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REPORT
of
COMMITTEE ON EXAMINATION

This is to certify that we the undersigned, as a Committee of the Graduate School, have given Francis Winfred Peck final oral examination for the degree of Master of Science. We recommend that the degree of Master of Science be conferred upon the candidate.

Minneapolis, Minnesota

May 25 1917

Andrew Boss
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REPORT
of
COMMITTEE ON THESIS

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by Francis Winfred Peck for the degree of Master of Science. They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science.

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FACTORS OF COST IN MEAT
PRODUCTION

A THESIS SUBMITTED TO THE FACULTY OF THE
GRADUATE SCHOOL OF THE UNIVERSITY OF MINNESOTA

by

FRANCIS WINFRED PECK

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FACTORS OF COST IN MEAT PRODUCTION

Introduction

The economic production of meat is attracting widespread attention in every meat-producing state. In the corn belt states this subject is demanding particular attention to the investigation of the problem and to the dissemination of the data obtained.

A more important problem has never confronted the American farmer; with an increasing population, limited area of land constantly rising in salable value, high-priced feed, scarcity of labor, and a widely fluctuating market, the producer has need of all possible knowledge that will make possible more economic production of meat.

In the past days of the range, cattle were produced in large numbers at a cost that allowed a profit to the raiser of the stock and at the same time allowed a margin between the range price and the finished fat-cattle price on which the corn belt farmer was able to make a direct cash profit besides the value of the by-product of fertility for the land. During the past few years the selling price of feeders grown on Western areas has been so high and the finished-cattle price at such a figure as to make profits with past methods of cattle-feeding extremely low, and in many instances the margin has been so narrowed as to cause actual cash losses on the operation.

Not only has the margin between buying and selling prices of cattle been narrowed but high values of feed and labor have operated to demand a wider margin than was formerly required.

The combination of these two conditions has been fundamental in decreasing profits in feeding.

The practicability of raising calves for feeding purposes on such priced land as obtains in southern and central Minnesota is a very important unsolved problem, and very little data on this question are available at this time. Another fact to be borne in mind is that a great many farms are now fully stocked and enough feed to produce beef cannot be raised if the other stock is maintained. In such localities calves are sure to be sold as veal. There is need of a thorough investigation of beef cattle raising operations in the state, and also of experimental data on the practical farm-raising and feeding of cattle.

That there is need of a thorough knowledge of the factors of cost from the farm standpoint is evident when one considers that practically all investigations in feeding have been experimental in nature, and have treated mainly of the feed consumption, its value and effect. From a business standpoint the other costs should be included so as to know the economic status of producing meat as compared with producing milk, crops, or any other farm product.

The possession of such knowledge based on practical operations means to be forearmed and experienced in the business side of such operations, and affords a basis for estimating costs in advance that may mean increasing the net returns from the farms.

Statistics of the Meat Situation¹

To illustrate the growth of the meat industry in the United States and the part it takes in world consumption and distribution, the following statistics are presented:

Beef Cattle and Hogs on Farms in United States

<u>Year</u>	<u>Number of cattle</u>	<u>Change in per cent</u>	<u>Number of hogs</u>	<u>Change in per cent</u>
1840	15,000,000		26,000,000	
1860	25,600,000	71	33,500,000	30
1880	36,000,000	40	47,700,000	42
1890	51,400,000	43	57,400,000	20
1900	67,700,000	32	62,900,000	10
1910	65,500,000	- 3	69,200,000	10
1912			76,400,000	10
1913	56,500,000	-14		
1914			58,900,000	-23
1916	61,800,000	9	68,000,000	15

- - - - -

The highest number of cattle was in 1907 when 73,534,000 were reported. The greatest decrease was from 1910 to 1914 in cattle, and 1913 and 1914 in hogs, due to the epidemic of hog cholera. The total estimated value of cattle, swine and sheep on farms January 1, 1916, was \$3,332,000,000, or a value per capita of population of over \$30.

¹Taken from U. S. Dept. of Agriculture Report No. 109 - "Meat Situation in the United States" 1915

Of the large meat producing countries Argentina leads in the number of head of animals per capita of population as indicated below.

Number of Head per Capita January 1, 1913

	<u>Cattle</u>	<u>Hogs</u>	<u>Sheep</u>
United States	0.60	0.67	0.48
Argentina	3.60	.43	9.75
Australia	.43	.16	17.50
England	.26	.07	.67
Germany	.31	.38	.08

Meat Exported

Up to 1914 the United States was a large exporter of beef, pork and mutton. In this year the exports fell off as indicated in the following figures, but in 1915 a considerable increase was made.

<u>Year</u>	<u>Beef pounds</u>	<u>Pork pounds</u>	<u>Mutton pounds</u>
1895	433,000,000	1,096,000,000	591,000
1901	705,000,000	1,468,000,000	691,000
1906	731,906,000	1,467,000,000	516,000
1914	151,000,000	923,000,000	4,685,000
1915	395,000,000	1,107,000,000	3,877,000

Of the world's export trade in beef and beef products Argentina furnishes 60 per cent, Australia 14 per cent, and United States 14 per cent. This suggests that there is a great world demand for meat products, and as competition increases in its production all the facts that affect the industry must be studied.

The total imports to the United States in 1915 of beef, pork and mutton were 226,000,000 pounds, principally from Argentina.

As an indication of the value to the world of meat products it may be mentioned that they constitute in terms of food calories, one-third of the value of the sugar crop, two-thirds the value of the potato crop, one-sixth the value of the wheat crop, and one-half that of the rye crop. Australia leads in per capita consumption of meat as indicated below.

Per Capita Consumption of Meat in 1909

	<u>Pounds</u>
Australia	263
New Zealand	212
United States	171
Germany	115
World	93

Chicago Prices of Cattle, Hogs and Sheep

To illustrate the fluctuations of prices paid to the producer at a typical market during the past ten years Table I and Figures 1, 2, 3 and 4 are presented.

TABLE I
Prices per Hundredweight at Chicago²

Year	Native steers	Fat cows and heifers	Veal	Sheep	Lambs	Hogs
1907	\$ 5.80	\$ 3.85	\$10.80	\$ 5.25	\$ 7.05	\$ 6.10
1908	6.10	4.10	11.00	4.65	6.35	5.70
1909	6.35	4.25	11.90	5.00	7.40	7.35
1910	6.80	4.60	13.50	5.25	7.55	8.90
1911	6.40	4.30	12.10	3.95	5.95	6.70
1912	7.75	5.25	13.80	4.60	7.20	7.55
1913	8.25	6.10	16.20	5.20	7.70	8.35
1914	8.65	6.55	15.90	5.55	8.00	8.30
1915	8.40	6.10		6.40	9.00	7.10
1916	9.50	6.75		7.85	10.75	9.60
- - - -						
5 year mean price 1893-1897	4.36	2.75		3.42	4.46	4.65
1914 increase of price over 1893-1897	99%	138%		62%	80%	79%
- - - -						

At the first glance at Table I it seems as though there had been a large and compensating increase in the price received by the producer for all classes of stock. The average rise in prices is clearly indicated by the secular trend on each figure and by Table II. A comparison of the increased prices paid for native steers with the prices of corn for the same period illustrates why increased profits have not been the rule in steer feeding. See Figure 1.

²Taken from U.S. Dept. of Agriculture Report No. 109 - 1907 to 1914. 1915 and 1916 from The Drover's Journal.

