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BULLETIN No. 261

ECONOMIC FACTORS IN CATTLE FEEDING
CATTLE FEEDING IN RELATION
TO FARM MANAGEMENT

By H. C. M. CASE AND K. H. MYERS



URBANA, ILLINOIS, MARCH, 1925

FOREWORD

The Animal Husbandry Department, in 1912, began the publication of a series of circulars on "Economic Factors in Cattle Feeding." By 1914 four circulars had been published, namely:

- No. 163 Relation of the United States to the World's Beef Supply
- No. 164 Argentina as a Factor in International Beef Trade
- No. 169 A Review of Beef Production in the United States
- No. 175 Cattle Feeding Conditions in the Corn Belt

It was planned that the final number of the series would be devoted to cattle feeding in its relation to farm management and soil fertility.

In 1912 the department began detail cost-of-production studies under the direction of Professor H. W. Mumford, then head of the department and the senior author of the above mentioned circulars. Professor W. F. Handschin, as a member of the department, was given immediate charge of the work and continued with this responsibility after he was made head of the Department of Farm Organization and Management in 1917.

These investigations, initiated by the Department of Animal Husbandry and continued by the Department of Farm Organization and Management, are the basis of the present publication. The analysis of the data and its interpretation in this publication have been the contribution of the authors.

SUMMARY

The detailed cost-of-production studies reported herein were carried on in Hancock county during the ten-year period 1913-1922 and include data on 1,558 steers fed in thirty-eight lots.

The average profit per steer, after allowing credit for the pork and manure produced, was \$2.07. However, the results of the enterprise varied widely on the different farms—from a profit of \$12.60 a steer to a loss of \$14.50. The cost of gains also varied widely, being more than twice as high on some farms as on others during the same year, and about 20 percent higher for cattle weighing above 1,000 pounds when put on feed than for cattle weighing less than 800 pounds.

Feed made up an average of 85.5 percent of the total feed-lot cost of fattening the cattle; man labor, 4.10 percent; horse labor, 1.81 percent; general farm expense, 2.90 percent; interest, 4 percent; building expense, .82 percent; miscellaneous, .21 percent; and death risk, .66 percent.

In cost accounting work, the cattle are charged with some items that may not constitute an actual cost on a particular farm. For example, they are charged with roughage, which is not usually sold from some farms and for which there is little demand. They are charged with man and horse labor used at seasons when other enterprises do not provide full employment. They also may help to carry a part of the overhead expense of the farm which would be incurred regardless of what enterprises were carried on. In attempting to show the value of the enterprise to the farm as a whole, however, some of these items may be differently assigned, and the showing of profit from the enterprise correspondingly changed. Cost accounts kept for a seven-year period on one of the farms included in this study showed a direct net profit of \$290.65 a year for an average of 56.4 steers fed annually; but when the enterprise was analyzed from the standpoint of the farm as a whole, it was found that it added a total of \$827.65 annually to the net income of the operator.

The economic relationship of any farm enterprise to the remainder of the farm business is quite as important as the study of the efficiency of the separate enterprise. Since the cattle-feeding enterprise does not directly require much land, it can be added to the farm business in an area producing surplus corn without displacing some other enterprise either wholly or in part. This adds volume to the farm business without requiring increased acreage; which fact is an important one in a section where land makes up such a large part of the total farm investment as it does in Illinois.

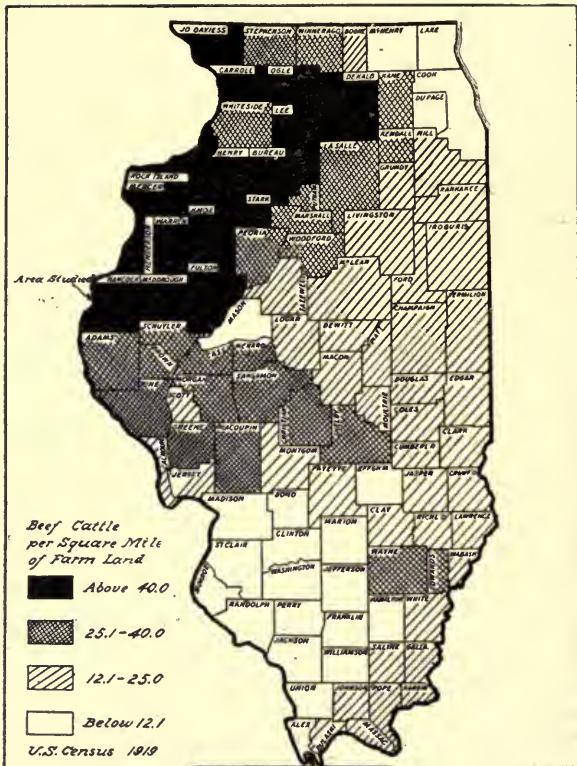


FIG. 1.—DISTRIBUTION OF BEEF CATTLE IN ILLINOIS

Hancock county, in which these studies were made, is in the principal beef-producing area of the state. On the basis of land area, this county finishes for market about twice its proportion of fat steers compared with the state as a whole.

CATTLE FEEDING IN RELATION TO FARM MANAGEMENT

By H. C. M. CASE, Assistant Chief in Farm Organization and Management,
and K. H. MYERS, Assistant in Farm Organization and Management

The place of beef-cattle feeding in the organization of farms thruout a large part of the corn belt has stood the test of time. Since it is a well-established farm practice it is evident that the enterprise either now has or has had a place in profitable farming. Many farmers consider, however, that little direct profit is realized from feeding beef cattle. While this may be true, the fact that the enterprise is retained as a regular farm practice by so many corn-belt farmers may be taken to indicate that either directly or indirectly, it contributes materially to the more efficient organization and operation of their farms.

The purpose of this bulletin is to show as accurately as possible, by an analysis of records collected over a period of ten years in the principal cattle-feeding section of Illinois, (1) the costs that enter into the cattle-feeding enterprise and the financial results, and (2) the place that cattle feeding fills in the organization and operation of corn-belt farms.

Studies on which this publication is based were made in Hancock county during the ten-year period 1913-1922. This county is in west-central Illinois bordering on the Mississippi river and is in an area generally recognized as the principal beef-cattle and hog-producing section of the state (Fig. 1). Corn makes up over 40 percent of the total cereal acreage; wheat and oats together comprize about an equal area. The farmers of this county produce yearly an average of 2,500 bushels of corn per farm and as a rule sell only about 25 percent; much of the corn that is sold is fed by other farmers in the county. The soil is well above the average of the state in productivity.

On the basis of land area, Hancock county finishes for market about twice its proportion of fat steers and hogs compared with the state as a whole. An average number of sheep and poultry are raised, but the county has less than two-thirds of its proportionate share of dairy cows, according to the 1919 Census. These conditions are characteristic of the counties lying between the Illinois and Mississippi rivers and indicate in a general way the wide difference between the type of farming in this area and that found in other parts of the state. The section of Hancock county in which the greater part of the cost-accounting investigations were conducted is a more specialized beef-cattle and hog-producing community than the county as a whole.

The usual practice in this area is to purchase feeder cattle at some western point and put them directly into the feed lot. An occasional cooperater bought stocker cattle, which were run on pasture before they were placed in the feed lot, or raised a few calves which were put into the feed lot.

Feeders which were purchased as stockers or raised and fed on the same farm were valued, when placed in the feed lot, at the price at which it was believed they would have sold locally as feeders. This publication, however, is concerned chiefly with the analysis of the feed-lot phase of the beef-cattle enterprise and the relation of the enterprise to the entire farm business, and not with the buying and breeding of cattle.

During the ten-year period, 1,558 cattle were finished for market. This number was made up of thirty-eight lots ranging from 13 to 85 head to a lot and representing an average of 41 head fed each year on each farm.

In order to study the records more conveniently, the cattle are divided into groups according to their initial weights. Since the feeding period was longer for light-weight cattle than for heavier animals, the method of grouping also brings together the cattle fed for similar periods.

No attempt is made to group the cattle according to quality. While there naturally were some variations on the different farms and in different years, practically no cattle of the poorer grades and relatively few of the best grade were included.

More cattle were fed in the early years of the study than in the later, but cattle of each of the different weights made up about the same proportion of all cattle fed each year. Differences in profits from cattle of different weights must have been due, therefore, on the whole, not

NOTE.—In gathering the facts on which this publication is based, eight to twelve farmers operating typical Hancock county farms cooperated with the Station each year, keeping detailed records of the cost of all farm products and the profit or loss realized from each productive enterprise.

