steer	5.43

The detailed financial statement submitted shows that no account was taken of the labor involved in feeding steers after the feed was prepared. It is thought that the amount of labor involved in feeding the steers in the various lots was practically the same after the feed was prepared. No charge is made for labor in caring for the steers nor for bedding, neither is any value assigned to the manure made by the steers. It is believed that the agricultural value of the manure intelligently preserved and distributed would be sufficient to balance the cost of the bedding and labor involved.

A further discussion of the financial bearing of this test will be found in the discussion following Table 11.

The data in Table 10 are presented to aid the reader in summarizing the results of the experiment under consideration. All of the data in the table except lines 5, 6, 7 and 8 are presented elsewhere in the bulletin. Lines 1 and 4 are discussed in connection with table 3; line 2, with table 5; line 3 simply combines lines 1 and 2; and line 8 is discussed in connection with Table 6. Lines 5 and 6 give an idea of the amount of concentrates and line 7 the proportion of a ton of clover hay fed per steer during the entire feeding period. From this data the cattle feeder can readily compute the feed required for fattening such steers as are here used after the methods of feeding followed. It also emphasizes the uniformity in amounts of feed fed the various lots.

TABLE 10.—SUMMARY OF GAINS AND FEED CONSUMED IN POUNDS

Line No.		Lot 1. Silage and corn meal.	Lot 2. Ear corn.	Lot 3.* Ear corn (without nitrogenous concentrates.)	Lot 4. Corn meal.	Lot 5. Corn meal, (hay chaffed.)	Lot 6 Corn and cob meal.	Lot 7. Corn and cob meal, (hay chaffed.)	Lot 8. Shock corn and ear corn.	Lot 9. Shelled corn, (mud lot.)	Lot 10. Shelled corn.
1	Gain per steer in 6 months	435.84	433.70	386.27	442.86	434.14	432.03	455.94	387.50	375.17	370.67
2	Pork produced per steer, 6 months feed.	6.30	62.60	74.13	20.66	20.02	18.00	24.00	73.50	85.80	111.50
3	Pork and beef produced per steer	442.14	496.30	460.40	463.52	454.16	450.03	479.94	461.00	460.97	482.17
4	Ave. daily gain per steer for 6 months	2.34	2.33	2.08	2.38	2.33	2.32	2.45	2.08	2.02	1.99
5	Total 6 mos. feed per steer for fattening. Bu. corn, shelled basis	54.97	54.79	57.70	55.23	55.54	54.80	56.12	59.74	55.00	55.17
6	Total 6 mos. feed per steer for fattening. Pounds oil meal and gluten meal	556.40	547.60	000.00	545.60	547.00	546.80	547.00	271.80†	558.40	558.40
7	Total 6 mos. feed per steer for fattening. Tons clover hay	.678	.746	.792	.820	.827	.756	.756	.673	.839	.841
8	Dry matter required for producing pound gain per steer	10.35	11.67	12.46	10.43	10.71	11 75	11.31	13.42	12.41	12.58

*Nitrogenous concentrates were fed in all other lots than 3, the only difference between lots 2 and 3 being that lot 2 received a nitrogenous concentrate and lot 3 did not.

†Oil meal was used in lot 8 as a supplement to corn during the latter part of the feeding period only.

TABLE 11.—MARKET VALUE OF EACH LOT AT CLOSE OF EXPERIMENT AND MARGIN PROFIT FOR EACH LOT

Line No.		Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8	Lot 9	Lot 10
		Silage and corn meal.	Ear corn.	Ear corn (without nitrogenous concentrates).	Corn meal.	Corn meal (hay chaffed).	Corn and cob meal.	Corn and cob meal (hay chaffed).	Shock corn and ear corn.	Shelled corn (mud lot).	Shelled corn.
1	Market value per cwt. of steers..........	$6.10	6.15	5.95	6.15	6.15	6.10	6.15	6.05	5.95	6.05
2	What each would have to sell for per cwt. to pay total cost, not counting value of pork produced..........	$5.75	5.68	5.50	5.80	5.91	5.86	5.83	5.61	5.96	6.06
3	Margin necessary per cwt. between buying and selling price to come out even, not counting value of pork produced.*......	$1.22	1.15	.97	1.27	1.38	1.33	1.30	1.08	1.43	1.53
4	Margin per cwt. received, not crediting pork produced..........	$1.57	1.62	1.42	1.62	1.62	1.57	1.67	1.52	1.42	1.52
5	Margin per cwt. received counting receipts for pork..........	$1.59	1.84	1.69	1.69	1.69	1.63	1.70	1.78	1.73	1.93
6	Net margin of profit per cwt. not considering value of pork production..........	$ .35	.47	.45	.35	.24	.24	.37	.44	††-.01	-.01
7	Net margin of profit per cwt. considering pork factor..........	$ .37	.69	.72	.42	.31	.30	.40	.70	.30	.40
8	Net cost per lb. of gain per steer.*†..........	$ .076	.067	.059	.075	.079	.078	.076	.065	.077	.075
9	Net profit per steer, corn 35 cents, clover hay $8.00 per ton.†..........	$5.28	9.84	9.75	5.99	4.50	4.34	5.78	9.77	4.13	5.43
10	Net profit per steer, corn 35 cents, clover hay $5.00 per ton.†..........	$6.57	12.07	12.12	8.45	6.97	6.61	8.05	11.46	6.64	7.95
11	Net profit per steer, corn 40 cents, clover hay $7.50 per ton.†..........	$2.17	7.54	7.34	3.66	2.18	2.07	3.46	7.01	1.85	3.14
12	Net profit per steer, corn 40 cents, clover hay $10.00 per ton.†..........	$1.03	5.68	5.36	1.64	.11	.18	1.58	5.65	.24	1.04
13	Net profit per steer, corn 50 cents, clover hay $10.00..........	-$4.84	.33	-.23	-3.75	-5.65	-5.15	-3.90	.125	-2.48	-1.27
14	Net profit per steer, corn 60 cents, clover hay $10.00..........	-$10.18	-4.97	-5.26	-9.05	-10.65	-10.49	-9.37	-5.41	-10.90	-9.65

Feeding cattle used in all lots graded as choice, first cost $4.53 per cwt. Gains in pork credited at $5.00 per cwt.
*Corn at $.35 per bushel and clover hay at $8.00 per ton.
†The pork produced is here taken into consideration.
††The use of – in the table means loss instead of profit.