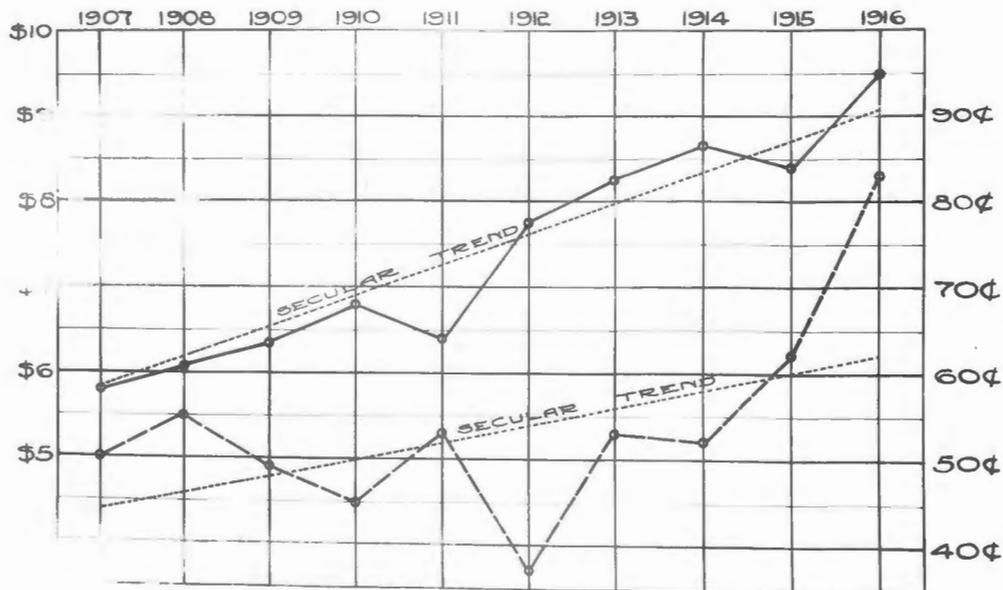


Figure 1 - Price per hundredweight of native steers at Chicago (top line) compared with the price per bushel of corn on Minnesota farms (lower line)

It is noted that while the fluctuations are not intimately correlated the secular trends indicate similar direction of price. The great seasonal and daily fluctuations from the average price in a market means that individual losses and gains are made with little direct relation to corn prices.

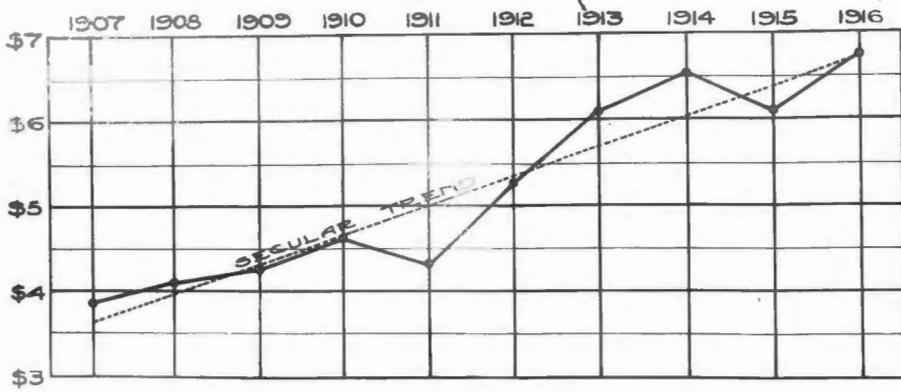


Figure 2 - Price per hundredweight of cows and heifers at Chicago

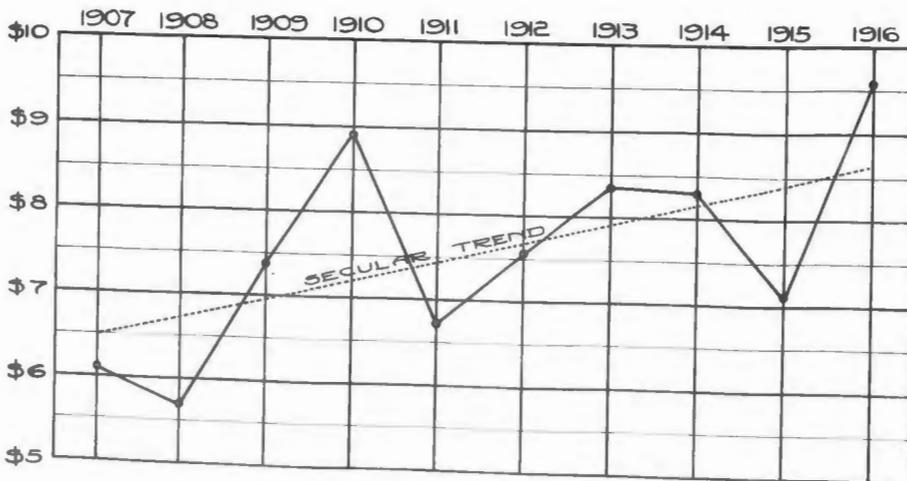


Figure 3 - Price per hundredweight of live hogs at Chicago

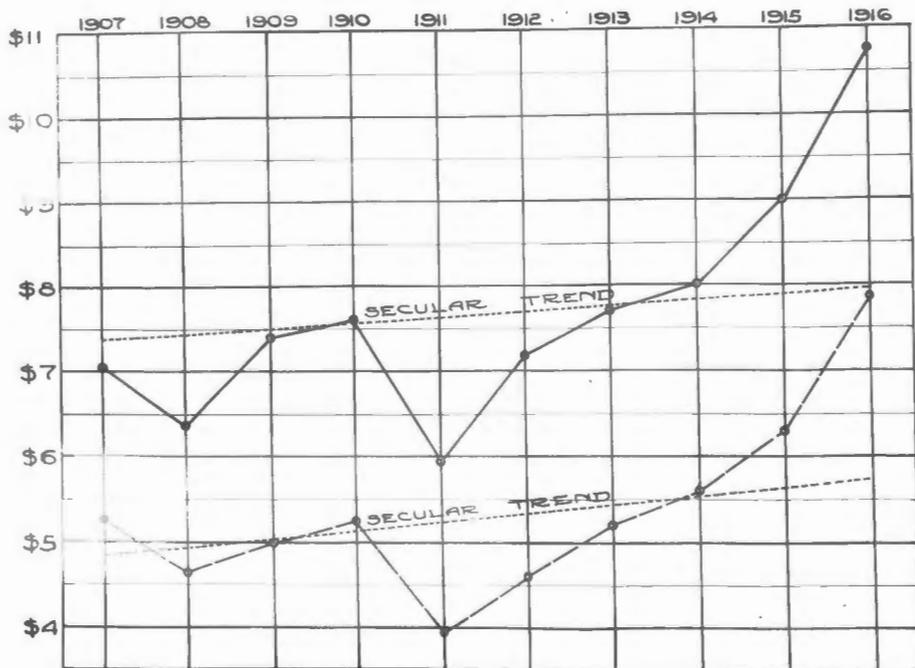


Figure 4 - Price per hundredweight of lambs at Chicago (top line)
Price per hundredweight of sheep at Chicago (lower line)

Prices of Minnesota Farm Feed

The prices of farm feeds have fluctuated although the changes have not been as violent as those of livestock prices.

Table II illustrates this fact.

TABLE II

Farm Prices per Bushel of Grain³

Year	Corn cents	Oats cents	Barley cents	Rye cents
1906	34	27	35	50
1907	50	41	67	66
1908	55	43	48	63
1909	49	35	47	60
1910	45	32	60	64
1911	53	40	96	78
1912	37	26	41	50
1913	53	32	48	47
1914	52	40	53	89
1915	62	32	49	81
Average	49	35	54	65
10-year average 1896-1905	31	24	33	44
1914 increase in price over 1896-1905	70%	66%	60%	102%

³Taken from U.S. Dept. of Agriculture Bureau of
Statistics Reports

Actual Food Prices Used

The following prices were used for the feed consumed by the stock during the three seasons of feeding in Minnesota. These prices were based on market prices less the cost of marketing for farm feeds and on cash purchases plus the cost of hauling for all purchased feed.

TABLE III

Prices per Bushel or Ton Charged to Livestock

Kind of feed	Unit	1913	1914	1915
Ear corn	bushel	\$ 0.34	\$ 0.49	\$ 0.58
Oats	"	.28	.34	.35
Barley	"		.45	.55
Rye	"	.45		
Oil meal	ton	34.00	32.00	34.00
Cotton seed meal	"	30.25		31.00
Shorts	"			21.70
Tankage	"	55.00	50.00	50.00
Corn fodder	"	4.70	5.66	5.33
Corn stover	"		2.00	2.00
Mixed hay	"	7.75	7.00	6.00
Alfalfa	"	10.00		
Silage	"	3.50	3.00	3.00

- - - -

In order to arrive at a usable figure for the price per hundredweight of farm grain, concentrates, roughage and silage, a weighted average of each kind of feed was made with the result shown in Table IV.

TABLE IVPrices per Hundredweight of Feed Consumed

<u>Kind of feed</u>	<u>1913</u>	<u>1914</u>	<u>1915</u>	<u>Average</u>
Farm grain	\$ 0.77	\$ 0.96	\$ 1.09	\$ 0.93
Concentrates	1.60	1.60	1.60	1.60
Roughage - hay	.38	.35	.30	.34
fodder	.23	.28	.26	.26
stover	.10	.10	.10	.10
Silage	.17	.15	.15	.15
Tankage	2.70	2.50	2.50	2.55

- - - -

The average farm price as quoted in Table IV for 1913, 1914 and 1915 for the four farm feeds is approximately ten cents per hundredweight higher than the average shown in Table II, which is as close as can be expected from the Year Book reports.