A representative of the Experiment Station visited each farm two to four times a month to collect and check the daily labor and feed records and cash receipts and expenditures kept by the cooperators. Careful records of crops produced and inventories of crops on hand were also kept and sent to the Station each month for record and analysis.

The object of these studies has been to determine the conditions which make for more profitable systems of farming in different parts of the state. The data secured are valuable for this purpose because the averages of records kept over a number of years round off the fluctuations due to seasonal conditions and changes in price levels, and give results representing average conditions. Also, since these studies include a record of all parts of the farm business, it is possible to show more accurately the relation of any single enterprise, like beef-cattle feeding, to the rest of the farm business, as well as to show how the enterprise may be conducted more economically. Such an analysis should help farmers to arrange their business to meet changing economic conditions.

to the favoring of a particular weight in years when that weight commanded a premium on the market, but to other causes which are discussed later.

PART I—THE COST OF PRODUCING BEEF

A combined financial statement for the 1,558 steers and the average financial statement per steer are given in Table 1. The total costs of feeding cattle are divided into three groups: the initial cost of the cattle, the operating or feed-lot costs, and marketing charges. The total cost less the estimated value of the manure produced and of the gain in the weight of hogs which followed the cattle, represents the net cost.

The average results per steer, as shown by Table 1, were as follows:

1. The average steer put into the feed lot at a weight of 894.2 pounds cost \$68.30.
2. The cost of putting on 273.7 pounds of gain was \$52.83.
3. The marketing charges were \$2.87 per steer.
4. The finished steer, weighing 1,167.9 pounds, represented a total cost of \$124.

TABLE 1.—RESULTS OF TEN YEARS OF CATTLE FEEDING IN HANCOCK COUNTY, ILLINOIS, 1913-1922

	Total of 1,558 steers		Per steer	
Average length of feeding period		186.8 days		186.8 days
Initial weight of steers (lbs.)...		1 393 060		894.2
Total gain (lbs.).....		426 449		273.7
Final weight (lbs.).....		1 819 509		1 167.9
Initial cost.....		\$106 387.74		\$68.30
Operating costs in feed lot.....		\$ 82 316.33		\$52.83
Feed.....	\$70 375.84		\$45.17	
Man labor.....	3 378.27		2.17	
Horse labor.....	1 474.41		.94	
General farm expense.....	2 395.07		1.54	
Interest charges.....	3 298.70		2.12	
Buildings and equipment....	669.80		.43	
Miscellaneous.....	175.75		.11	
Death risk.....	548.49		.35	
Marketing expense.....		\$ 4 477.99		\$ 2.87
Total cost at date of selling....		\$193 182.06		\$124.00
Total credit.....		\$ 18 951.83		\$ 12.17
Manure credit (75c a ton) ...	\$ 9 141.33		\$ 5.87	
Pork credit (1½lb. per bushel of corn fed).....	9 810.50		6.30	
Net cost.....		\$174 230.23		\$111.83
Sale price.....		177 480.95		113.90
Profit.....		\$ 3 250.72		\$ 2.07

NOTE.—The number of cattle fed and marketed during the different years was as follows: 1913, 324; 1914, 311; 1915, 160; 1916, 99; 1917, 73; 1918, 169; 1919, 165; 1920, 0; 1921, 82; 1922, 175.

5. The net selling price per steer was \$113.90, leaving a deficit of \$10.10.

6. Manure gave a credit of \$5.87 per steer when valued at 75 cents a ton. Pork gave a credit of \$6.30 per steer at current prices for pork, the gain in weight by the pigs being estimated as 1½ pounds for each bushel of corn fed to the cattle.

7. The net profit after allowing the above credit of \$12.17 for by-products was \$2.07 per steer. However, as shown later (Table 5), the results on the different farms varied from a profit of \$12.60 per steer to a loss of \$14.50, in the same year.

Some cattle were fed on the cooperating farms each winter except the winter of 1919-20. The enterprise for the ten-year period probably would have shown a loss had the cattle feeders in this area fed the usual number of steers that year, for at that time cattle feeding in general was an unprofitable enterprise owing to the high prices of feeder cattle and feed and a declining market when many fat cattle were sold.

HOW THE DIFFERENT ITEMS OF COST WERE DETERMINED

1. *Cost of Feed.*—This was determined for each month at farm prices; that is, in the case of home-grown feeds the cost charged to the steers was the local market price less the cost of hauling to market, and in the case of purchased feed it was the local market price plus the cost of hauling to the farm. Roughages were valued at conservative prices whether or not it was customary to sell such roughages from the farm. As a check on the daily feed record kept by the farmer, the feeds on hand were carefully measured each month.

2. *Man Labor.*—The rate per hour for all hired labor was determined by dividing the total labor cost for the month by the hours of labor performed by hired help during the month. The labor of members of the family not paid a definite wage was charged at the average monthly rate of hired labor on all the cooperating farms. The amount of labor spent in caring for cattle was recorded daily by the cooperator and checked by the route man on his visits to the farm.

3. *Horse Labor.*—The cost of horse labor per hour was determined by dividing the total cost of keeping horses for the entire year by the number of hours of horse labor performed on the farm during the year. The cattle-feeding enterprise was then charged with the number of hours devoted to it.

4. *General Farm Expense.*—There are always expenses incurred in the operation of the farm that cannot be charged directly to any one farm enterprise but must be shared by all the productive enterprises. The more important items included here are taxes,¹ automobile expense

¹It will be noted that a portion of taxes was charged to the feeding cattle. This amount included a small part of both the personal and land tax assessed to the farm

incurred in operating the farm, fencing, maintenance of the farmstead and water system, and such minor items as telephone service. The share of these expenses to be charged to each productive enterprise was determined by the proportion of man labor devoted to the enterprise. This seemed to be as accurate and fair a basis as any for making this division.

5. *Interest*.—This charge includes interest on the total investment in cattle when the cattle were put on feed, charged at the rate usually paid on borrowed money.

6. *Buildings and Equipment*.—This annual cost includes depreciation, upkeep, and interest on buildings, feed-bunks, hay racks, and other miscellaneous equipment. Where such buildings and equipment are shared with other livestock, the amount to be charged to cattle is estimated as accurately as possible.

7. *Miscellaneous Expenses*.—These include such items as veterinary fees, medicines, and personal expenses of the operator in purchasing and selling cattle.

8. *Death Risk*.—The initial cost of animals that died while on feed is included here. The feed consumed by cattle that died is charged in with the feed fed to the remaining cattle in the lot.

RELATIVE IMPORTANCE OF DIFFERENT ITEMS OF EXPENSE

During the ten years covered by this study, feed made up 85.5 percent of the feed-lot costs, man labor 4.1 percent, and interest 4 percent. General farm expense made up 2.9 percent, horse labor 1.81 percent, buildings .82 percent, miscellaneous .21 percent, and death risk, .66 percent (Table 2 and Fig. 2). This represents a fairly normal distribution of costs.

Naturally some variation occurred from year to year among the different items of expense. In 1921 feed made up only 80.6 percent of the costs, but in 1918 and again in 1919 it made up as much as 89 percent.

This difference may be explained by the high prices of feeds during 1918 and 1919 followed by the decided drop in 1921. The other items of expense did not show wide variations for the other years, when expressed in terms of percentage, except in two or three instances noted in the following paragraphs.

The continued high costs of labor and purchased materials in 1921 and 1922, in comparison with the prices of farm products, were largely responsible for the variation in general farm expense and man labor.

and equipment. If all the land tax had been left out of the charge against cattle, the general farm expense would have been reduced by about 30 cents per steer or 11 cents per 100 pounds gain. While it might be better practice to leave all taxes out of the cost of beef production in instances where the cattle have use of a relatively small amount of land, it will be noted that this charge made no appreciable difference in the results. It is the only charge made against cattle in these data which the authors felt might be questioned.