Table 11 groups some very important data. Line 1 for example shows that some of the lots were in better marketable condition than others. The steers in lots 2, 4, 5, and 7 seemed to be in the best condition and they were so uniform in condition (uniformity in quality was, by design, the same in all lots) that they sold equally well on the market. Lots 3 and 9 sold at the lowest price of any of the lots,—twenty cents per hundred weight less than the top,—while lots 1, 6, 8, and 10 were sold for but five cents per hundred weight less than the best. Line 2 shows the price per hundred weight each lot had to sell for in order to make it possible for the cattle feeder to "break even". The figures presented do not take into consideration the pork produced. They are valuable in emphasizing to what a large extent the method of feeding may affect the margin necessary for coming out even in cattle feeding operations. This is perhaps more clearly brought out in line 3 where the margin between buying and selling price necessary to come out even is stated. The results of this experiment clearly indicate that simple methods, or in other words, cattle feeding practice involving but a small amount of labor require considerably smaller margins than do more complicated methods involving a large labor element. It shows that under conditions obtaining in this experiment and with feeds at the prices named it is sometimes possible to feed without loss choice 1000 pound feeding cattle on as low a margin as $1.00 per hundred weight. That the method of feeding should make as high as 55 cents per hundred weight difference in the margins necessary for finishing steers is a subject worthy of careful consideration by every cattle feeder.

There is much of importance in the data presented in lines 4, 5, 6, and 7. Compare for example lines 4 and 5 and it is seen that in all lots except 9 and 10 where the corn part of the ration was fed in the shelled form the margin per hundred weight was sufficient to show some profit without taking into account the pork produced. In the two lots mentioned the extent of profit depended entirely upon the amount of pork produced. Line 6 shows that not counting the pork produced the margin of profit was as large or larger where corn was fed whole (except in case of shelled corn) than it was where meal was used.

Many who advocate the feeding of ear corn to cattle if hogs follow, advocate the feeding of meal if for any reason it is impossible to have hogs follow the cattle. The writer has been of this opinion but the results of this experiment indicate that, after eliminating the hog from the cattle feeding operations here presented, the feeding of broken ear corn was followed with larger profits than the feeding of meal.

Line 7 shows that the largest margin of profit per hundred weight is found where corn was fed in the form of shock or fodder corn, and ear corn, and this too without the addition of a concentrated nitrogenous supplement. Line 8 brings out clearly the influence of methods of preparation upon cost of gains. A comparison of cost of gains means but little unless the quality of the product is taken into consideration. It is safe to conclude that the quality or character of the gains made in lots 2, 4, 5, and 7 were approximately the same since they sold in the open market at the same price per hundred weight; however, we find that the gains in these lots cost respectively $.067, $.075, $.079, and $.076. It is seen by this that cost of gains was least in lot 2 where broken ear corn supplemented with gluten meal and oil meal and clover hay was fed. It should be noted, however, that the gains in all the lots were in some cases considerable and in others only slightly less than eight cents per pound.

Line 9 briefly sums up the whole matter. The net profit per steer in each lot including receipts for gains made on hogs following the cattle is for lot 1, $5.28; lot 2, $9.84; lot 3, $9.75; lot 4, $5.99; lot 5, $4.50; lot 6, $4.34; lot 7, $5.78; lot 8, $9.77; lot 9, $4.13; and lot 10, $5.43. These results indicate that with conditions obtaining during the progress of this experiment it was not as profitable to grind, shell, or silo the corn or chaff the hay as the feeding of the same feeds in a more natural state. Broken ear corn either with or without a nitrogenous supplement and shock or fodder corn, all fed in conjunction with clover hay, gave the largest net profits per steer. These differences are sufficiently large to make it safe to accept the results without reserve. Lines 10, 11, 12, 13, and 14 show what results would follow had feeds been of other values than those used in this bulletin. Line 12 illustrates the fact that unless higher prices for fat cattle, or lower prices for stock cattle, or both, prevail than in conditions here recorded, the possibilities of profit with corn at 40 cents per bushel and clover hay at $10.00 per ton are very small indeed.

Lines 11, 12, 13, and 14 are presented too, that the reader may determine whether or not it would pay to grind, shell, or silo the corn had feeds been higher. By referring to the data given it will be seen that the more simple methods of preparing the feeds which have been elsewhere shown to be practically as efficient for beef production, and fully so for combined beef and pork production show smaller losses than where the corn was siloed, ground, or shelled.

TABLE 12.—SHIPPING AND SLAUGHTER WEIGHTS

Lot No.	Ave. shrinkage per steer in shipping, lb.	Percent shrinkage in shipping.	Percent carcass to live weight.	Ave. weight of hides, pounds.	Percent fat. †
1	26.50	1.82	62.70	87.29	8.60
2	35.00	2.36	63.20	87.80	8.55
3	40.60	2.91	61.10	85.83	7.68
4	25.00	1.73	62.70	84.16	8.68
5	34.30	2.33	62.40	85.19	8.41
6	30.00	2.06	62.10	85.07	8.48
7	20.66	1.41	61.10	85.10	8.37
8	29.00	2.03	62 30	84.03	8 98
9	20.50	1 46	61.60	84.85	8.46
10	38.50	2.03	61.80	83.76	7.70

†This includes gut fat, gut end fat, caul and ruffle in the following percentages respectively:

Lot No.	Caul,	Ruffle,	Gut,	Gut end,	Total, *
1	1.88	1.62	4.73	.37	8.60
2	1.85	1.69	4.67	.34	8.55
3	1.67	1.47	4.20	.34	7.68
4	1.83	1.75	4.75	.35	8.68
5	1.82	1.66	4.61	.32	8 41
6	1.79	1.72	4.62	.35	8.48
7	1.84	1.64	4.56	.33	8.37
8	1.97	1.76	4.89	.36	8.98
9	1.72	1.79	4.63	.32	8.46
10	1.67	1.51	4.19	.33	7.70

*"The carcass fats are not included in these items. There are such fats as Tripe fats, Chip fat, No. 1 Fat Trimmings, and No. 2 Fat Trimmings, which derive from every carcass, we get about 130 pounds of this extra fat to every 100 pounds of caul, ruffle, gut and gut end fat." Geo. L. Franklin of S. and S. Co.

Table 12 shows the average shrink per steer in each lot in shipping from Champaign to Chicago, the percents of shrink, dressed beef, and fat and the weight of hides. There was no effort made to so handle the cattle that an abnormally light shrink would result; on the contrary, a normal shrinkage was desired in order to secure normal percentages of dressed beef. The largest shrink occurred in lots 2, 3, 5, and 10 and the smallest in lots 7 and 9. In general the shrinkage in the different lots is not sufficiently variable to have any special significance. The differences that are shown are undoubtedly due largely to the difference in the way the different lots "filled" in the yards. It has been frequently stated that silage feeding is conducive to large shrinkage in shipping. This did not prove to be true in this instance.