Under the discussion of feed as a factor of cost will be found a more complete discussion of the kind and quality of feed consumed in the feeding operations.

The Scope of the Investigation

In 1908 the Office of Farm Management, U. S. Department of Agriculture, started a study of the cost of producing gains on feeding-cattle, hogs and sheep in Indiana. A year later similar studies were started in Iowa with the writer as field agent gathering the desired data. The plan contemplated obtaining an accurate knowledge of the kind and amount of feed consumed by the feeding stock; the hours of man and horse labor required; all cash expenses and receipts for the stock, and the amount of gain in pounds of product made for the food consumed. The writer spent eighteen months in the field gathering the data, and three months in the office compiling the two feeding seasons' results. A brief summary of the costs obtained is presented in Farmers' Bul. 588, U. S. Department of Agriculture.

The data that form the basis of this thesis were obtained by the writer in Iowa during the two feeding seasons of 1909-1910 and 1910-1911, and in Minnesota during the three winters of 1912-1913, 1913-1914 and 1914-1915. Hereafter the seasons will be mentioned as 1910, 1911, 1913, 1914 and 1915. Emphasis has been placed on the factors of cost and the principles underlying their use and their relations rather than on the actual money costs and income of carrying on the feeding operations. This investigation dealt only with feeding-cattle, hogs and sheep, hence the data included on the cost factors of raising the stock to the feeder stage are quoted from other investigations. Available data covering Minnesota investigations on this subject are included in the discussion on "Purchase or Inventory Value of Stock."

Citations of previous work on the various factors of cost are made in the discussion of each factor rather than in a general statement covering the results of such work. Some of the results from both the Iowa and Minnesota investigations are presented in this thesis with the emphasis laid on the Minnesota studies. Figures 5 and 6 show the location of the cooperating farms in Minnesota and Iowa.



Figure 5 - Location of farms in the Minnesota investigation

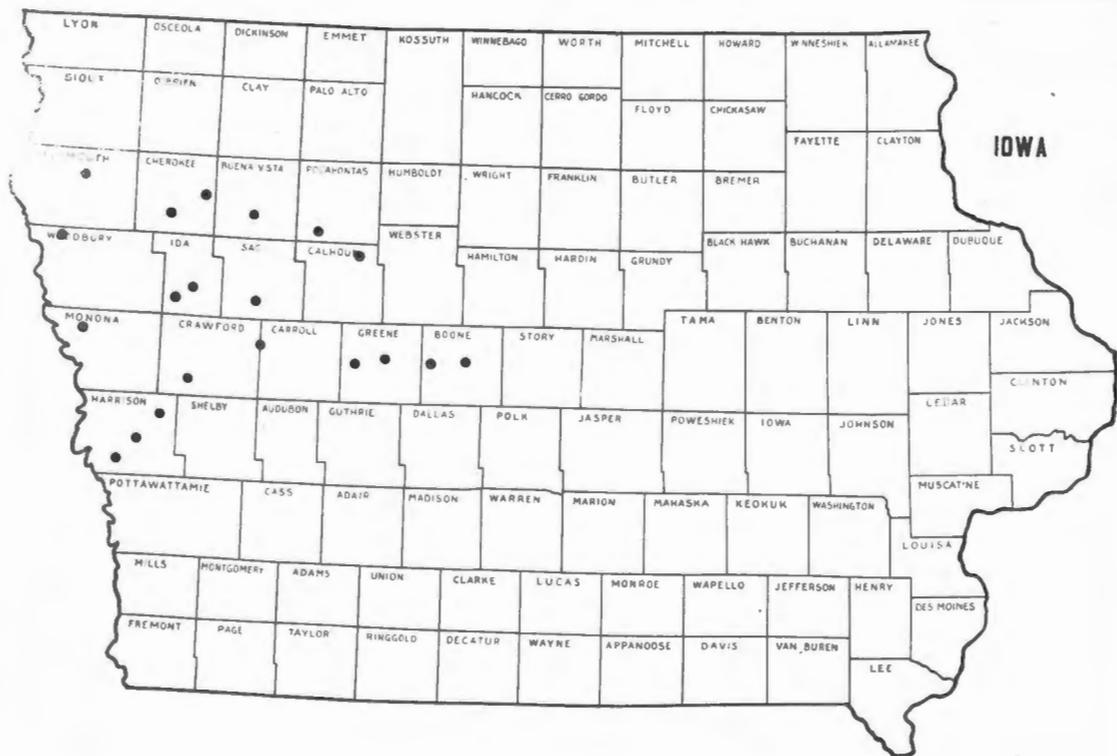


Figure 6 - Location of farms in the Iowa investigation

The Plan of the Investigation

In the Iowa work twenty-three cooperators were obtained in a territory approximating 900 miles of travel. Each was visited once every twenty-eight days in regular order, and feed and stock weights were obtained by the field man. Usually the stock was weighed on the day of the field man's visit to the farm. All farms were equipped with stock scales and accurate feed weights were obtained either by wagon or "unit" weights. The "unit" system of feeding was adopted, that is, the man doing the actual feeding of the stock fed with a basket, a scoop or a certain measure, and he recorded the changes in the number of these units fed and also the changes in the kind of feed. The field man, by weighing a large number of these units obtained an average weight per unit. A blank, kept in duplicate, see Figure 3, was filled out at each visit of the field man and left on the farm. This stated the pounds of feed consumed per head per day, hence the operator could see the increase or decrease of the ration and the accompanying gain at a glance, in understandable terms.

Other blanks were filled out and sent to the office for filing, but a duplicate of everything was kept by the field man. Many additional notes were made to supplement the feeding data in order to better understand the local conditions.

At the close of a feeding record, when the stock was sold or invoiced, a complete financial statement was left with the operator as indicated in Figure 7.

FEEDING RECORD - Farm of *Henry Arnold*

Kind of Stock: **Steers** Sheet No. _____

No.	Date	Age	DAILY FEED RATION - H.L. ARNOLD					No. Days	Daily Gain	Avg. Gain	Remarks
			Ear	Tim	Chop	Ground	Oil				
			CORN	Way	Corn	Corn	Meal				
21	10/1	11/5	46					46			
	11/6	11/3	8					8		28 more Clo-Tim.	
	11/20	12/7	24	18.4	11.9			4		12 = Corn Steaks	
	12/28	12/9	2	21.5	11.9			4			
	12/30	1/7	19	22.1	11.9			4	995.7		
	1/18	2/7	20	24.5	11.9			3 1/2			
	2/8	2/11	8		11.9	17.0		3 1/2			
	2/15								1083.0	1.9	
	2/16	4/21	6 1/2	11.9	17.0			3 1/2			
	2/21	2/27	6 1/2	11.9		12.6		3 1/2			
	2/28	3/1	2	11.9		14.6		3 1/2			
20	3/2		1	12.5		15.4		3 1/2		1 head died	
	3/9	3/6	4	12.5		17.6		3 1/2			
	3/17	3/15	9	8.3		17.6		3 1/2			
	3/16	3/21	6	3.3		22.86		1			
	3/22	3/23	2	3.3		25.4		1			
	3/24	3/26	3	3.3		20.3		1			
	3/27	3/30	3 1/2	3.3		20.3	1.2	1			
	3/30	4/13	10 1/2	3.3		20.3	3.5 1.2	1			
	4/13								1180.5	1.7	
	4/14	4/11	28	3.3		24.0	3.5 1.2	1			
	4/11								1248.5	2.43	
	4/12	4/10	9	3.3		24.0	3.5 1.2	1			
	4/21		4			3.5		4	1272.5	2.4 Sold at Chicago	

Salt, 1 lb @ \$1.50

Total	485.2	1083.7	715.4	432.5	115.4	132.0	51.2
Feed	504	\$1020	474	484	354	200	150
Cost	222.60	1083.20	33.60	255.60	40.25	26.00	42.00

19740 @ 425 cost	838.95	Gross Sales	1723.15	838.95	.073	2.20
all feeds	730.81	Cost	1713.66	83.42	.0737	2.17
Interest @ 6%	25.17	Net profit	9.49	.47	.0003	.03
20 head	68.85			392.7	min	21.9
Total Cost	1713.66			1573	min	8.8

Figure 7 - Showing a sample page of the feeding record filled out from visit to visit on each farm with the summary left at the end of the feeding period

The Minnesota study embraced but eight farms for each of the three years, and all of these records have not been used in this paper owing to abnormalities that prevent comparing essential features of the material. The accompanying maps show the location of the farms on which the studies were made. The same kind of data were secured as in the Iowa project, and in addition more complete data on building and equipment costs for fattening stock were obtained.