TABLE 2.—FEED-Lot COSTS OF PRODUCING 100 POUNDS OF BEEF, SHOWING VARIATION BY YEARS, 1913 TO 1922

Year	Feed		Man labor		Horse labor		G. F. E.		Interest		Bldg. exp.		Miscellaneous		Death risk		Total	
	Cost per 100 lbs. gain	Percent of total cost	Cost per 100 lbs. gain	Percent of total cost	Cost per 100 lbs. gain	Percent of total cost	Cost per 100 lbs. gain	Percent of total cost	Cost per 100 lbs. gain	Percent of total cost	Cost per 100 lbs. gain	Percent of total cost	Cost per 100 lbs. gain	Percent of total cost	Cost per 100 lbs. gain	Percent of total cost	Cost per 100 lbs. gain	Percent of total cost
1913.....	\$10.67	84.5	\$.64	5.1	\$.21	1.7	\$.41	3.2	\$.62	4.9	\$.05	.4	\$.03	...	\$.03	.2	\$12.63	100
1914.....	14.91	86.0	.70	4.0	.27	1.6	.51	3.0	.70	4.0	.13	.8	.03	.1	.09	.5	17.34	100
1915.....	15.68	85.2	.79	4.3	.25	1.4	.50	2.7	.91	5.0	.14	.8	.12	.6	...	...	18.39	100
1916.....	19.41	83.8	1.06	4.6	.42	1.8	.51	2.2	.89	3.9	.11	.5	.17	.7	.59	2.5	23.16	100
1917.....	19.23	85.2	.91	4.0	.63	2.8	.65	2.9	.88	3.9	.20	.9	.06	.3	...	...	22.56	100
1918.....	29.06	89.0	1.03	3.1	.58	1.8	.50	1.5	1.28	3.9	.18	.5	.07	.2	...	...	32.70	100
1919.....	32.64	89.0	1.11	3.0	.68	1.9	.51	1.3	1.24	3.3	.27	.7	.01	...	.30	.8	36.76	100
1921.....	12.52	80.7	.82	5.3	.33	2.1	1.08	6.9	.53	3.4	.23	1.5	.02	.1	...	...	15.53	100
1922.....	14.25	82.5	.68	4.0	.26	1.5	.60	3.5	.50	2.9	.32	1.9	...	...	.64	3.7	17.25	100
Aver. entire period....	\$16.50	85.5	\$.79	4.1	\$.35	1.81	\$.56	2.9	\$.77	4.0	\$.16	.82	\$.04	.21	\$.13	.66	\$19.30	100

Building expense shows a variation from 5 to 32 cents for 100 pounds of gain. While building expenses advanced with prices of farm products up to and thru 1919, thruout the latter part of the ten-year period they remained at a higher level than most of the other expenses connected with cattle feeding. Some of the variation in this item, how-

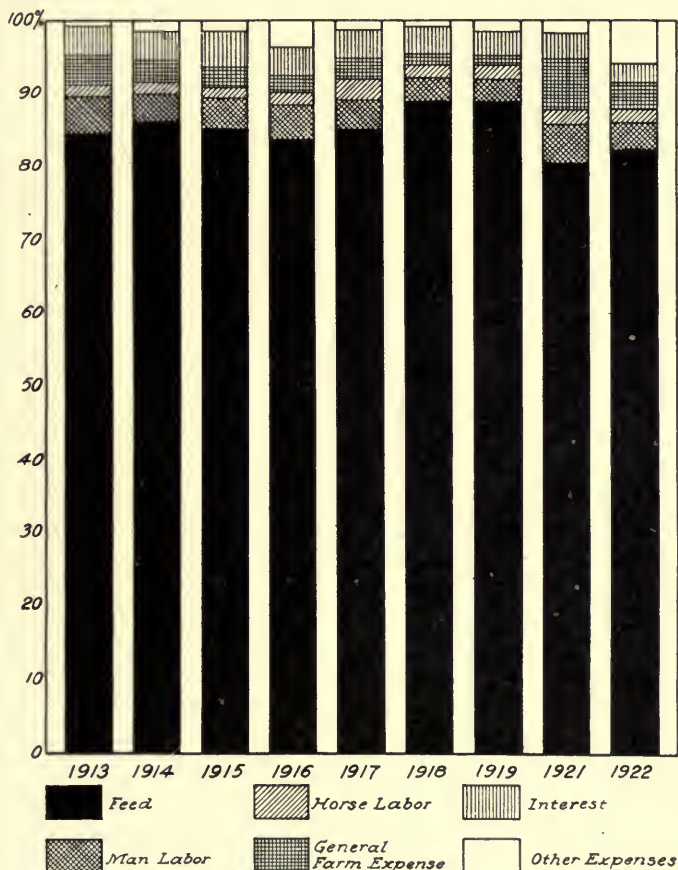


FIG. 2.—DISTRIBUTION OF COSTS ON A PERCENTAGE BASIS

The different items entering into the cost of feeding cattle for market did not vary widely from year to year, on a percentage basis.

ever, is due to differences between the amount and cost of equipment on the farms of new cooperators who were added during the ten years and old cooperators who were dropped.

In 1916 and in 1922 more cattle died while on feed than during the average seasons, and consequently miscellaneous livestock expense and risk made up a relatively large proportion of the total cost (see Fig. 2, "other expense"). In 1916 the death risk amounted to 59 cents

for 100 pounds of gain and in 1922 to 64 cents, while the average for the whole period amounted only to 13 cents (Table 2).

Even tho the distribution of expenses, on a percentage basis, remained nearly the same from year to year, as shown above, it is to be noted that the cost of 100 pounds of gain varied widely (Table 2 and Fig. 3). In 1921 the cost of feed for 100 pounds of gain was only \$12.52,

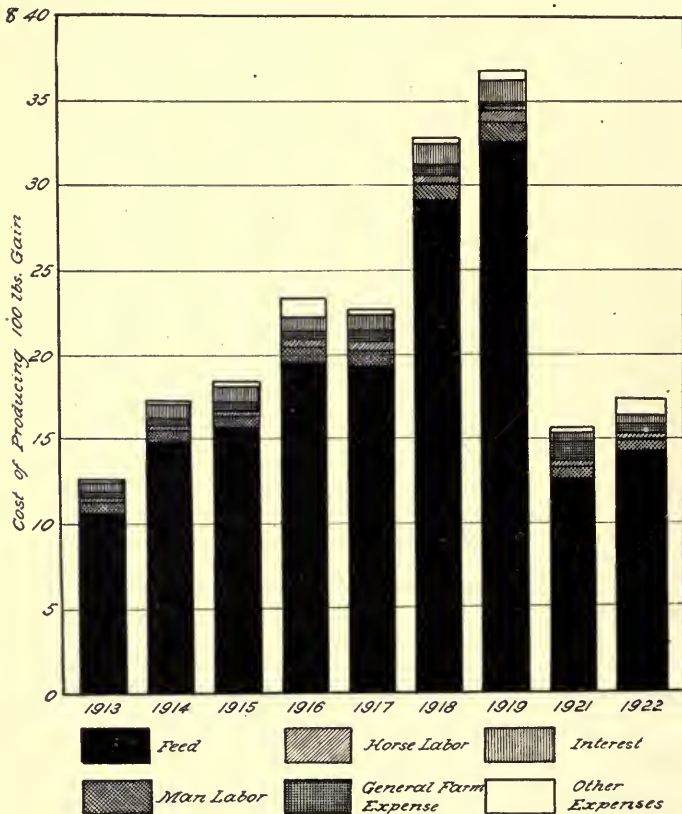


FIG. 3.—COST OF PRODUCING 100 POUNDS OF GAIN

The average cost of producing 100 pounds of gain varied from \$12.63 in 1913 to \$36.76 in 1919, owing largely to changes in the prices of feed.

while in 1919 it was \$32.64, or almost two and one-half times as much.

This difference is explained in part by the price of No. 2 corn, which on January 1, 1921, was 70 to 78 cents a bushel on the Chicago market, and on the same day in 1919 was \$1.50 to \$1.62 a bushel. Labor costs were higher from 1916 to 1919 than during the other years, but owing to the greatly increased cost of feed during the war man labor and horse labor continued to make up about the same proportion of the total cost.

COST OF GAIN VARIES WITH SIZE OF CATTLE

That the weight of cattle when put in the feed lot has a direct bearing on the cost at which gains are produced is shown by the analysis of costs presented in Table 3. Here the cattle are divided into groups according to their initial weights. In one group are those lots that weighed less than 800 pounds, in another those that weighed between 800 and 1000 pounds, and in another those that weighed over 1000 pounds.