The percentages of dressed beef in the different lots does not vary directly with the condition or degree of fatness of the lots as is usually the case where no unusual circumstance is operating. In this instance relatively large or small shrinkages in shipping were important factors in determining the percentages of dressed beef. For example, the large shrinkage in shipping of lot 3 undoubtedly raised the normal percentage of dressed beef in this lot, while the relatively small percentage of shrink in lot 7 lowered the natural percentage of dressed beef in this lot. The percentages of dressed beef taken as a whole, however, indicate that the cattle were well finished and ready for market.

The accompanying Table (13) gives the individual gains of the steers in the different lots from December 26 to April 16, a period of sixteen weeks and also from December 26 to May 28, a period of twenty-two weeks. In general the daily gains were larger for the whole 22 weeks during which this record was kept than for the first 16 weeks. The most uniform gains were made by the steers in lots 5 and 7, while the greatest variation is noted in lots 3, 8, 9, and 10. The largest average daily gain made by any steer was made by No. 341 in lot 4; the second largest gains by No. 312 in lot 2. The former made an average daily gain of 3.57 pounds per day and the latter 3.54 pounds. The smallest daily gain, .53 of a pound, was made by steer No. 415 in lot 9. Two steers in lot 10 made small average daily gains, viz., Nos. 428 and 429, the gains of which were respectively .89 and .98 of a pound daily. These wide variations of course represent but the extremes. A careful study of the table will show, however, that there was considerable variation in the gains of individual steers. These variations simply emphasize former records, showing that steers vary considerably as to their capacity for making gains. It is impossible to state whether or not the steers making the largest gains were the most economical producers of beef

TABLE 13.—INDIVIDUAL GAINS OF STEERS *

Lot No.	No. of Steer.	During first 16 weeks Dec. 26-Apr. 16.	During 22 weeks Dec. 26-May 28.
1	301	2.08	2.305
1	302	2.62	2.662
1	303	1.74	1.850
1	304	1.96	2.013
1	305	2.05	2.110
1	306	2.76	2.889
1	307	2.54	2.564
1	308	2.50	2.564
1	309	3.08	3.084
1	310	3.48	2.824
2	311	2.18	2.370
2	312	3.92	3.538
2	313	2.49	2.467
2	314	2.23	2.597
2	315	1.51	1.493
2	316	2.85	2.954
2	317	3.12	3.051
2	318	1.78	1.980
2	319	3.21	2.780
2	320	2.98	2.207
2	321	2.72	2.759
2	322	1.91	2.013
2	323	1.69	1.915
2	324	2.76	2.727
2	325	2.67	2.629
3	326	2.23	2.240
3	327	2.18	2.078
3	328	1.47	1.590
3	329	2.63	2.662
3	330	1.20	1.363
3	331	2.23	2.435
3	332	2.63	2.662
3	333	1.47	1.785
3	334	2.45	2.597
3	335	2.17	2.500
3	336	1.20	1.590
3	337	2.45	2.177
3	338	1.78	2.078
3	339	2.36	2.337
3	340	2.63	2.629

Lot No.	No. of Steer.	During first 16 weeks Dec. 26-April 16.	During 22 weeks Dec. 26-May 28.
4	341	3.52	3.571
4	342	1.83	1.915
4	343	2.72	2.824
4	344	2.50	2.240
4	345	2.41	2.337
4	346	2.07	3.116
4	347	2.50	2.922
4	348	2.41	2.305
4	349	2.14	2.177
4	350	2.27	2.467
4	351	2.27	2.207
4	352	1.65	1.655
4	353	2.72	2.785
4	354	1.83	1.948
4	355	2.44	2.629
5	356	1.83	2.857
5	357	1.65	2.013
5	358	1.96	2.013
5	359	2.36	2.402
5	360	1.78	2.013
5	361	2.05	2.240
5	362	2.05	2.142
5	363	2.54	2.207
5	364	1.96	2.272
5	365	2.72	2.662
5	366	2.76	2.824
5	367	2.36	2.597
5	368	2.76	2.824
5	369	2.54	2.564
5	370	2.67	2.987

* Final individual weights were taken May 28, 1904, and not June 1 when steers were marketed.

TABLE 13—CONTINUED.

Lot No.	No. of Steer.	During first 16 weeks Dec. 26–Apr. 16.	During 22 weeks Dec. 26–May 28.	Lot No.	No. of Steer.	During first 16 weeks Dec. 26–April 16.	During 22 weeks Dec. 26–May 28.
6	371	2.14	2.142	8	386	2.49	2.467
6	372	1.43	1.785	8	387	1.96	2.078
6	373	2.23	2.727	8	388	1.96	2.045
6	374	1.51	2.013	8	389	2.18	2.370
6	375	2.63	2.597	8	390	1.47	1.753
6	376	1.92	1.850	8	391	1.65	1.655
6	377	3.03	2.954	8	392	1.51	1.720
6	378	2.67	2.662	8	393	2.49	2.370
6	379	2.32	2.402	8	394	2.18	2.337
6	380	1.78	2.370	8	395	1.83	2.272
6	381	2.18	2.013				
6	382	2.59	2.857				
6	383	2.99	2.564	9	411	2.00	2.110
6	384	3.08	3.019	9	412	2.98	1.948
6	385	2.32	2.240	9	413	1.96	2.142
				9	414	1.74	1.558
				9	415	.53	1.071
				9	416	1.47	1.785
				9	417	2.14	2.435
7	396	2.00	2.337	9	418	2.67	2.629
7	397	2.14	2.272	9	419	2.27	2.207
7	398	2.94	2.759	9	420	2.50	2.370
7	399	3.03	2.564	9			
7	400	2.00	2.785				
7	401	2.32	2.629	10	421	2.14	2.013
7	402	3.21	2.467	10	422	2.00	1.948
7	403	2.98	2.987	10	423	2.94	2.824
7	404	2.50	2.500	10	424	2.63	2.889
7	405	2.00	2.177	10	425	2.32	2.370
7	406	2.14	2.078	10	426	1.74	1.525
7	407	2.23	2.564	10	427	1.38	1.558
7	408	1.96	2.500	10	428	.89	1.331
7	409	2.67	2 727	10	429	.98	1.363
7	410	1.16	2.207	10	430	2.18	2.142

since the steers were fed in lots of ten and fifteen. In general, it was observed that the rapid gainers were large eaters. These variations in gains of individual steers indicate that it is a very hazardous undertaking to conduct a cattle feeding experiment with less than ten steers in a lot.