In order to discuss specific feeding operations the farms are numbered and reference to each may be noted in the discussion of the material presented in tabular form.

Table V presents the essential features of both the Iowa and Minnesota studies. The averages used in all the tables are weighted averages and not averages of averages.

TABLE V

<u>Item</u>	<u>Iowa</u>	<u>Minnesota</u>
Number of feeding seasons	2	3
Specific years	1910-11	1913-14-15
Number of farms each year	23	8
Total number of cattle on record	2100	726
" " " hogs " " (fed alone)	405	780
" " " " " "(back of cattle)	3000	1050
" " " sheep " "	5824	6120
Average " " cattle " " annually	1050	242
" " " hogs with cattle "	1500	350
" " " " fed alone "	200	390 - 2 yrs.
" " " sheep on record "	2950	2040
Total number of lots of cattle	6	20
" " " " hogs (fed alone)	6	7
" " " " sheep - - - - -	6	3

Kind of Stock

Cattle

In Iowa both native and western cattle were fed, being purchased in the locality in which they were fed or in Omaha, Nebraska, or Sioux City, Iowa. Usually fairly good quality steers were obtained with weights ranging from 350 pound calves for baby beef feeding to 1200 pound steers for short-time heavy feeding. Shorthorn and Hereford grades predominated although several lots of Angus bred steers were on record. In Minnesota the cattle were purchased at South St. Paul or in the locality in which they were fed. Shorthorn blood predominated and as a whole they were of poorer quality than those on record in Iowa. One lot of calves fed for baby beef was on record, the other lots ranging from 800 to 1000 pounds per head at the start of the feeding operations.

Hogs

Practically every lot of cattle was followed by hogs in the feed lot, and the usual practice was to allow about one and one-half hogs to the 1000 pound steer on full feed and to feed the hogs some extra feed to obtain maximum returns. Inventory prices were placed on the hogs unless purchased at the start or during the feeding season. Several records were obtained each year of the operations in feeding hogs alone, the data for which are presented in the following material.

Sheep

In Iowa most of the sheep records dealt with "sheeping-off" standing corn as a part of their fattening ration and in but one instance were records obtained on raising several hundred lambs from breeding ewes.

In Minnesota but one sheep feeder's records were obtained for each of the three years, and this stock was purchased at South St. Paul in the fall and fed on screenings and silage as hereinafter discussed.

Practically all the lots of stock were sold at South St. Paul, there being but two lots of steers shipped to Chicago in the three feeding seasons.

Factors of Cost

The factors of cost considered in the farm production of beef, pork and mutton are as follows: purchase price or inventory value of stock; feed; labor; interest; shelter; equipment; risk and selling expense. The total of all but the first makes up the operating cost in the business.

The Iowa data consider only purchase cost; feed; labor; interest and sale cost, there being no data on shelter or equipment charges. On many of the Minnesota farms it was impossible to accurately arrive at a satisfactory shelter and equipment charge hence the tables and figures presenting the complete cost cover only those lots of stock for which accurate data were available.

Purchase or Inventory Value of Stock

Inasmuch as most of the hogs on record were raised on the farm and their value based on the market price less the cost of marketing, the discussion of initial cost relates primarily to beef cattle and sheep which in the majority of the instances cited were purchased on the open market for fattening purposes.

The bearing of the first cost of livestock in the marketing of farm produce in meat form is one of the most important factors of the feeding business. An investment should always be

made with a certain definite fact in mind, namely, the finished product must pay back the invested capital with interest at a fair rate, besides all costs of producing the product and then leave a balance, if a profit is to be made. A serious responsibility is undertaken when a large investment is made in livestock. Certain risks are assumed and in order to reduce risk and insure chances for profitable operations the initial cost should be closely studied. An old adage in Iowa says "A steer well bought is half sold," meaning that if purchased advantageously half the profits are insured to the feeder. The rest must come by feeding and marketing. The point is clear, a high first cost of stock demands in advance a high finished price and high feed cost increases the risk.

High purchase costs cut down chances for profit and they increase the speculative chances the feeder takes. The greatest aid to a man, when confronted with the problem of paying a high price for stock is to have some idea of the difference between the price he pays and that he is likely to receive, and how near that difference will come to paying the operating costs. In other words, he must know something about what margin he must have to pay out or make a profit. This is figuring operating costs.

Most of the hogs were raised on the farm of the feeder, though at sales many young pigs were picked up to put in the feed lot. The initial cost of the pigs is not the economic problem that it is in cattle buying. When hogs were selling at 10 cents per pound in 1910 and in 1915, feeders paid as high as 13 and 14 cents per pound for sixty and seventy pound shoats to put back of cattle, and they made a profit. Hogs are looked upon more as an accessory to cattle feeding, and as most of them are raised and few purchased the initial price does not constitute as important a part as do

other costs.

Buying sheep is more similar to purchasing steers. Here the buying price is very important and often means a loss at the very start of the operation. The margin between buying and selling prices is not so great with sheep, and the economical gains made on the feed consumed is the main factor in successful sheep feeding, together with managing so as to reduce the death loss to a minimum.

Tables VI and VII present the average purchase cost of the stock fed in Iowa and Minnesota respectively.

TABLE VI

Initial Cost of Stock on the Iowa Farms

Year	Kind of stock	Number head	Average weight per head	Price per hundred-weight	Price per head	Average
1910	Cattle	935	910	\$ 4.68	\$42.64	{ \$ 4.82 per cwt.
1911	Cattle	963	990	4.94	49.06	{ 45.85 " head
1910	Hogs	141	51	7.00	3.57	{ 7.58 " cwt.
1911	Hogs	280	125	7.78	9.72	{ 7.66 " head
1910	Sheep	2963	69	5.07	3.50	{ 5.28 " cwt.
1911	Sheep	2948	66	5.44	3.59	{ 3.54 " head

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TABLE VII

Initial Cost of Stock on the Minnesota Farms

Year	Kind of stock	Number head	Average weight per head	Price per hundred-weight	Price per head	Average
1913	Cattle	97	954	\$ 6.15	\$58.74	{ \$ 6.36 per cwt.
1914	Cattle	138	900	6.38	57.41	{ 57.88 " head
1915	Cattle	121	890	6.49	57.72	{ 910 lb." "
1913	Hogs	429	114	7.67	8.74	{ 7.40 " cwt.
1914	Hogs	249	112	6.90	7.73	{ 8.37 " head { 113 lb." "
1913	Sheep	1880	83	5.10	4.23	{ 5.73 " cwt.
1914	Sheep	2111	75	5.40	4.05	{ 3.97 " head
1915	Sheep	2129	56	6.55	3.67	{ 69 lb." "

The purchase price per hundredweight of stock fed, as an average for the years covered in the investigation, illustrates in a measure the quality of stock selected for fattening. In the case of cattle the weight indicates feeder class and the price for each of the years is a very fair average of the prices paid at that time. Extra heavy cattle of prime quality and calves to be fed for baby beef were not included in the average quoted as they commanded relatively much higher prices. For example the lot of Hereford calves averaging 388 pounds per head were purchased at a cost of \$9.02 per hundredweight, while as high as \$7.75 per hundredweight was paid for the 1000 pound steers of good quality. It is noted from Table VI that the prices in 1910 and 1911 were much lower than those paid by Minnesota farmers in later years. The finished product was correspondingly lower in price as is shown in Table XXXVII. Taking the average of the three years, 1913 to 1915 the cost per head of \$58 for a 910 pound steer represents a very

fair average cost to the farmer. The same might be said of the figure quoted for the sheep feeders, but the number of hogs is sufficient only to base a very rough estimate on their value with an average weight of around 100 pounds about October first. Pigs of 60 to 80 pounds will often command a relatively high price per pound for following steers on feed because of the profits in pork as a by-product of the cattle feeding operation. This will be discussed under the title "Income from Feeding Cattle."