The cattle in the heaviest group consumed more feed in making 100 pounds of gain than did the lightest cattle, and feed made up a greater part of the total costs. It took \$8.80 worth more feed to put 100 pounds on the heaviest cattle than on the lightest. Since large steers require more feed for maintenance than do small steers, it is to be expected that they would require more feed for the same gain in weight.

Expenses for labor, both man and horse, were slightly higher for the heaviest cattle than for the light-weight—38 cents more for man labor and 22 cents more for horse labor for 100 pounds of gain. Some difference would naturally be expected because of the greater amount of feed consumed by the larger cattle. Also, the larger cattle were usually fed during the winter, when more labor is required in caring for them. The smaller cattle were on feed for a longer period but frequently were fed during better weather.

The slight differences in general farm expenses and building expense can be attributed to differences on individual farms rather than in the weights of the cattle. This is shown by the fact that the relative differences from farm to farm for both these items were greater than the differences between the different groups of cattle.

The interest charge varies with the original costs of the cattle and the length of the feeding period. While the light-weight cattle cost less per animal, the total interest charge for them was almost as high as for heavy cattle, since they were fed for a longer period. The variations in other items of cost—miscellaneous expenses and death risk—cannot in any way be related to the weights of the cattle (Tables 3 and 5).

While the total cost of 100 pounds of gain increases as the initial weights of the cattle increase, the credit for manure and pork is larger for the heavier cattle. The differences in these items in the different groups reduce substantially the differences in the net cost of gains. While the total cost of producing 100 pounds of beef varied from \$16.52 with the lighter cattle to \$26.17 with the heavier—a difference of \$9.65—the net cost after allowing credit for the manure and pork varied from \$13.28 to \$20.23, lowering the difference from \$9.65 to \$6.95. The medium-weight group showed the lowest net cost for 100 pounds of gain, \$13.08, even tho an abnormally high death risk, which of course cannot be considered peculiar to cattle of this weight, is included.

TABLE 3.—COST OF FEEDING CATTLE OF DIFFERENT WEIGHTS: HANCOCK COUNTY, ILLINOIS, 1913-1922

	All cattle		Cattle weighing under 800 lbs.		Cattle weighing 800-1000 lbs.		Cattle weighing over 1000 lbs.	
	Cost per 100 lbs. gain	Percent of total cost	Cost per 100 lbs. gain	Percent of total cost	Cost per 100 lbs. gain	Percent of total cost	Cost per 100 lbs. gain	Percent of total cost
Total cost per 100 lbs. gain.....	\$19.30	100.00	\$16.52	100.00	\$17.61	100.00	\$26.17	100.00
Feed.....	\$16.50	85.50	\$14.03	84.93	\$14.88	84.48	\$22.83	87.22
Man labor.....	.79	4.10	.64	3.86	.78	4.46	1.02	3.88
Horse labor.....	.35	1.81	.25	1.53	.34	1.95	.47	1.82
General farm expense.....	.56	2.90	.64	3.86	.48	2.70	.61	2.35
Interest.....	.77	4.00	.74	4.52	.76	4.52	.83	3.18
Building.....	.16	.82	.13	.77	.14	.78	.23	.89
Miscellaneous.....	.04	.21	.04	.26	.01	.05	.10	.37
Death risk.....	.13	.66	.05	.27	.22	1.26	.08	.29
Total credits:								
Value of manure.....	\$ 2.14		\$ 1.86		\$ 2.22		\$ 2.40	
Value of pork.....	2.30		1.38		2.31		3.54	
Net cost per 100 lbs. gain.....	\$14.86		\$13.28		\$13.08		\$20.23	

Since on most of these farms, the refuse of roughage provided most of the bedding for the cattle, the full charge for material used as bedding is included with the charge for feed.

All cattle = 38 lots, 1,558 animals.

Cattle weighing under 800 pounds = 12 lots, 399 animals, average weight 609 pounds.

Cattle weighing 800-1000 pounds = 15 lots, 666 animals, average weight 915 pounds.

Cattle weighing over 1000 pounds = 11 lots, 493 animals, average weight 1,097 pounds.

TABLE 4.—AMOUNTS OF FEED REQUIRED IN FEEDING BEEF CATTLE OF DIFFERENT WEIGHTS: HANCOCK COUNTY, 1913-1922

	All cattle Average for 1,558 cattle			Cattle weighing under 800 lbs. (399 cattle)			Cattle weighing 800-1000 lbs. (666 cattle)			Cattle weighing over 1000 lbs. (493 cattle)			
	Per steer daily	Per 100 lbs. gain	Per steer daily	Per steer daily	Per 100 lbs. gain	Per steer daily	Per steer daily	Per 100 lbs. gain	Per steer daily	Per steer daily	Per 100 lbs. gain	Per steer daily	Per 100 lbs. gain
Length of feeding period (days).....	186.8												
Aver. initial weight (lbs.)...	894.1												
Gain in weight (lbs.).....	273.7												
Concentrates													
Corn (lbs.).....	2 494.2	911.2	1 901.0	7.68	543.6	2 788.0	15.66	1 004.5	2 577.4	19.37	1 244.5		
Oats (lbs.).....	34.5	12.6	129.0	.52	36.9	1.3	.01	5	3.0	.02	1.4		
Protein meal (lbs.).....	165.4	60.4	94.4	.38	27.0	183.4	1.03	66.7	198.8	1.49	95.9		
Roughage:													
Silage (lbs.).....	1 778.7	649.8	2 821.3	11.41	806.8	1 373.9	7.72	495.0	1 481.9	11.14	715.5		
Hay (lbs.).....	608.3	222.2	602.6	2.44	172.3	614.1	3.45	220.8	604.9	4.55	292.1		
Straw (lbs.).....	298.1	108.9	289.7	1.17	84.0	135.1	.76	48.7	525.1	3.94	253.5		
Corn stover (lbs.).....	591.6	216.1	376.8	1.52	107.7	568.9	3.20	205.2	795.4	5.98	384.1		
Pasture (days).....	30.0	10.9	80.8	.32	23.1	18.9	.10	6.81	3.7	.03	1.8		
Man labor (hours).....	11.01	4.02	10.6	.04	3.03	11.68	.06	4.21	10.44	.08	5.04		
Horse labor (hours).....	8.93	3.26	5.53	.02	1.57	9.72	.05	3.50	10.62	.08	5.13		

The smaller credit for pork and manure, per 100 pounds of gain in weight, in the light-weight group is at least partially accounted for by the fact that light cattle consume less feed, including corn, for every pound of gain (see Table 4). Also, it is a generally recognized fact that younger cattle make better use of their feed. The lightest cattle consumed a smaller proportion of concentrates to roughage than did the other cattle; this was undoubtedly due to the method of feeding rather than to the class of cattle fed. It may be noted that the light cattle were fed for a longer period of time. Many feeders buy light-weight cattle and feed them for longer periods, getting a considerable part of the increase in weight thru growth rather than thru fattening, which makes possible the use of larger proportions of roughages.

VARIATIONS IN COST ON DIFFERENT FARMS

That the ability of men as cattle feeders varies widely is shown by the wide variation in the cost of producing 100 pounds of beef on eight different farms during the winter of 1913-14 (Table 5 and Fig. 4).

TABLE 5.—VARIATIONS IN COST OF FEEDING BEEF CATTLE ON DIFFERENT FARMS DURING THE WINTER OF 1913-14

Farm No.....	1	2	3	4	5	6	7	8
Number of cattle fed	40	25	20	15	60	23	44	84
Period fed (days)...	222	210	148	132	166	133	168	90
Initial weight per steer (lbs.).....	918	836	758	920	991	1 007	888	1 216
Total gain per steer.	380	366	249	273	267	213	188	125
Final wt. per steer..	1 298	1 202	1 007	1 193	1 258	1 220	1 076	1 341
Initial cost per cwt..	\$7.24	\$7.02	\$6.90	\$6.88	\$7.35	\$7.00	\$7.35	\$7.90
Selling price per cwt.	8.50	8.20	7.90	8.20	8.63	8.15	8.30	9.00
Margin.....	1.26	1.18	1.00	1.32	1.28	1.15	.95	1.10
Total cost of production per cwt.....	\$11.66	\$12.43	\$13.63	\$15.47	\$16.16	\$19.53	\$25.04	\$26.61
Feed.....	10.14	9.82	11.00	13.46	14.03	17.41	20.45	24.47
Man labor.....	.33	.77	.70	.50	.84	.38	1.26	.74
Horse labor.....	.15	.48	.51	.35	.28	.33	.40	.....
G. F. E.....	.26	.60	.64	.40	.58	.30	.74	.57
Interest.....	.70	.62	.55	.52	.32	.78	1.12	.72
Bldgs. and equip.	.08	.14	.23	.24	.05	.33	.23	.04
Miscellaneous.....	.....	.....	.....	.....	.06	.....	.06	.07
Death risk.....	.....	.....	.....	.....	.....	.....	.78	.....
Profit or loss per steer.....	\$12.60	\$7.30	\$1.98	\$.65	\$1.10	\$-2.77	\$-14.50	\$-4.25

These records are selected for illustration because they were not affected by any violent price changes and because there are enough of them to provide a good basis for comparison.