CONCLUSIONS

RAPID GAINS AND QUICK FINISH

1. The average daily gain per steer in pounds in the various lots is as follows: Lot 1, 2.34; lot 2, 2.33; lot 3, 2.08; lot 4, 2.38; lot 5, 2.33; lot 6, 2.32; lot 7, 2.45; lot 8, 2.08; lot 9, 2.02; and lot 10, 1.99 pounds.

2. Silage ranks with ear corn, corn meal, and corn and cob meal in its ability to make rapid gains on fattening cattle.

3. Corn meal and corn and cob meal seem to be about equally efficient in producing quick finish.

4. In this test more rapid gains were secured with whole than with shelled corn and equally as good as with meal.

5. A reasonably quick finish may be secured without the feeding of an excessively heavy grain ration. In this test the largest average amount of concentrates fed daily throughout the experiment was in lots 2, 6, 7, and 8, in all of which, the cob is included. The daily ration of concentrates in these lots varied from 23 to 23.5 pounds or approximately one peck of ear corn and 3 pounds of gluten meal or oil meal per thousand pounds live weight of cattle.

6. The feeding of a nitrogenous concentrate to supplement corn undoubtedly stimulates the appetite and increases the capacity of the steer for consuming to advantage large quantities of concentrates. Hence this system of feeding is to be recommended where a quick finish is desired.

ECONOMICAL GAINS; EFFICIENCY OF FEEDS

7. Where conditions are such as prevailed in this experiment, corn and cob meal is not so valuable for fattening steers, pound for pound as corn meal.

8. The presence of the cob in ground corn does not appear to materially increase the efficiency of corn for beef production or for combined beef and pork production under conditions prevailing in this test. Whether or not the cattle feeder should use corn meal or corn and cob meal is largely a matter of convenience, what roughage is used, how the corn part of the ration is supplemented with other concentrates, and perhaps the season during which it is used.

9. A given amount of corn and cob meal did not produce any more beef and considerably less beef and pork combined than did ear corn.

10. Corn meal proved much more efficient for beef production than shelled corn, while for combined beef and pork production, they appear to be about equally efficient.

11. Corn meal is not more efficient for beef production than is ear corn.

12. Ear corn is much more efficient for beef production than is shelled corn.

13. This test indicates that the supplementing of corn with nitrogenous concentrates used in this instance increases the efficiency of corn and clover hay for beef production.

14. The chaffing of hay and mingling it with the concentrates in the form of meals did not add materially to their efficiency for beef

production, although by this system of feeding there is less likelihood of getting the steers off feed or of scouring.

15. By following the method employed in this test of getting cattle on full feed, large and economical gains may be secured up to the time of marketing without the length of the finishing period being materially lengthened. That is to say, as large and as cheap gains are made during the last as the first half of the feeding period.

PORK MADE

16. The amount of gain made by hogs following steers appears to be largely regulated by the amount of undigested corn in the droppings of the steers in an available form for the hogs to recover; therefore, larger gains are made by hogs following steers fed corn only than where it is supplemented with oil meal and gluten meal thus rendering it more efficient for beef production.

17. Where enough pigs are provided to consume undigested feed in the droppings of steers it requires fully twice as many where corn is fed whole as it does where meal is fed to the steers.

18. The gain on hogs following the different lots of steers per steer in pounds was as follows: Lot 1, 6.3; lot 2, 62.6; lot 3, 74.13; lot 4, 20.66; lot 5, 20.02; lot 6, 18.00; lot 7, 24.00; lot 8, 73.5; lot 9, 85.8; and lot 10, 111.5 pounds. The pounds gain made by the hogs per 100 pounds corn fed the steers was as follows: Lot 1, .19; lot 2, 1.68; lot 3, 1.89; lot 4, .67; lot 5, .65; lot 6, .46; lot 7, .63; lot 8, 1.81; lot 9, 2.79; lot 10, 3.61.

PROFITABLE GAINS.—MISCELLANEOUS

19. For profit to the cattle feeder the three rations giving best rereturns ranked as follows: Ear corn supplemented with oil meal and gluten meal; shock or fodder corn and ear corn; and ear corn without supplement, clover hay being fed in all the lots. The profits in these lots, 2, 3, and 8, were so nearly alike that the conclusion that the feeding of any one of these rations would be followed by larger profits than the feeding of the others would be unwarranted.

20. The three rations giving smallest net profits were shelled corn (mud lot), corn and cob meal, corn meal (hay chaffed). In each of these instances the corn part of the ration was supplemented with oil meal and gluten meal.

21. The cost per pound of gain on the steers varied with the different methods of feeding from 5.9 to 7.9 cents per pound.

22. There was a difference of twenty cents per hundred weight in the marketable finish of the various lots.

23. The net profit varied from $4.13 to $9.84 per steer.

24. From the records of this experiment, $0.26 per hundred weight should be added to the cost of feeders in market to determine their cost delivered in feed lots where freight rates and shrinkage in shipping are comparable with conditions obtaining in this test.

25. The method of feeding steers may make as much as $0.50 per hundred weight difference in the margin necessary for coming out even. The methods involving least labor requiring a margin of approximately $1.00 per hundred weight for choice steers, while those requiring a maximum amount of labor require a margin of about $1.50 per hundred weight. Steers fed by the former method are not as a rule in as desirable marketable condition as those fed by more complex methods, hence, the latter usually command a higher price on the market; in this instance the difference was but $0.20 per hundred weight.

26. The results of this experiment are so striking that it appears that the grinding of corn for feeding choice two year old steers during the winter season is not warranted. The profits of feeding ear corn are fully twice as large as those secured in feeding corn meal or corn and cob meal.

27. The feeding of silage in moderate quantities is not necessarily conducive to heavy shrinkage in shipping or small percentages of dressed beef. The reader is cautioned not to conclude that since the feeding of silage was not followed with as large profits as the feeding of several other rations, that it has no place in beef production. Its use in growing young cattle and as a part of the ration of the breeding herd promises well in the hands of the experienced feeder, but to just what extent it may be profitably used for these purposes remains to be determined by future investigations.

28. Many who advocate the feeding of ear corn to cattle if hogs follow, advocate the feeding of meal if for any reason it seems desirable to eliminate the hog. The results of this experiment do not warrant such a conclusion. After eliminating the hog from the cattle feeding operations here presented the feeding of broken ear corn was followed with larger profits than the feeding of meal.

29. Since the profits in feeding shock or fodder corn and ear corn are approximately the same the writer is inclined to favor the feeding of ear corn in preference to fodder corn because in feeding fodder corn one is sometimes obliged to get on the land when it is too wet. This statement applies especially to seasons of the year when bad weather is likely to prevail.