Market Price versus Cost of Cattle Raising

There has been considerable discussion of the probable profits in raising feeders on Minnesota farms. Claims have been made that calves can be raised to two years old cheaper than they can be purchased, while equally positive are the expressed views of those taking the opposite side. Little authentic data are available to prove or disprove the claims and it is doubtful if any quoted average could be said to prove the point. The best that can be done is to cite actual instances of what has been done under the conditions as found on the farms concerned:

As reported in the U.S. Department of Agriculture Report No. 111 on "The Meat Situation in the United States," the net cost of raising a yearling calf in Minnesota varied from \$31.95 to \$50.98, depending on the manner of raising. The high figure refers to the calves raised in the straight beef group, which surely is no cheaper than a good yearling fit for baby beef feeding could be purchased. It is the belief of the writer, based on the experience gained by talking with cattle men and by digesting what data there are available, that with good pasture, clover hay and corn silage as foundation feeds good feeding stock can profitably be produced from good milking strains of beef-bred cows, and it is further believed that results will bear out this opinion in practice.

Table VIII presents the figures for the various groups in Minnesota for two years 1914 and 1915.⁴

TABLE VIII

Cost of Producing a Minnesota Yearling Calf
Two Year Average 1914 and 1915 - U.S.Rep.No.111

Method of raising	Number of calves	Cost at weaning time	Average cost per yearling			
			Feed cost	Labor cost	Other costs	Gross cost
Straight beef	222	\$37.24	\$10.13	\$ 2.38	\$ 2.48	\$52.23
Dual-purpose	357	21.12	7.76	2.28	2.35	33.51
Mixed	340	28.59	10.55	2.49	2.20	43.83
Double nursing	60	25.20	10.72	1.69	2.29	39.90
Manure credit	Net cost	Average weight	Cost per pound	Remarks		
\$ 1.25	\$50.98	485	cents 10-1/2	Full nursing		
1.56	31.95	385	8-1/3	Skim milk calves		
1.19	42.64	435	9-3/4	Combination of above		
1.22	38.68	450	8-1/2	Two calves on one cow		

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The "dual-purpose" group in Table VIII shows a net cost per calf of \$31.95, indicating in all probability a calf fit for early fattening and one that would cost around 9 to 10 cents per pound on the calf market. The same may be said of the "double-nursing" group, although obviously better cows will be required and the operator will not have the cash income from milking, but on the other hand more labor will be required by the "dual-purpose" group.

Some of the points brought out in a questionnaire to western stockmen are of interest in the cost of production of feeder cattle. A reproduction of the averages obtained is presented. This is taken from Report No. 110 of the U.S. Department of Agriculture series on "The Meat Situation in the United States."

⁴ Taken from U.S. Dept. of Agriculture Report No. 111

TABLE 10.—Averages, by States, of answers from stockmen to questions 1 to 17, on the cost of producing cattle.

State.	1	2		3	4	5	6	7	8	9	10			11	12	13	14		15	16	17
		a	b								a	b	c				a	b			
	Months.				Months.			Per ct.		Per ct.	Pounds.	Pounds.									
Arizona.....	12.0	\$1.26	\$1.16					6.00	\$82.00	57.00	8.30	4.40	6.40	6.00	12.70	9.90	774.0	935.0	\$2.43	\$2.02	\$23.01
California.....	10.0	6.22	5.51	\$11.83	2.00	\$7.18	\$9.32	3.73	94.75	73.55	6.76	4.15	4.12	4.95	17.22	8.10	968.2	1,141.6	2.94	2.12	19.19
Colorado.....	7.4	2.35	2.12	9.50	4.60	8.56	8.80	4.16	131.90	69.30	8.03	4.90	4.54	5.26	18.32	8.82	883.0	1,084.5	2.76	2.36	35.66
Idaho.....	7.5	2.25	2.15	8.35	4.00	8.50	8.00	4.00	100.00	75.00	7.00	4.00	3.00	12.00	16.00	10.00	1,000.0	1,200.0	2.95	2.00	30.00
Montana.....	8.0	3.97	3.07	9.02	4.00	8.04	9.20	3.44	138.00	75.80	7.04	3.57	2.74	4.74	17.50	9.69	991.0	1,211.0	3.87	2.63	29.59
Nevada.....	8.0	3.00	2.56	7.28	3.50	7.57	7.95	4.00	93.00	70.00	6.00	4.00	4.00	6.00	17.00	8.00	940.0	1,140.0	2.75	1.88	20.00
New Mexico.....	11.2	1.24	1.10	1.00	.20			5.00	83.00	66.00	10.60	5.60	5.80	5.80	15.40	10.20	725.0	894.0	2.77	4.62	28.00
Oregon.....	8.59	3.94	3.51	9.92	3.41	7.61	8.05	4.04	113.35	75.74	5.39	3.27	3.00	3.35	13.50	8.42	975.7	1,185.9	3.53	1.85	25.80
Utah.....	9.0	2.98	1.95	7.65	3.50	7.65	8.15	4.00	93.00	69.00	6.00	5.00	5.00	8.00	15.00	8.00	900.0	1,065.0	2.95	3.88	20.00
Washington.....	7.9	5.47	5.19	8.61	4.10	9.92	12.28	3.72	124.15	79.48	5.33	4.78	3.70	5.24	14.70	8.70	1,032.0	1,225.0	3.71	3.20	25.61
Wyoming: ¹																					
District 2..	7.85	3.76	3.72	8.65	4.15	6.64	7.30	5.52	160.50	73.20	5.87	3.92	2.79	3.58	18.00	9.56	937.0	1,155.0	2.33	1.624	30.42
District 4..	7.0	3.14	1.89	9.33	5.00	8.33	9.75	4.00	132.00	83.00	7.00	3.00	3.00	7.00	12.00	9.00	1,075.0	1,300.0	1.87	2.29	32.00

¹ These are the district divisions of the Forest Service. District 4 covers the Teton and Wyoming National Forests south of Yellowstone Park and lying adjacent to the Idaho State line. District 2 covers the rest of the State.

SCHEDULE OF QUESTIONS SUBMITTED TO STOCKMEN.

- How many months are your cattle run on the open range or in pasture?
- What is the average cost to you per head for range and pasturage (for the time given under 1) for (a) a cow and calf; (b) dry stuff from (including) yearlings up?
- What do you estimate the range, pasturage, and other feed costs you to raise a calf from birth to 12 months of age?
- How many months each year do you feed your cattle hay or other farm crops?
- What is the cost of this feed (not including labor for feeding) per head of stock from yearlings up per year, where the cattle are fed as stock cattle, not as beef?
- What is the average cost per head for this winter feed, including the labor of feeding, in cases where feeding of stock cattle is contracted for by the head, the contractor to furnish hay and do the feeding?
- How many bulls to the hundred cows do you use in your herd?
- What is the average value of your bulls?
- What is the average number of calves born for each hundred cows of breeding age?
- How many cattle of all ages do you estimate you lose every year for each hundred head from disease, predatory animals, poison, and other causes (a) of calves up to 12 months old; (b) yearlings 12 months to 24 months old; (c) cattle over 24 months old.
- Based on her value what per cent do you allow for the yearly depreciation of a range cow?
- What is the average yearly per cent depreciation of bulls?
- What is the average annual rate of interest charged in your vicinity for money loaned on cattle?
- What is the average weight of (a) long 2-year-old steers sold direct from the range or pasture; (b) long 3-year-old steers sold direct from the range or pasture?
- What is your estimate of the yearly labor cost per head for your cattle, excluding calves?
- What is the rate of taxation per \$100 in your county?
- What is the per head valuation placed upon range cattle in your county for purposes of taxation?

Figure 8 - Summary Table reproduced from U.S.D.A. Report No. 110

Operating Costs

Feed

The item of feed cost is by far the largest and most important item of cost in the operation of feeding livestock. It constitutes approximately 80 per cent of the total operating cost of feeding cattle, and hence demands and deserves special consideration by the feeder. Upon the providing of a ration of farm feeds that produces economical gains on the stock fed depends to a large extent the success of the operation. From a two year average of 951 steers in Iowa that cost \$45.85 per head, the feed cost amounted to \$27.14 per head, or 59 per cent of the purchase price. The average cost of feed per steer for the three years on Minnesota farms was \$23.21, which amounted to 40 per cent of the average purchase price. This emphasizes the point that the feed cost should be reduced, if possible, even though labor is slightly increased.

The feed cost of fattening hogs constituted 76 per cent of the total operating cost on the Minnesota farms and 79 per cent on the Iowa farms where they were shipped to market in car lots. In the sheep feeding operations in Minnesota the records indicate the feed cost to be 91 per cent of the total cost, without any selling cost included. Table IX presents the average feed cost per head, per hundredweight and per pound of the cattle, hogs and sheep in the localities studied.