The cost of the feed used in producing 100 pounds of beef varied from \$9.82 on Farm No. 2 to \$24.47 on Farm No. 8. The cost of man labor varied from 33 cents on Farm No. 1 to \$1.26 on Farm No. 7, a difference of 93 cents for every 100 pounds of gain. No horse labor was used on Farm No. 8, while on Farm No. 3 horse labor cost 51 cents for every 100 pounds of gain.

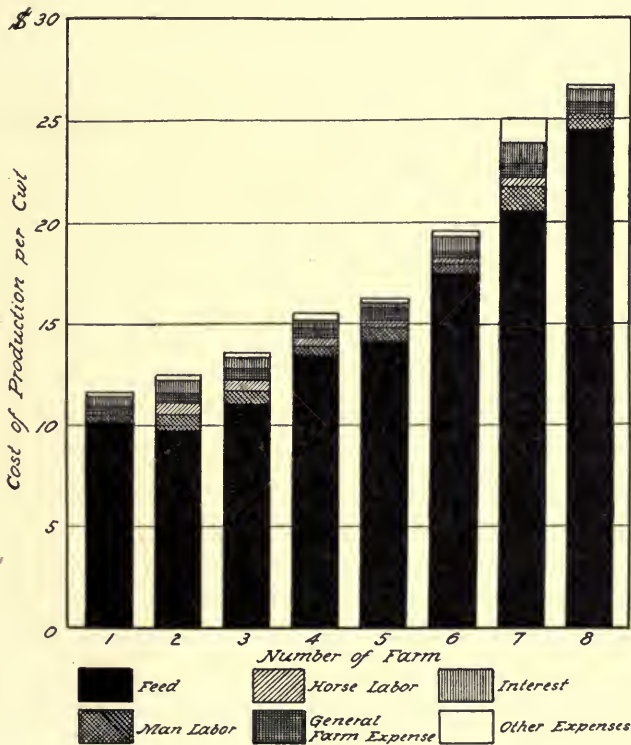


FIG. 4.—VARIATIONS ON DIFFERENT FARMS OF COST OF PRODUCING 100 POUNDS OF BEEF

In 1913-14 the cost of producing 100 pounds of beef varied from \$11.66 to \$26.61.

The variation in buildings and equipment expense from 5 cents on Farm No. 5 to 33 cents on No. 6 indicates what a wide difference there may be in this overhead expense.

General farm expenses, interest on the investment, and miscellaneous expenses also show considerable variation from farm to farm.

The margin between the total cost of the cattle and their selling price varied from a profit of \$12.60 per steer on the farm showing the lowest cost, to a loss of \$14.50 per steer on the farm having next to the highest cost, and a loss of \$4.25 per steer on the farm having the highest cost.

This margin between the total cost of producing 100 pounds of beef and the selling price must not be confused with the margin between the price paid per hundred pounds for the animal when put in the feed lot and the selling price, which is an entirely different matter discussed under the next heading.

THE NECESSARY MARGIN IN CATTLE FEEDING

Finished steers usually sell for more per hundredweight than they cost as feeders. This margin between the purchase price and the selling price is necessary under normal conditions, it is generally agreed, if a direct profit is to be realized in feeding cattle.

		Margin Received - Percent of Purchase Price per Cwt																
		Less than 5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%	35-40%	40-45%	45-50%	50-55%	55-60%	60-65%	65-70%	Above 70%	Total	
Loss	\$ 20-25	1	1														2	
	15-20		1	1	1	1										1	5	
	10-15	2			1												3	
	5-10							1									1	
	0-5		1	1	1		1	1									5	
	Profit																	
	0-5			1	2		1	1										5
	5-10				1	2		1	1			1						6
	10-15				1	2	1		2									6
	15-20											1			1			2
20-25									1			1			1		3	
Total		3	3	3	7	5	3	4	3	1		2	1		1	2	38	

FIG. 5.—RELATION BETWEEN MARGIN AND PROFIT OR LOSS PER STEER

The need of a good margin between the buying and selling price of cattle is evident from the above study of the profit or loss per steer in the 38 lots.

The profit or loss per steer for the different lots, and the margin expressed as a percentage of the purchase price, are shown in Fig. 5. If, for example, feeder steers were purchased at \$7 a hundredweight and sold at \$7.70, the margin would be 70 cents, or 10 percent of the purchase price.

While it would seem from these data that a margin equalling 15 percent or more of the purchase price would be necessary for a profit (Fig. 5), it should be recognized that it may be more or less than this, depending upon a number of factors such as the costs of feed, labor, and materials, the weight of the cattle when put on feed, the cost per

hundredweight when put on feed, and the total gain and the rate of gain a day.

All six lots of cattle which sold at a margin less than 10 percent above the purchase price made no profit (Fig. 5). Of 16 lots which showed losses, the average margin was only 18.6 percent of the purchase price, and only three lots showing a loss received over a 30-percent margin. Of the 22 lots which showed profits, the average margin was 33.6 percent and only 5 of these lots received a margin of less than 20 percent.

As shown in Fig. 5, while the results do not furnish a means of determining how large a margin is required, they do serve to point out the importance of a fair margin between the buying and selling price of feeder cattle in order to insure a direct profit under normal conditions.

CHARACTER OF FEED UTILIZED

The ability of fattening cattle to utilize large amounts of roughage is shown by the fact that the cattle in these studies used from 50 to 60 percent as much roughage other than silage (measured by weight) as

TABLE 6.—CHARACTER OF FEED UTILIZED BY FATTENING CATTLE OF DIFFERENT WEIGHTS: HANCOCK COUNTY, 1913-1922

Feed	Feed required for 100 pounds gain			
	All cattle	Cattle weighing less than 800 pounds	Cattle weighing from 800 pounds to 1000 pounds	Cattle weighing above 1000 pounds
	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>
Concentrates.....	984.2	607.5	1 071.7	1 341.8
Silage.....	649.8	806.8	495.0	715.5
Other roughages	547.2	364.0	474.7	929.7

they consumed of grain (Table 6). The feeds consumed by different weights of cattle are further analyzed in Table 4.

It is not usually appreciated that a rotation of corn, corn, oats, and clover, with yields of 50 bushels of corn, 45 bushels of oats, and two tons of clover per acre, produces approximately 1,780 pounds of grain and 3,062 pounds of roughage per acre yearly, or a ratio of grain to roughage of 100 to 174.

These roughages would mean little profit if sold, because of the limited market for them. While under favorable conditions hay may command a market price that returns a good profit, such crops are liable to weather damage, and it is frequently more profitable to feed them on the farm than to sell them. The problem of soil management also makes it more profitable to utilize roughages, especially those of a

leguminous nature, on the farm, for in this way a considerable part of the plant food taken up in the crops is returned to the soil instead of sold from the farm.

Since different rotations of crops found in the corn belt normally produce more roughage than concentrates, and since fattening cattle, as compared with other meat animals, consume a large amount of roughage, cattle feeding would seem to fit especially well into corn-belt agriculture.

RELATION OF CATTLE-FEEDING COSTS TO OTHER FARM COSTS

An attempt to show the place of the cattle-feeding enterprise in the organization of the farm should first of all take into account available feeds, since feed normally makes up well over 80 percent of the cost of fattening beef steers (Table 2). Other conditions which must be considered are the available man and horse labor, the equipment already on the farm, and the ability of the farmer.

While in this study each cost item was valued at average farm prices, on a particular farm some of the items may not represent as large an actual cost as on other farms; that is, cattle feeding may reduce costs of other products or utilize labor or feed that otherwise would not be used to the best advantage.