30. While the results of this experiment show that it does not pay to grind corn for winter feeding it should not be assumed that it does not pay to grind corn for cattle that are being fattened in summer on grass.

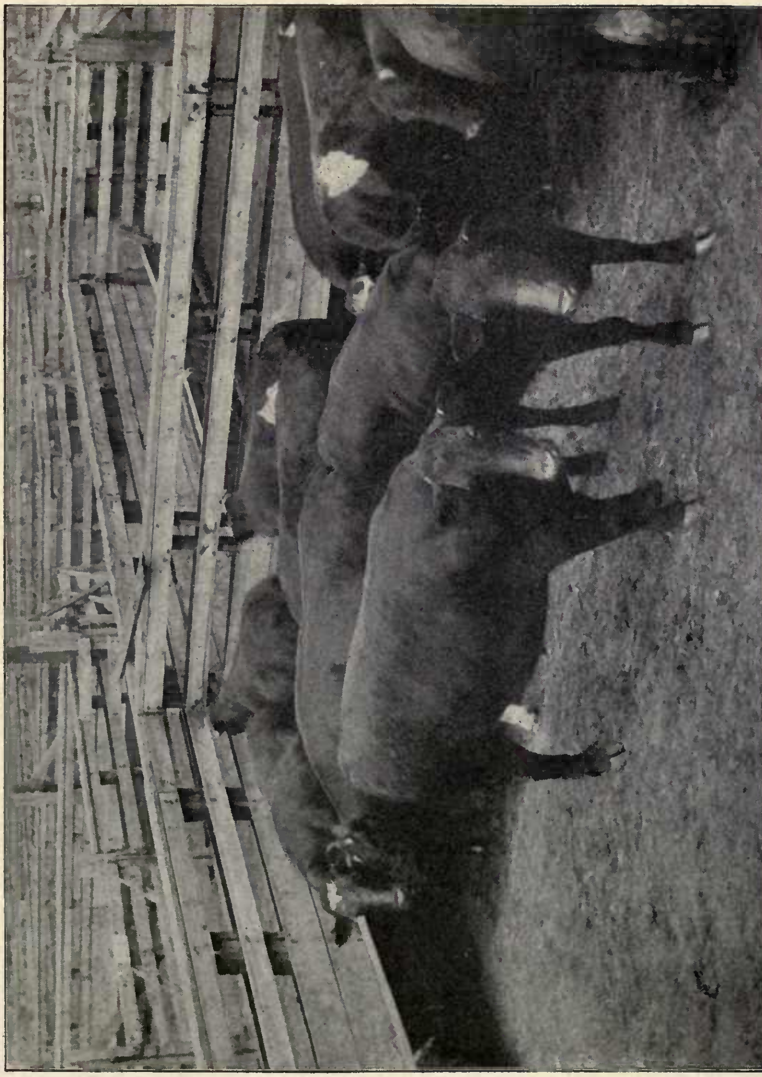

PLATE 1. LOT 1 AT TIME OF MARKETING JUNE 2, 1904. MARKET VALUE $6.10 PER CWT. RATION MADE UP OF SILAGE, CORN MEAL, GLUTEN MEAL, OIL MEAL, AND CLOVER HAY.

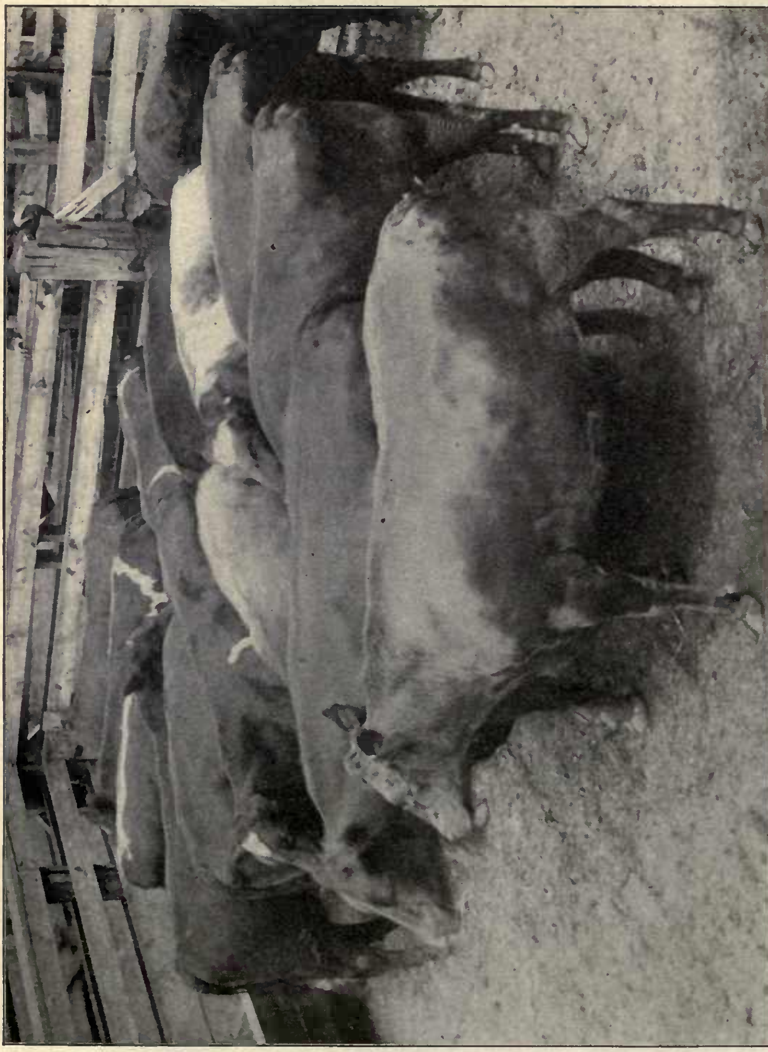

PLATE 2. LOT 2 AT TIME OF MARKETING JUNE 2, 1904. MARKET VALUE $6.15 PER CWT. RATION MADE UP OF EAR CORN, GLUTEN MEAL, OIL MEAL, AND CLOVER HAY.