TABLE IX

Feed Cost of Stock on Record

Period	State	Kind of stock	Total number head	Number lots	Feed Cost			Per cent of operating cost
					per head	per cwt. of gain	per pound of gain	
2 yr. avg. 1910-11	Iowa	Cattle	1898	46	\$27.14	\$ 8.95	\$0.089	80.9
3 yr. avg. 1913-15	Minn.	Cattle	356	9	23.21	9.96	.099	79.0
2 yr. avg. 1910-11	Iowa	Hogs	405	6	3.71	3.33	.033	79.4
3 yr. avg. 1913-15	Minn.	Hogs	678	5	4.45	3.46	.035	76.0
2 yr. avg. 1910-11	Iowa	Sheep	5824	6	1.10	7.30	.073	75.3
3 yr. avg. 1913-15	Minn.	Sheep	6120	3	1.97	7.58	.076	91.6*

*No sale or labor cost in total cost

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In the Minnesota lots of cattle the cost of feed per pound of gain ranged from 6.2 cents per pound to 12.5 cents per pound with the average of 9.9 cents as indicated. The Hereford calves fed as baby beef cost 6.3 cents for feed per pound of gain. Other data on the feed cost per pound of gain seem to be very close to this cost under similar conditions.

In 1914 it is reported⁵ by a Kansas company that the feed cost per pound of gain on sixty three-year old steers fed 95 days was 12.8 cents. On sixty two year old steers fed 99 days the average feed cost per pound of gain was 11.8 cents, while on 26 yearlings fed 115 days the feed cost was 10.3 cents per pound. In 1915 the same company fed 84 three year old steers 101 days with an average feed cost of 8.9 cents per pound of gain.

⁵Breeders' Gazette pp.69-670 March 23, 1916

Ratio of Roughage to Grain

The proportion of grain and roughage in the ration and the kind of grain determine largely the cost of feed. It is believed that the common ratio in Iowa feeding is being changed to a more narrow ratio, that is, less grain is being consumed and better quality of roughage in nutriment is being fed. The average daily ration per head for the cattle in Iowa investigations was approximately 23 pounds of grain and 7.6 pounds of roughage, silage fed cattle not included; this is in the ratio of one part roughage to three parts grain. In 1908-9 the results of the feeding in Indiana indicated a ratio of about 1:1.5 and in some instances reversed the ratio, feeding slightly more roughage than grain⁶.

Table X presents the average daily ration in pounds per head for cattle with the ratio of roughage to grain, and also the number of days fed and the gain per head per day. Those lots receiving silage have a more narrow ratio because three pounds of silage is assumed to be equal to one pound of hay and is included in the roughage.

⁶Taken from unpublished data, by courtesy of the Office of Farm Management, U.S. Department of Agriculture

TABLE X

Ratio of Roughage to Grain in Cattle FeedingMinnesota Farms

Number of farm	Number head	Number days fed	Initial weight per head pounds	Grain daily per head pounds	Rough- age daily per head pounds	Ratio rough- age to grain	Gain per head per day	Remarks
2	45	124	875	28.0	12.5	1:2.2	2.2	
3	22	217	1046	34.5	17.6	1:2	3.0	
4	25	160	909	21.6	9.2	1:2.3	1.6	
5	72	215	970	12.8	12.5	1:1	1.6	Silage 26.5 lb. per head daily
9	28	151	981	19.6	18.3	1:1.1	1.8	
9	31	231	800	13.7	12.7	1:1.1	1.4	
5	69	166	916	6.9	12.5	1:0.5	0.9	Silage 25 lb. per head daily
5	72	227	780	11.4	11.7	1:1	0.5	Off feed
10	56	158	891	18.6	9.1	1:2	1.8	Silage 15 lb. per head daily
11	60	250	388	8.4	8.0	1:1	1.7	Baby beef calves
12	35	119	1056	4.9	27.0	1:0.2	1.2	Silage 45 lb. per head daily
14	28	149	871	15.2	16.4	1:1.1	1.5	Silage 14 lb. per head daily part time
15	27	83	800	7.7	16.0	1:0.5	1.2	Silage 36 lb. per head daily
16	26	150	871	9.4	17.0	1:0.6	1.7	Silage 27 lb. per head daily

The daily ration for hogs varied from five pounds per head to 10.2 pounds depending on pasture, skim milk, etc., used in the hog feeding. Ordinarily from two to four per cent of the hog's weight is estimated as being the amount usually fed. The sheep averaging about 70 pounds in weight consumed 2.2 pounds of screenings, one pound of silage and two-tenths pound of hay per head per day and gained almost two-tenths pound daily per head.

Recent investigations in the feed required by fattening cattle indicate that a much smaller grain ration can be fed over a long period of time with more profit than a large grain ration fed but a short time. Professor Haecker's published results⁷ show that the grain fed per head daily was slightly less than one per cent of the animal's live weight. In other words, a 1200 pound steer received but 10.7 pounds of grain daily where the calves were fed steadily from 100 pounds to 1200 pounds in weight. The cost of feed per pound of gain on steers from 200 pounds to 1200 pounds in weight did not exceed 11 cents; the range in cost being from 4.9 cents per pound for calves from 200 to 300 pounds in weight, to 11 cents for steers from 1100 to 1200 pounds in weight. The average cost of feed per pound of gain from 12 to 24 months or from 600 to 1200 pounds was nine cents. For heavier steers this cost increased so that the feed cost per pound between 1400 and 1500 pounds was 15.4 cents.

Table XI presents the actual amount of grain and roughage consumed per head per day and per 100 pounds live weight. It is extracted from Minnesota Bul. No. 155.

⁷Minnesota Bul. No. 155

TABLE XIDaily Gain, Grain and Roughage Consumed During Given Periods

Period Pounds	Actual			Per 100 Pounds Live Weight	
	Gain Pounds	Grain Pounds	Roughage Pounds	Grain Pounds	Roughage Pounds
100 to 200	0.88	0.86	0.99	0.57	0.65
200 to 300	1.37	2.85	3.71	1.14	1.48
300 to 400	1.48	3.79	6.08	1.08	1.74
400 to 500	1.62	4.39	7.45	.98	1.66
500 to 600	1.98	5.17	8.83	.94	1.60
600 to 700	1.71	6.25	8.94	.97	1.38
700 to 800	1.78	7.61	9.51	1.01	1.27
800 to 900	1.53	8.53	10.25	1.00	1.20
900 to 1,000	1.62	8.91	11.23	.92	1.18
1,000 to 1,100	1.53	9.49	11.29	.90	1.08
1,100 to 1,200	1.48	10.71	11.16	.93	.97

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On this ration the average gain per head per day was approximately 1.6 pounds for the period of 24 months.

Pounds of Grain and Roughage per Pound of Gain

There is a great variation in the pounds of grain per pound of gain, especially in cattle. The amount of grain depends on many factors, chief of which are weight and quality of steers, condition of feed and yards, kind of roughage, and manner of feeding. In other words, these factors affect the rate of gain per day and per unit of feed.

Table XII presents the feed consumed per pound of gain on the Minnesota farms.

TABLE XII

Grain and Roughage Consumed per Pound of Gain by Steers

Number of farm	Number head	Number days fed	Initial weight per head pounds	Gain daily per head pounds	Pounds feed per pound gain		Remarks	
					Grain	Roughage		
2	45	124	875	2.2	13.0	5.7		
4	25	160	909	1.6	10.9	4.6		
5	72	215	970	1.6	8.1	4.7	Silage fed	
5	69	166	916	0.9	8.5	13.8	Silage fed	
9	28	151	981	1.8	11.5	10.7		
10	56	158	891	1.8	10.4	5.1		
11	60*	250	388	1.6	5.0	4.8	Baby beef silage	
12	35	119	1056	1.2	10.7	22.2	Silage and stover	
14	28	149	871	1.5	10.3	8.0	Silage fed	
9	31	231	800	1.4	10.6	9.7		
16	13	150	978	1.7	5.4	9.2	Silage fed	
16	13	150	964	1.8	5.1	10.4	Bundle corn	
15	27	83	800	1.2	6.4	13.4	Silage fed	
Average		502	161	915	1.5	9.3	8.7	

* Not in average

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In 1910 the records from 774 steers fed in 15 lots in the Iowa study showed that 11.6 pounds of grain and four pounds of roughage were consumed per pound of gain, and in 1911 an average of 668 steers gave 10.8 pounds of grain and 3.8 pounds of roughage per pound of gain. Hay was the only roughage fed to these lots of steers. The average daily gain per steer for both years was 2.1 pounds, hence the average daily ration consumed can be easily computed.