On farms that produce large amounts of corn for sale, the feeding of beef cattle fits into the farming system in a more advantageous way than any other livestock enterprise except perhaps the feeding of sheep. Feeder cattle can be purchased after the rush of crop work is completed, fed during the winter months, and sold in the spring before the heaviest demand for labor. Also, cattle fed during the winter do not take up land in a way that reduces the crop acreage.

In estimating the availability of feed one should consider both the cropping system and the amount of untillable land that can be used only for pasture. If untillable land is to be utilized, the farm is suited for grazing stocker cattle or sheep, raising beef calves, dairying, or feeding cattle on pasture. If the farm is composed entirely of tillable land the problem is little different, except that the pasturing of livestock on that particular farm is not a necessity if feed-lot production fills the need for livestock in a safe system of farming.

All salable feeds consumed by cattle were charged at farm prices in these studies. Values also were placed on roughages which could not have been sold advantageously. Cattle feeding provides a method of marketing such roughages and at the same time returns to the soil a large part of the plant food materials removed by the crops. The credit assumed for manure in these data was a conservative estimate; the final value of manure can best be determined in terms of long-time increases in yields. Also, corn and other grains which have been damaged by unfavorable weather can usually be marketed to better advantage in the form of livestock and livestock products than when sold directly.

If all the man labor used in fattening a carload of cattle were hired, it would amount to a considerable charge, but in this area farmers frequently feed cattle without employing other than family labor. Winter labor created by cattle feeding also may help provide all-year employment and serve as a means of retaining hired labor of a good grade. The corn-belt farmer who does not have livestock usually has little opportunity to use labor productively during the winter months. The labor available at that time is often sufficient to feed a carload or more of cattle; hence cattle feeding may be considered an advantageous means of marketing labor.

On many farms the cost of horse labor used in feeding cattle is to a large extent a gain from the standpoint of the whole farm. Frequently there is little labor for horses on corn-belt farms during the winter unless they are used in caring for livestock. The cost of keeping horses is in the main a fixed expense which must be borne by all of the labor the horse performs. Hence the horse labor used for cattle may be looked upon as a reduction of the horse-labor expense which would have to be borne by other productive enterprises if cattle were not fed, or as a means of creating a market for horse labor at a fair rate per hour.

If cattle were not fed a considerable part of the farm crops, both man and horse labor would be used in marketing that part of the crops. If this plan were followed on a particular farm during the winter season, it would be accomplished mainly by exchange labor, which would have to be repaid at various times of the year. Some exchange labor in marketing crops, especially corn, must be repaid during the growing season, when farm labor should be most productive. Consequently it would seem that direct marketing of crops adds materially to farm labor costs since it does not utilize available seasonal labor as effectively as cattle feeding.

General, or over-head, farm expenses must be proportioned in some way to the various productive enterprises. In the main these expenses will be realized whether or not cattle are fed. When cattle feeding is introduced and a portion of general expenses is charged to cattle, the amount of expense thus shifted tends to increase the profits of the other enterprises. However, the usual cost-accounting procedure does not credit the cattle for such resulting advantages.

Most of the other items of expense charged to cattle feeding in this study were directly due to that enterprise.

By carefully analyzing the organization of the entire farm, it becomes clear that the separate enterprises of the farm are largely dependent on each other for their success; in fact, that the efficiency or profitableness with which the farm unit is operated is more dependent upon the interrelation of the separate enterprises than upon the management of any single one.

PART II—THE PLACE OF CATTLE FEEDING ON A CORN-BELT FARM

Whether cattle feeding will fit profitably into a system of farming is dependent upon many factors, as was shown by the preceding discussion of costs. The most profitable system of farming for any given farm depends upon conditions which may be peculiar to that farm, and the advantages realized from a particular enterprise may not be realized to the same extent or in the same way on other farms. Each farm then becomes an individual problem.

The following analysis of one of the farms in this study is offered as an illustration of the way in which the beef-cattle enterprise may be analyzed so as to show just what its relation is to the farm as a whole. That is, having determined the direct profit from the enterprise, we may then ask what is the indirect profit as shown by the effect of the enterprise in reducing the cost of other enterprises, and what are the benefits realized in the organization and operation of the farm as a whole.

The farm selected comprized 295 acres, all of which could be cultivated, and records on it were secured for a continuous seven-year period.

TABLE 7.—RESULTS OF SEVEN YEARS OF CATTLE FEEDING ON THE SAME FARM IN
HANCOCK COUNTY, ILLINOIS, 1913-1919

395 cattle fed

	Average per year for the seven-year period		Average per steer	
Initial weight of cattle (lbs.)		58 116		1 030
Total gain (lbs.)		14 280		253
Final weight (lbs.)		72 396		1 283
Initial cost		\$4 616.09		\$ 81.84
Operating costs in feed lot		\$3 251.17		\$ 57.64
Feed	\$2 812.11		\$49.86	
Man labor	146.06		2.59	
Horse labor	71.84		1.27	
General farm expense	68.77		1.22	
Interest	107.19		1.90	
Buildings and equipment	19.47		.35	
Miscellaneous	14.68		.26	
Death risk	11.05		.19	
Marketing expense		\$ 170.66		\$ 3.02
Total cost at date of selling		\$8 037.92		\$142.50
Total credit		\$ 800.69		\$ 14.19
Manure credit	\$ 319.04		\$ 5.65	
Pork credit	481.65		8.54	
Net cost		\$7 237.23		\$128.31
Sale price		7 527.86		133.47
Profit		\$290.63		\$ 5.16

It is not considered ideal, but is typical of many corn-belt farms. From 40 to 79 cattle were fed annually; a total of 395 during the seven years.

Practically all the cattle were put on feed in October or November at an average weight of 1,030 pounds and were sold in March, April, or May at an average weight of 1,283 pounds, showing an average gain of 253 pounds. The cattle were fed an average of 156 days.

The initial cost of steers per head was \$81.84, the operating costs while in the feed lot were \$57.64, and the marketing expense was \$3.02, making the gross cost \$142.50 (Table 7). A credit of \$5.65 for manure and \$8.54 for pork left a net cost of \$128.31. With a selling price of \$133.47, there was a net profit of \$5.16 per steer. The operator then realized a direct profit of \$290.63 a year as an average.

When, however, all less-direct profit is taken into consideration, the value of the enterprise to this particular farm proved to be \$827.65 yearly, or two and one-half times as much as shown above. This profit, tho less obvious, is just as real as the "direct" profit and is the amount one should take into consideration when deciding whether or not the enterprise is a desirable one for his farm.

How the total value of the cattle enterprise to the farm was determined is shown in the following pages from several standpoints: namely, the utilization of farm raised crops; the utilization of available man and horse labor; the lowering of the amount of general expense charged to other enterprises; the effect upon the maintenance of soil fertility; and finally by way of summary the effect upon the farm as a whole, expressed in dollars and cents, if the enterprise were removed from the farm.

CATTLE FEEDING UTILIZES FARM-RAISED CROPS

As an average for the seven-year period, \$2,812.11 worth of feed was consumed annually by beef cattle. This represented \$2,464.48 worth of farm-raised concentrates and purchased feeds and \$347.63 worth of farm-raised roughages. While some of the roughages had a sale value, a large part of this feed would have been returned directly to the land if cattle had not been fed. Expressed in terms of weight, a total of 242,620 pounds of roughage and 172,073 pounds of grain was utilized by the cattle, or in the ratio of roughage to grain of 141 to 100 (Table 8). The importance of this utilization of roughage is again emphasized by comparing the total production of roughages with the total production of crops, which gives a ratio of 152 to 100.

Cattle and horses were the only classes of livestock that consumed a large proportion of roughages as compared with grain. While the horses used a larger proportion than the cattle—a ratio of 201 to 100 as compared with 141 to 100—the number of horses kept to operate the average corn-belt farm is not large enough to make it possible to use in that way any large part of the roughages grown.