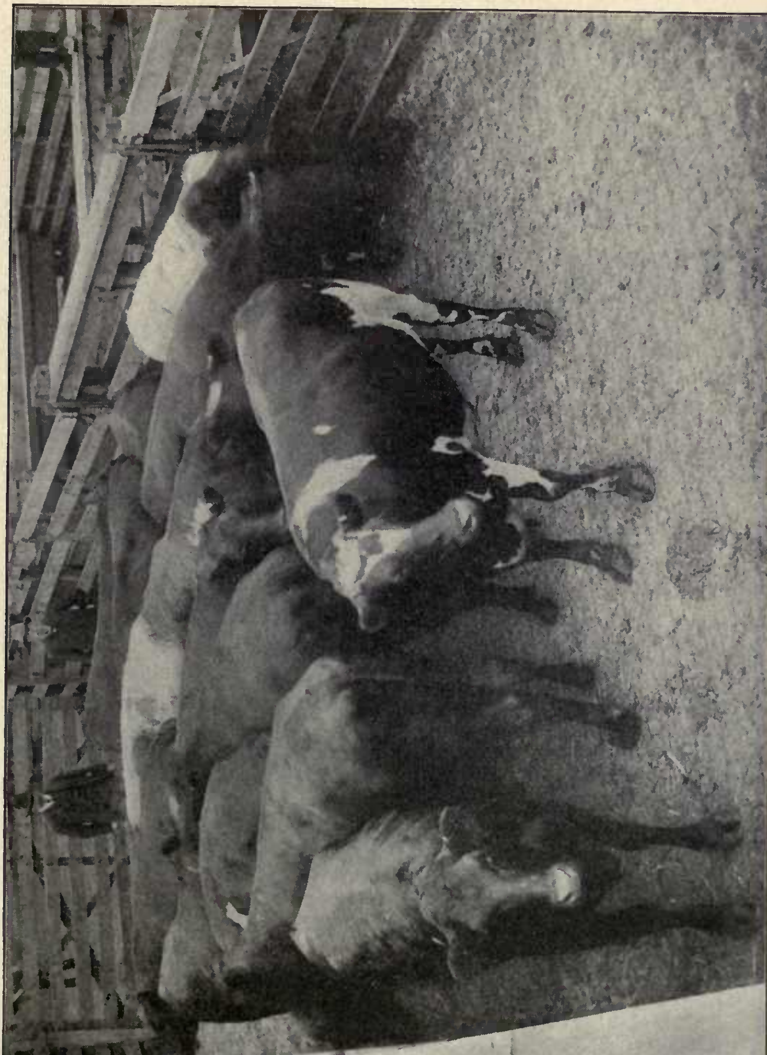

PLATE 3. LOT 3 AT TIME OF MARKETING JUNE 2, 1904. MARKET VALUE $5.95 PER CWT. RATION MADE UP OF EAR CORN AND CLOVER HAY.

PLATE 4. LOT 4 AT TIME OF MARKETING JUNE 2, 1904. MARKET VALUE $6.15 PER CWT. RATION MADE UP OF CORN MEAL, GLUTEN MEAL, OIL MEAL, AND CLOVER HAY.

PLATE 5. LOT 5 AT TIME OF MARKETING JUNE 2, 1904. MARKET VALUE $6.15 PER CWT. RATION MADE UP OF CORN MEAL, GLUTEN MEAL, OIL MEAL, AND CLOVER HAY (CHAFFED).

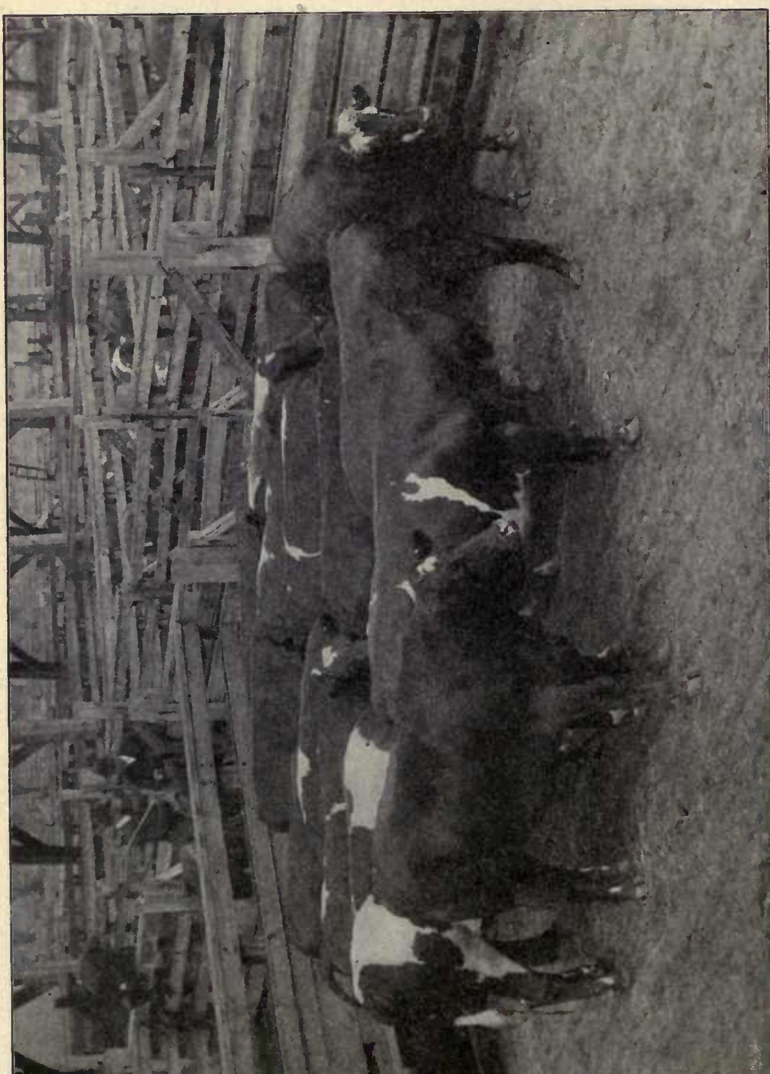

PLATE 6. LOT 6 AT TIME OF MARKETING JUNE 2, 1904. MARKET VALUE $6.10 PER CWT. RATION MADE UP OF CORN AND COB MEAL, GLUTEN MEAL, OIL MEAL, AND CLOVER HAY.