The amount of feed consumed per pound of gain by hogs and sheep on Minnesota farms is shown in Table XIII.

TABLE XIII

Grain Consumed by Hogs and Sheep per Pound of Gain

Kind of stock	Number of farm	Number head	Number days fed	Initial weight per head pounds	Gain daily per head pounds	Pounds grain per pound gain	Pounds gain per bushel corn
Hogs	6	173	85	104	1.70	6.1	9.3
"	7	206	124	122	1.25	7.6	7.4
"	8	50	115	114	1.23	7.9	7.1
"	8	173	124	105	.93	4.6	14.3
"	7	78	88	128	1.23	4.7	14.1
Sheep	5	1880	136	83	.20	13.0	
"	5	2111	136	75	.21	13.0	
"	5	2129	154	56	.15	11.0	

Sheep were fed screenings as grain

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Experimental data on this subject indicate that pork gains may be obtained at a considerable less number of pounds of grain per pound of gain. The same is true of mutton gains.

The factors that affect the rate of gain for feeds consumed are the kind and condition of the feeds, the quality and weight of the stock, weather conditions and methods of feeding. The above results are presented merely to show what was actually fed to the stock in these instances. The number of lots are too small to afford a comparison with the many feeding experiments that have been carried on.

Corn Silage

Corn silage is becoming a common feed in beef production, and was also used as a very important part of the ration for fattening sheep in the Minnesota studies. The choosing of roughages that provide maximum nutriment per acre and that make a more economical balanced ration is becoming more common practice. Any rough feed that will displace high priced grain is sure to rank high in economic favor. Corn silage is such a feed for it has practically the same feeding value per acre as alfalfa when the yield is ten tons of silage and three tons of alfalfa.

The convenience of feeding, the saving of labor in feeding, the value of the succulence with other feeds, and the consumption of the entire corn plant assist in making silage a valuable feed in the ration. There were but a few lots of cattle silage fed in the Iowa work and it cannot be said that the Minnesota lots have proved any outstanding facts on this point.

Several lots of steers were fed silage in varying amounts and these are compared with four lots that received no silage. In as much as the grain ration of these lots varied in kind and amount the data are not conclusive and are here presented merely as an indication of the possibility that silage displaces a certain amount of grain in a ration.

TABLE XIV

Comparing "Silage" Rations with "No Silage" Rations

Year	Number of farm	Number head	Initial weight per head pounds	Daily per head				Pounds grain per pound gain
				Grain pounds	Roughage pounds	Silage pounds	Gain pounds	
1913	5	72	970	12.8	3.7	26.5	1.6	8.0
1914	10	56	891	18.6	4.1	15.0	1.8	10.4
1914	5	69	916	6.9	4.4	25.0	0.8	8.6
1915	14	28	871	15.2	11.8	14.1	1.5	10.3
1915	12	35	1056	12.9	12.0	45.0	1.2	10.7
1915	15	27	800	7.7	4.0	36.0	1.2	6.4
1915	16	13	978	9.4	7.0	26.7	1.7	5.4
Average		300	927	12.3	5.5	25.0	1.4	8.9

No Silage in Ration

1913	2	45	875	28.0	12.5		2.2	13.0
1913	4	25	909	21.6	9.2		1.6	10.9
1914	9	28	981	19.0	2.3 hay 16.0 stover		1.5	12.6
1915	9	31	800	13.7	2.3 hay 10.4 stover		1.4	9.8
Average		129	886	20.9	13.6		1.8	11.6

It is noted that the silage fed steers required 8.9 pounds of grain per pound of gain while those that received no silage required 11.6 pounds of grain per pound of gain. If three pounds of silage is allowed to equal one pound of the roughage fed, the silage steers would have received the same number of pounds of roughage as the no-silage lots. The daily gain was less by almost one-half pound per head with the silage steers.

Pasture

The provision of pasture in a ration is a method of combining a cheap source of roughage with grain that proves exceptionally economical from a cost standpoint. The charge for pasturage is usually computed by considering the rental value of the land and varies from 75 cents to \$1.50 per head of cattle per month. The gains made on pasture alone are the cheapest that can be produced as is shown by the following citation of three lots of cattle that were fed on pasture without grain.

TABLE XV

Cattle on Bluegrass Pasture Without Grain - Iowa Farms

Number of farm	Number head cattle	Number days pastured	Initial weight per head pounds	Gain daily per head pounds	Cost of pasture daily	Value daily gain	Feed paid for gain %	Profit per byhead	Average % feed paid for in grain feeding
9	40	86	857	2.0	\$.045	0.09	200	\$ 5.69	59
16	16	242	503	1.47	.022	.066	300	16.85	59
28	60	156	650	2.06	.025	.09	360	9.93	59

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It is at once apparent that the gains made on pasture alone are produced much more economically than by any other system of feeding. Cattle fed grain on pasture produce gains with less grain than those fed in the feed lot. The following tabulation is worthy of notice in that it shows the per cent of daily feed paid for by the daily gain with pasture and grain and also the saving of grain per pound of gain over that required in dry lot feeding.

TABLE XVI

Cattle on Pasture with Grain - Iowa Farms

Number of farm	Number head cattle	Number days fed and pastured	Initial weight per head pounds	Gain daily per head pounds	Cost of feed daily	Value daily gain	Feed paid for by gain %	Pounds grain per pound gain Avg.	Saving in pounds grain per pound gain
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18	30	189	849	2.6	\$0.14	\$0.16	115	5.3	6.9
20	44	182	962	2.5	.21	.15	71	9.0	3.2
2	20	244	720	2.0	.15	.11	75	7.6	4.6
2	18	219	693	1.5	.12	.08	67	8.7	3.5
27	71	116	640	1.9	.16	.13	81	9.8	2.4

Note: Average number pounds grain per pound gain in dry-lot feeding 12.2 pounds

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It is noted by this practice^{that} from two to six pounds of grain may be saved on each pound of gain produced on the cattle.

The value of pasture for fattening cattle is also expressed in terms of pounds of beef per acre. The Breeders' Gazette, pages 64-627, reports a return of \$12.00 per acre for permanent pasture and also a gain of 150 pounds of beef on another farm. An Iowa feeder who has kept very accurate records of his gains on pasture shows as high as 200 pounds of beef per acre of bluegrass pasture, allowing two acres for each mature steer. Prof. Haecker reports⁸ a saving of grain by pasture for steers weighing from 600 to 1200 pounds of \$10.54 per head for the period of 21 weeks.

⁸Minnesota Bul. No. 155

Condition of Feedstuffs

The condition of the feeds when fed to stock affects the feed cost to a certain extent. Corn should be well cured and mature and not soft and soggy if it is to produce economical gains. In the fall of 1909 early snows and storms caused the corn crop to be placed in the crib wet and soft. The result was a great deal of poor moldy corn, and it was common knowledge that it required more of such corn to produce a given gain than it did of well ripened, seasoned corn. Moldy hay and fodder have a similar effect besides being distasteful and, therefore, more difficult to feed to the cattle. Well relished food is as essential to livestock as to man if the best results are to be obtained, and that should be the aim. By the proper storage facilities much better conditioned grain and hay may be provided for feeding purposes. It is not true that "any old eatable thing" is good enough for hogs or cattle. We are preaching economy of feeding to produce adequate product - not to produce any product by "any" means - for the final statement from such practices usually shows the operation to have resulted in a loss. Weather conditions in as much as they affect the physical condition of the feeds and as they affect their storage and "keeping" are an important factor in providing the kind of feed most desirable.

Weather conditions in their effect on the feed yards and the stock are factors to be considered. Heavy cold storms cause more food to be used for body heat and energy and an increase is necessary to provide the product in the form of animal fat. Cattle and hogs wallowing in the feed lot in mud do not produce the gains that are possible under favorable conditions on the feed consumed. The fall of 1909 is a striking example of this, for weeks the stock barely gained on feed that should have produced an economical gain.

It was being used to produce strength and power to wade around in the mud and not for the production of fat. Under such conditions much feed is wasted and while not consumed it is included in the feed bill and must be charged against the enterprise.

The conveniences and mechanical methods of feeding are a factor in saving or wasting feed. The example of Iowa farm No. 1 where hay is stored and grain fed in bunks from a carrier and all effort made to provide the best feed in a saving manner, is one that proves such practices are worth while. Feeding hogs in the mud as against providing concrete feeding floors, providing adequate shelter and feed appliances, are details that result in either conserving feed and in providing it in the most profitable manner, or in wasting it and paving the way for a loss to result.