TABLE 8.—FEED PRODUCED AND FEED UTILIZED YEARLY BY FATTENING CATTLE AS AN AVERAGE OF SEVEN YEARS ON A HANCOCK COUNTY FARM

Crops	Acres	Amount produced			Amount used by fattening steers				Value		
		Tons or bushels	Weight in pounds		Tons or bushels	Weight in pounds		Concentrates	Roughage	Concentrates	Roughage
			Concentrates	Roughage		Concentrates	Roughage				
Corn—Grain.....	145.0	5 583	312 648	352 812	3 069	171 864	128 900	\$2 127.53			
Stover.....		176.4		37 143	64.5		36 640			\$122.32	
Silage.....		18.5			18.3						
Oats—Grain.....	57.7	2 436	77 952	76 286	6.5	209	25 780	4.55		41.71	
Straw.....		38.1			12.9						
Rye—Grain.....	11.2	148	8 280	12 286	4.1		8 280			10.35	
Straw.....		6.1									
Soybeans—Grain....	12.0	41.6	2 496	16 857	4.6		7 960			48.70	
Hay.....		8.4		2 430	1.0		2 000			.75	
Chaff.....		1.2									
Clover—Hay.....	27.1	26.9	53 857	21 714	14.6		29 240			110.62	
Chaff.....		10.8			1.9		3 820			10.18	
Mixed hay.....	2.5	3.5	6 930	80 days						3.00	
Timothy hay.....	16.5	14.5	28 914								
Pasture days.....											
Total.....			401 376	609 229		172 073	242 620	\$2 132.08	\$347.63		
Purchased feed.....					9.5	19 040		\$ 332.40			
Total.....			401 376	609 229		191 113	242 620	\$2 464.48	\$347.63		

An average of \$100 worth of roughage per year charged to cattle may well be considered to have had no sale value; oat and rye straw, clover and soybean chaff, corn stover, and pasture from second growth on fields would not have been sold. Also, a portion of the clover hay was clover cut following rye, which was not good marketable hay. Some of the soybean hay was also hardly a marketable product. Altho some of this feed might have commanded the sale value assigned to it, it was not the usual practice on this particular farm to sell such roughages as were not used in the cattle-feeding operations.

In so far as cattle consume roughages which otherwise would not have been sold, they provide a means of marketing such roughage and thereby increase the farm income. Normally such roughage would be charged to cattle at the price it would command in the market. However, from the standpoint of the farm that would not market such roughage except thru feeding it to livestock, the value of such roughage should not necessarily be considered a charge against the cattle.

Moreover, the fact that a farm produces a large quantity of roughage does not mean that all such roughage necessarily would command the market price assigned to it. There is a limited market demand for cheap roughage feed, and if every farmer who ordinarily sells grain should attempt to sell a large part of the roughage produced on his farm, the prices of such feeds would fall far short of paying the actual cash expense of marketing them.

MAKES USE OF LABOR THAT OFTEN IS WASTED

The average charge for the man and horse labor devoted to cattle feeding was \$217.90. This amount represents 771 hours of man labor and 911 hours of horse labor used from October to May inclusive. (Table 9 and Figs. 6 and 7.)

If cattle had not been fed, it is probable that much of this labor would have been wasted unless some other livestock had been kept, for thruout the winter sufficient family labor was available to care for the cattle and there was comparatively little other work for the horses. By the feeding of cattle, this labor was made productive and at the same time the enterprise added very little to the peak load of labor during the crop season.

Rates for man labor were determined monthly and each enterprise charged monthly with its share of labor. Cattle feeding, in providing a market for \$146.06 worth of man labor, used over 73 percent of this labor during December, January, February, and March, when there were no heavy labor demands for other productive work. In fact, only 14 percent of the man labor required by cattle feeding came at the time of the heavy spring crop work. Even this situation might have been avoided by earlier marketing of the cattle, altho the fact that cattle prices are ordinarily higher in April and May justified the holding of the cattle past the beginning of the cropping season, especially since

less than 6 percent of the total labor expended on the farm during those months was required in feeding cattle.

Cattle feeding results in a more distinct advantage in the case of horse labor costs than in the use of man labor. A large part of the charge of \$71.84 for the 911 hours of horse labor used was a clear gain to the farm. About 80 percent of this labor was required during December, January, February, and March, or the third of the year in which only 22 percent of the total amount of horse labor was used. The horse labor used for cattle was for feeding and bedding. This work was not heavy at any time and added little to the cost of maintaining the horses. The total cost of \$71.84 for horse labor charged to cattle may therefore be considered largely profit. The creating of a use for 911 hours of horse labor may be looked upon to a large extent as either an income due to marketing that amount of horse labor at a fair rate, or as a reduction of a like amount in the regular horse labor cost which would have been borne by the other enterprises if cattle had not been fed.

The use of labor in feeding cattle can be considered an advantage when the enterprise does not interfere with those parts of the farm business which require the largest amounts of labor. In this section the largest amount of labor is needed for spring crop work. The cattle-feeding enterprise as organized on this particular farm undoubtedly did provide a needed market for available man and horse labor.

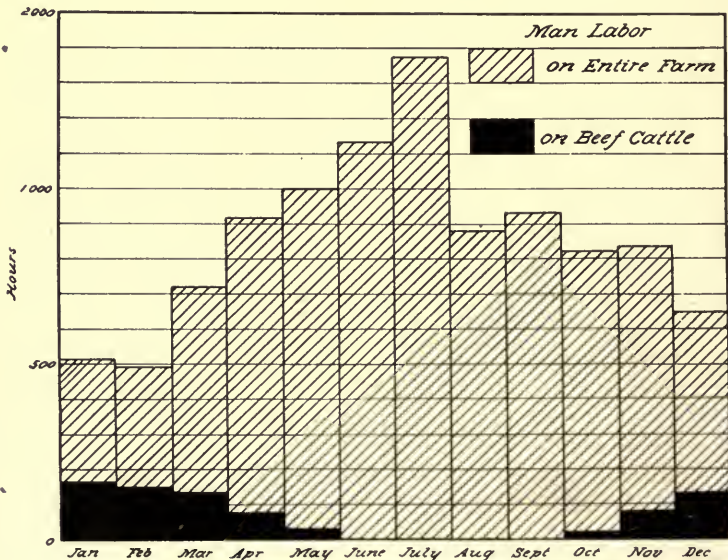


FIG. 6.—DISTRIBUTION OF MAN LABOR ON ONE FARM BY MONTHS: AVERAGE OF SEVEN YEARS

The heaviest demands for man labor for the feeding of beef cattle came during the months when the other enterprises required the least labor.

TABLE 9.—MONTHLY DISTRIBUTION OF MAN AND HORSE LABOR DEVOTED TO BEEF CATTLE AND OTHER WORK OVER A SEVEN-YEAR PERIOD (1913-1919) ON A HANCOCK COUNTY FARM

Month	Hours of man labor			Hours of horse labor		
	Beef-cattle work, 56.4 steers	All work except for beef cattle	All farm work	Beef-cattle work, 56.4 steers	All work except for beef cattle	All farm work
January.....	164	347	511	202	293	495
February.....	144	352	496	178	250	428
March.....	132	586	718	179	942	1 121
April.....	79	837	916	77	1 715	1 792
May.....	31	969	1 000	30	1 798	1 828
June.....	...	1 133	1 133	...	1 632	1 632
July.....	...	1 370	1 370	...	1 316	1 316
August.....	...	889	889	...	1 024	1 024
September.....	1	933	934	...	1 137	1 137
October.....	13	802	815	7	1 267	1 274
November.....	78	747	825	91	1 380	1 471
December.....	129	519	648	147	766	913

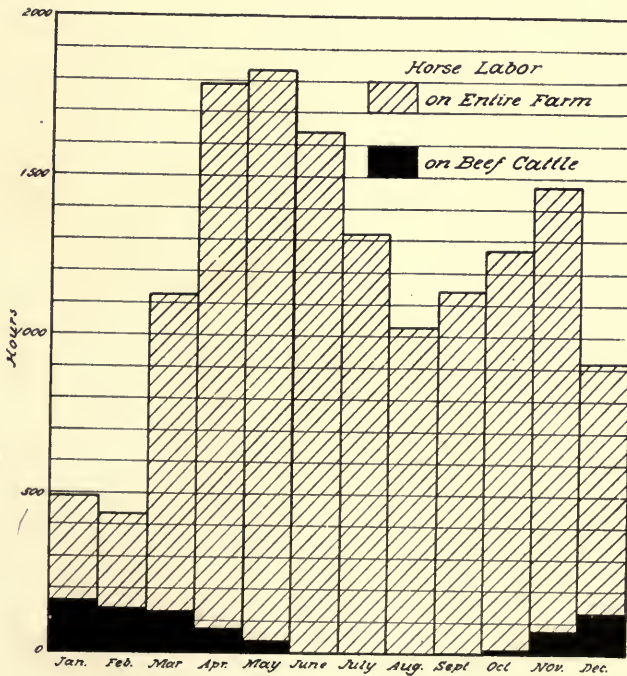


FIG. 7.—DISTRIBUTION OF HORSE LABOR ON ONE FARM BY MONTHS: AVERAGE OF SEVEN YEARS

The feeding of beef cattle provides winter use for horses when there is little other productive work for them.