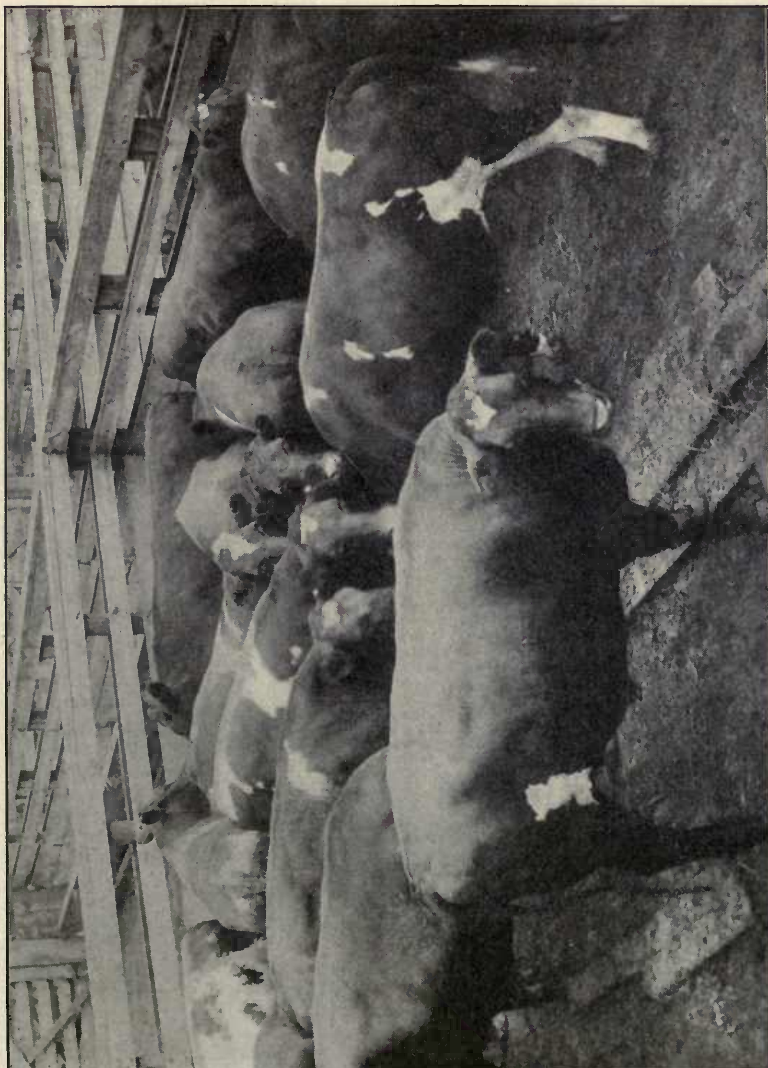

PLATE 7. LOT 7 AT TIME OF MARKETING JUNE 2, 1904. MARKET VALUE $6.15 PER CWT. RATION MADE UP OF CORN AND COB MEAL, GLUTEN MEAL, OIL MEAL, AND CLOVER HAY (CHAFFED).

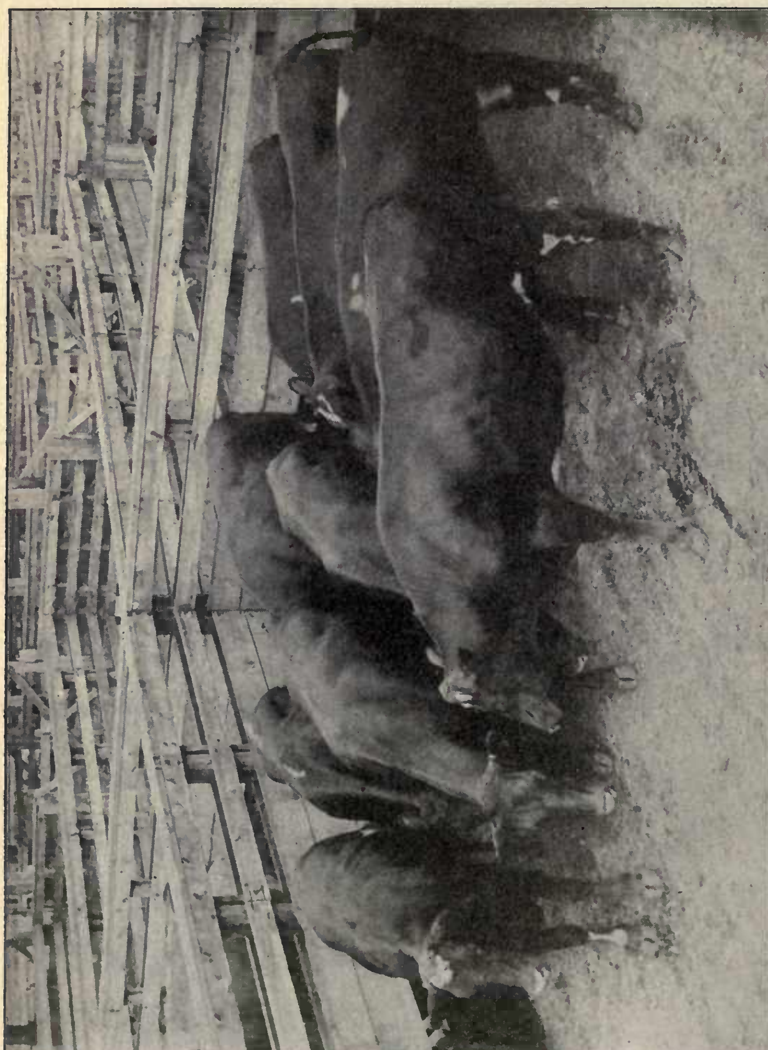

PLATE 8. LOT 8 AT TIME OF MARKETING JUNE 2, 1904. MARKET VALUE $6.05 PER CWT. RATION MADE UP OF SHOCK OR FODDER CORN, EAR CORN, AND CLOVER HAY; ALSO OIL MEAL DURING THE LATTER PART OF THE FEEDING PERIOD.