REDUCES GENERAL FARM EXPENSE CHARGED TO OTHER ENTERPRISES

The item of general farm expense charged to cattle amounted to a sum nearly equal to the cost of horse labor, an average of \$68.77 a year. As stated on page 220, the total general farm expense is charged against the different productive enterprises in proportion to the amount of man labor expended on each enterprise. Since general farm expenses are realized in large part regardless of what enterprises are included in the business, the charging of a portion of the general farm expenses to beef cattle relieves the other productive enterprises of a large part of these costs.

The other items of expense on this farm, including death risks, building expense, interest, and miscellaneous expense, represent actual expense chargeable directly to cattle feeding.

HELPS TO MAINTAIN SOIL FERTILITY

The maintenance or the improvement of the soil thru livestock production is an advantage which would hardly have been recognized thirty to forty years ago. Now, however, the reduced productivity of land in most parts of the corn belt warrants careful attention.

The value of farm manure is measured most accurately in terms of increases in crop yields. On the particular farm studied it was impossible to measure accurately increases in yields following the application of farm manure, because cattle feeding had been a regular practice for over twenty years and accurate crop records were not available over so long a period. However, the following statement of the owner, who began operating the farm forty-five years ago, is a real contribution. "Twenty-five years ago it was noted on this farm that the soil was becoming impoverished. Crop yields and the physical condition of the soil were becoming worse year by year, even tho a rotation of corn, corn, oats and clover was followed. After the feeding of cattle was well started, yields with the same rotation were increased from 15 to 25 percent."

Since we have no records from this farm with which to measure the value of the manure in terms of increased crop yields, we may measure it by applying a conservative money value directly to it. At 75 cents a ton, the value of the manure produced by the cattle on this farm amounted to \$319.04 yearly (Table 7).

That this credit is conservative is shown by actual increases in yields secured from the use of farm manure in field experiments in Hancock county. The following results are reported from the University field at Carthage. For the seven-year period 1915-1921 inclusive (the same time during which the cost-of-production data were being secured in Hancock county), manure applied at the average rate of 1.74 tons a year gave increases in crop yields amounting to 4.2 bushels

of wheat, 6.3 bushels of corn, 3.8 bushels of oats, and a slight increase in the yields of clover and other legume hay. These increases valued at current prices were worth about \$1.40 for each ton of manure applied. After giving the cattle a credit of 75 cents a ton for the manure produced, a difference of 65 cents a ton is left to pay for hauling and spreading the manure, which would seem to be an ample allowance to cover actual expenses. It is apparent, therefore, that the credit of \$319.04 allowed the cattle for manure is supported by experimental evidence.¹

EFFECT UPON FARM AS A WHOLE IF CATTLE-FEEDING ENTERPRISE WERE REMOVED

It is clear from the foregoing that the increase in the farm income due to cattle feeding is a cumulative increase resulting from the interrelation of cattle feeding with the other farm enterprises. It has been shown that cattle feeding utilized feeds advantageously, provided profitable employment for available man and horse labor at a season when the labor was not needed for other productive enterprises, bore a share of the over-head expenses which otherwise would have been borne by the other enterprises, and resulted in considerable increases in crop yields. One way of measuring the cumulative value of these advantages is to contrast the financial statement of the entire farm business with a statement showing the cattle-feeding enterprise removed; this can be done fairly accurately for a given farm on which detailed cost information is available.

In removing the record of the cattle-feeding enterprise from the financial account of this farm (Table 10), the receipts were reduced by the selling value of the cattle and by the value of pork produced and accredited to cattle; and the sale of crops was increased by the value of the salable crops fed to beef cattle, figured at the local market price. The farm expenses were lessened by the initial cost of the cattle, the value of the feed purchased and fed to cattle, the annual cost of equipment chargeable to cattle, the interest on the added investment in cattle and equipment, and the share of other expenses which would be charged to the cattle.

This comparison shows the cattle-feeding enterprise to have added \$508.61 to the family income. The additional credit of \$319.04 for the value of plant food returned to the soil gives a total credit of \$827.65. From the standpoint of the farm as a whole, the cattle-feeding enterprise added this sum to the net income realized from the farm, whereas the enterprise analyzed separately showed a profit of only \$290.63, or

¹Further evidence that the credit allowed the cattle for the manure produced is conservative is found in Bulletin 209 of this Station: Fertilizing Constituents Excreted by Two-Year-Old Steers, by H. S. Grindley, H. W. Mumford, A. D. Emmett, and Sleeter Bull. 1918.

TABLE 10.—INCREASE IN SIZE OF FARM BUSINESS DUE TO CATTLE-FEEDING ENTERPRISE
AVERAGE OF SEVEN-YEAR PERIOD ON THE SAME FARM

	Farm income <i>with</i> cattle		Farm income <i>without</i> cattle	
Receipts and net increases.....		\$19 457.02		\$ 13 909.00
Crops.....	\$ 5 986.76		\$ 8 466.96	
Feeding cattle.....	7 546.57		.....
Pork credited to cattle.....	481.65		.....
Sale of other livestock.....	5 319.43		5 319.43	
Miscellaneous.....	122.61		122.61	
Cash expenses and depreciation..		\$ 8 121.76		\$ 3 186.55
Grain, feed, and seed bought..	\$ 971.51		\$ 639.11	
Livestock other than feeders..	694.24		694.24	
Feeding cattle.....	4 627.14		.....
Threshing, baling, etc.....	288.80		347.28	
Cash labor hired.....	420.77		420.77	
Upkeep and depreciation....	471.18		451.71	
Taxes and miscellaneous.....	648.12		633.44	
Net income.....		\$11 335.26		\$10 722.45
Interest on investment.....		2 354.36		2 250.16
Family income.....		8 980.90		8 472.29
Increase in family income.....		\$ 508.61		
Value of added fertility.....		319.04		
Total credit due to cattle feeding.....		\$ 827.65		

little more than a third as large a credit. The following statement of the owner in regard to the advantages of cattle feeding to the farm as a whole may well be added.

"I look back upon the years spent in buying and feeding cattle as the best years of my life, that is, from the standpoint of using labor advantageously and in satisfying the love of gain."

VALUE OF COST ACCOUNTS IN ANALYZING THE FARM BUSINESS

The analysis just given illustrates the primary purpose of cost accounting, which is to show how farms may be organized on a more profitable basis. Detailed cost-accounting data make possible a careful analysis of the efficiency of any part of the farm business, both when the enterprise is considered separately and when it is considered in its relation to the farm business as a whole.

The economic relationship of any farm enterprise to the remainder of the farm business is quite as important as the study of the efficiency of the separate enterprise, as has been shown clearly in the foregoing; and while productive enterprises other than the feeding of beef cattle might lend themselves to a similar analysis, hardly any other phase of farm production has the same complementary relationship with other

parts of the farm business. The beef-cattle enterprise is favored by the fact that crop enterprises compete with each other for labor at the season of the year when labor is in greatest demand, and that other livestock enterprises, except the feeding of sheep, the grazing of beef cattle, and possibly winter dairying, are subject to all-year labor demands and require a larger proportion of readily salable grain crops. Furthermore, the cattle-feeding enterprise, which does not directly require much land area, can be added to the farm business in a surplus corn-producing area without displacing some other enterprise either wholly or in part. This adds volume to the farm business without requiring increased acreage. This is important in a section where land makes up a large part of the total farm investment.

Finally, this analysis helps to explain the belief of many cattle feeders that while over a period of years there seems to be comparatively little direct profit in feeding cattle, the enterprise nevertheless adds materially to the net income of the farm as a whole. This is due largely to the fact that it utilizes non-marketable or low-grade feed, provides employment for available man and horse labor, shares a part of the overhead costs of the farm, and helps maintain the productivity of the land.



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