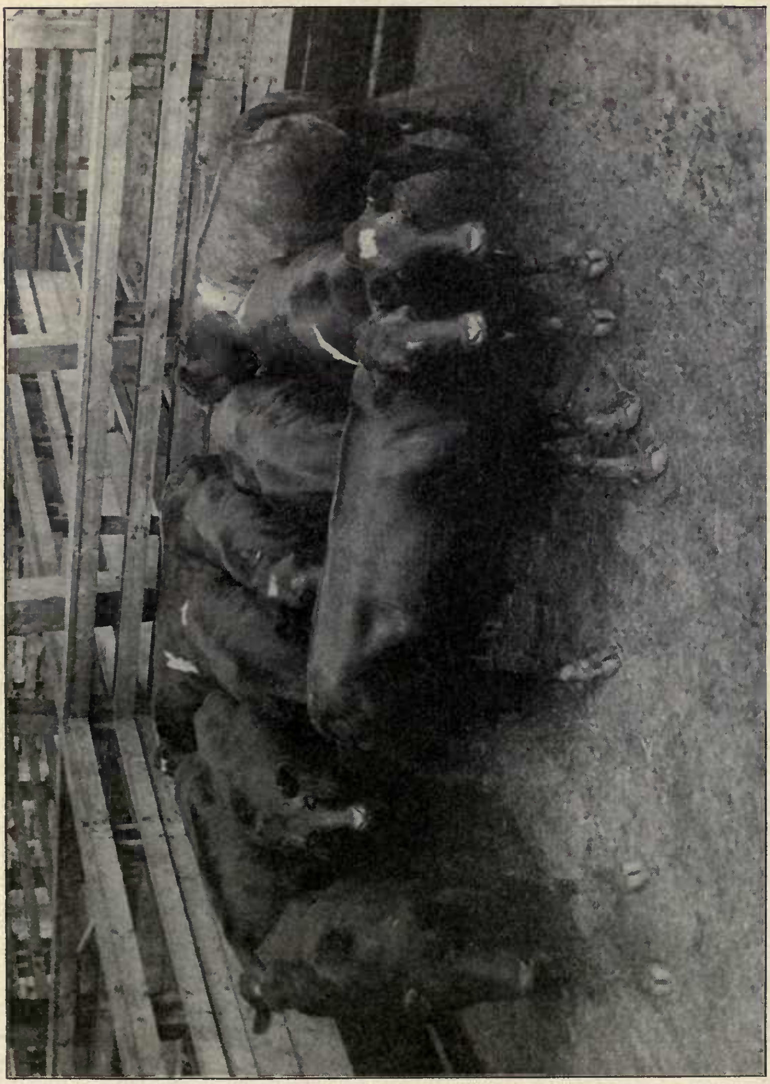

PLATE 9. LOT 9 AT TIME OF MARKETING JUNE 2, 1904. MARKET VALUE $5.95 PER CWT. RATION MADE UP OF SHELLED CORN, GLUTEN MEAL, OIL MEAL, AND CLOVER HAY. (MUD LOT).

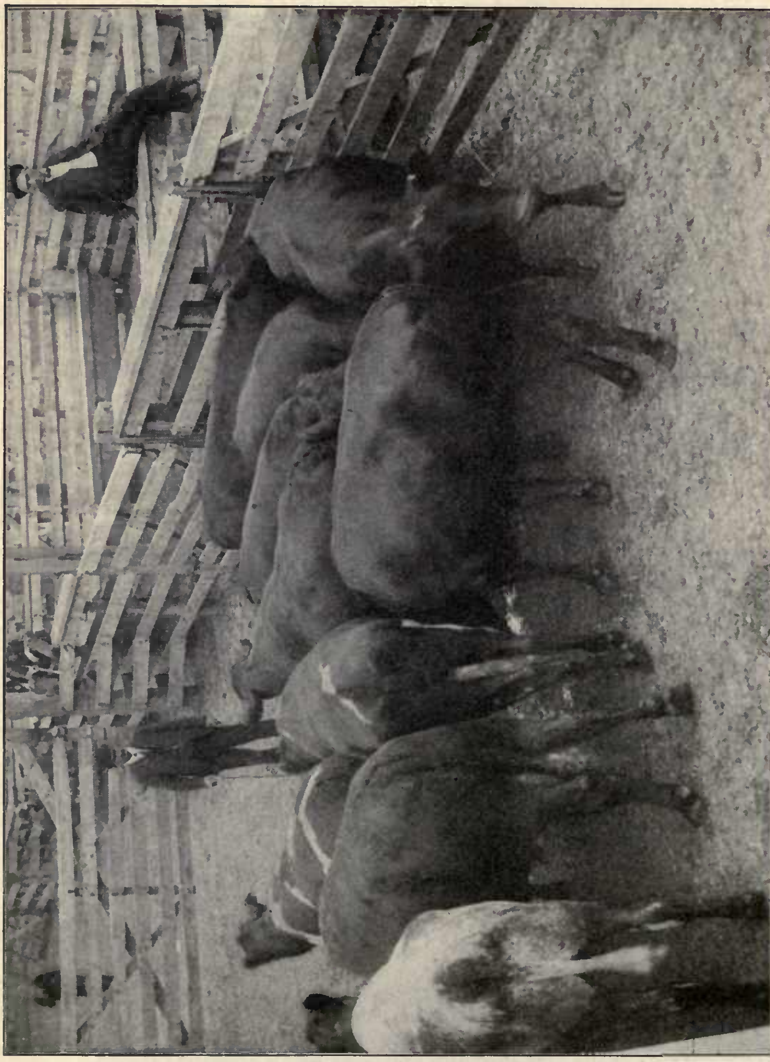

PLATE 10. LOT 10 AT TIME OF MARKETING JUNE 2, 1904. MARKET VALUE $6.05 PER CWT. RATION MADE UP OF SHELLED CORN, GLUTEN MEAL, OIL MEAL AND CLOVER HAY.

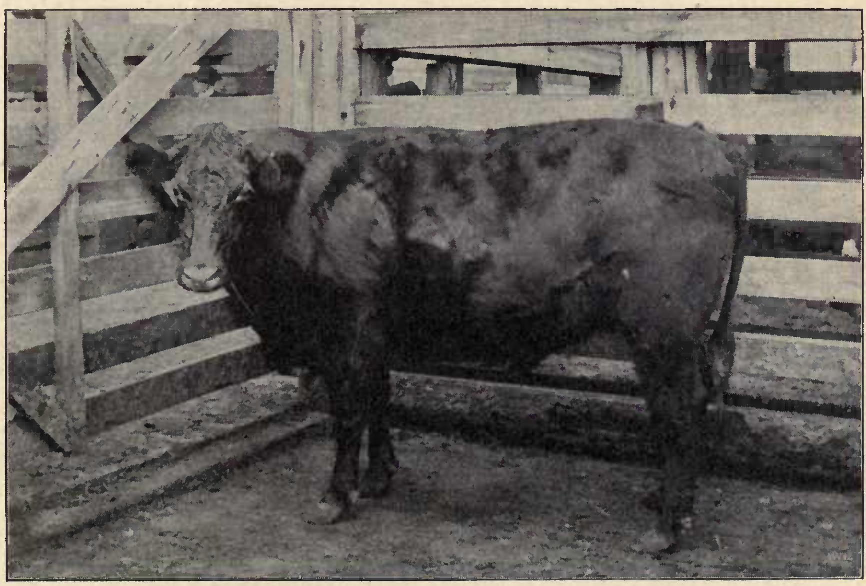

PLATE 11. NO. 319 IN LOT 2. THE BEST PRIME STEER IN ANY LOT AT TIME OF MARKETING.