Method of Reducing the Feed Costs

The final feed cost for a given lot of cattle depends in general on the following factors:

- a- The proportion of grain to roughage, or the proper combination of feeds into an economical ration,
- b- The physical and chemical condition of the feeds fed,
- c- Weather conditions, as they affect feeding yards, stock, etc.
- d- Methods of feeding the stock.

Any appreciable reduction of the feed bill must be by means or methods that affect the above factors. Probably the best method of reducing the feed cost is the providing of any economical ration made up in most part by the feeds produced on the farm. Here enters the proportion of grain to roughage to feed for the greatest gains at the least cost. Large gains are not the object in feeding unless they are produced economically. Any man can feed quantities of corn and concentrates and clover and alfalfa hay and obtain large

gains but the cost is prohibitive. A gain of a pound per day on a steer may be much more profitable feeding than a gain of three pounds.

The grain is the expensive feed, the roughage usually the cheap filler. To obtain such a combination as will include more cheap roughage and less high priced grain and achieve the result desired is the difficult part of providing a ration.

Labor

The cost of labor in feeding fattening stock is exceedingly variable. The number of stock, the method of feeding, the kind of feed, the arrangement for bedding, weighing, etc., all affect the number of hours required to feed and care for fattening stock. The cost per head also varies with the number in the lot; one man can care for 50 steers with little more time than that required by 20 or 30. In feeding hogs, 100 will be fed and cared for with little more time than that required by 40 or 50. Group or lot feeding with no individual care such as is required by the dairy cow, lends itself to saving time per head by having fairly large groups.

In the Iowa and Minnesota studies an attempt was made to record the hours of man and horse labor spent on the various classes of stock. This was a difficult record to obtain accurately, and still more difficult to average into a figure that holds reasonably applicable for similarly fed stock. It is not claimed that the figures here quoted are absolutely the average labor requirements in all feeding operations, yet these lots of stock were handled in an ordinary farm manner under varying weather conditions. Similar labor reports from feeding operations indicate that the averages are within reasonable limits of variation. The labor cost is usually not considered in fattening cattle as the manure is

assumed to cover this item as well as others, such as interest, shelter, etc.

The average cost was one cent per steer per day for the two years study in Iowa. The lots of cattle, 45 in number, averaged 41 steers to the lot and the average daily requirement was $1\frac{1}{2}$ man hours and $1\frac{1}{2}$ horse hours. The rates used were 16 cents per hour for man labor and 8 cents for horse labor. The cost varied from four mills to two cents per steer per day, depending on how the cattle were handled.

In the Minnesota investigation very similar results were obtained. A three year average with a total of nine lots of steers averaging 40 steers to the lot gave a cost of nine-tenths of one cent per head per day. The rates used were 16 cents per hour for man labor and 10 cents for horse labor. The average daily time spent per lot of steers was $1\frac{1}{2}$ man hours and $1-1/5$ horse hours. The cost varied from less than one-half of one cent to two cents per head per day.

A large feeder in Kansas⁹ who fed 1000 steers each winter figured on one cent a day per steer for labor. A large feeding plant that operated for eleven years in Nebraska figured this labor cost at $1\frac{1}{2}$ cents per head per day.

From the above data it appears that the charge of one cent per head per day for average feeding of cattle is a very close approximation of the actual cost.

The proportion to the total cost in feeding is not large, being 4.4 per cent of the Iowa cost where shelter and equipment were not figured and five per cent of the total cost in the Minnesota study.

⁹U.S. Dept. of Agriculture Farmers' Bul. No. 588, page 8 - 1914

The labor cost for hogs fed alone was also a difficult charge to accurately ascertain. The number of lots of hogs studied in both Iowa and Minnesota investigations was so small that only an approximation could be made. All six lots of hogs in Iowa averaging 123 head to the lot, fed 178 days, gave a cost for labor of 26 cents per head. This was figured at the same rates as used in the cattle cost. It required one hour of man labor per day to care for this number.

The average cost of the five lots in Minnesota averaging 125 hogs to the lot, fed an average of 109 days, was 22 cents per head, which is very comparable to the Iowa figure. Obviously this cost may be a very variable figure and those quoted are used as an indication of the cost for the lots studied. This cost amounts to but 3.7 per cent of the total operating cost.

The only data in this study on the labor spent on sheep were taken from the Iowa results. No labor records were obtainable on the sheep on record in Minnesota. The labor spent in feeding sheep varies a great deal with the method of feeding. Allowing sheep to fatten in the corn fields saves considerable labor, while yard feeding usually takes a comparatively large amount of horse and man labor if a large number is being fed. From an average of six lots of sheep fed in Iowa averaging 990 to the lot, fed 105 days, the cost was 5½ cents per head. Labor was figured at 16 cents for man labor and eight cents for horse labor. It required 2.1 man hours and 1.7 horse hours daily per lot of sheep. Part of this labor was in herding the sheep when first turned on the corn fields. This cost amounted to 3.4 per cent of the total operating cost as an average for the two years' feeding.

Interest on Stock Investment

Interest is a legitimate cost that should be included in the operating expense of conducting any business. By interest cost as a factor in meat production is meant the interest on the purchase price or inventory value of the livestock being fed. In many instances the farmers actually paid interest on the borrowed capital so invested. The rates actually paid varied from six to seven per cent. In those instances where an arbitrary rate was assumed a rate of six per cent was used. The interest on building and equipment is included in the shelter and equipment costs.

The interest cost per head of stock does not amount to a great deal and yet it constitutes about four to 5½ per cent of the total operating expense and amounts to approximately as much as the labor cost. Table XVII presents the interest cost per head for the various kinds of stock on Iowa and Minnesota farms and the per cent of this cost of the total operating cost.

TABLE XVII

Interest Cost per Head of Stock

	Iowa two years			Minnesota three years		
	Cattle	Hogs	Sheep	Cattle	Hogs	Sheep
Total number head	1898	405	5911	356	678	6120
Cost per head	\$1.25	0.11	0.056	1.62	0.15	0.10
Per cent of total cost	3.8	2.5	3.8	5.5	2.6	4.6

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Shelter

This is a very difficult charge to make on feeding stock because of the kind of buildings used, the variety of uses to which the buildings are put and the difficulty in accurately apportioning charges to the various classes of stock cared for in the same building.

Because of these varying conditions records from only a part of the cooperators could be used in computing this cost. This explains the data being based on only 356 steers on the Minnesota farms out of a total of 726 head. In the Iowa investigation no record was made of the building investment hence no such cost was computed for the Iowa farms.

The buildings used for the stock being fed were invoiced at an estimated value and in as much as in practically all cases only sheds, "lean-tos", or straw-sheds were used, the values were very low. Where other than the feeding stock on record used the same shelter as the stock on record a division of the value was made on the unit of livestock basis, which is based on the 1000 pound cow or horse as a unit. Ten per cent of this value was used as an arbitrary rate as the usual shelter charge. This is to cover interest at five per cent for the time used by the stock, depreciation at three per cent and repairs, taxes and insurance at two per cent. The rate may vary on individual farms under varying conditions and should be considered here as an arbitrary rate that seemed approximately correct in these instances. The shelter cost per head and its relation to the total operating cost is shown in Table XVIII.

Table XVIII

Shelter Cost Per Head and Relation to Total Cost

	Cattle	Hogs	Sheep
Number of head	356	678	6120
Cost per head	\$0.79	0.17	0.07
Per cent of total cost	2.7	2.9	3.3

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The shelter cost in these instances ranged around three per cent of the total operating cost for each of the three classes of stock.

There has been considerable discussion of barn-fed cattle versus lot-fed cattle with an open shed for shelter. Several experiments have been carried on to determine advantages of each method. W .A. Cochel¹⁰ reports in a series of trials that the three sided shed is better than a closed barn for feeding beef cattle. He showed that cattle fed in lots of ten to twelve head with ample room to feed, made more satisfactory gains than those fed in stanchions and with less labor required. More bedding was used in the open feed lots thereby increasing the value of the fertility by-product.

Hoard's Dairyman¹¹ reports that steers fed in stanchions and then turned loose indoors, 16 head in a space 13 x 14 feet, and watered outside made better gains and produced a better quality of beef than open-fed steers.

Available data on the paving of feed lots are not numerous but it all indicates that for a permanent business paving the lot is a paying practice. A large Iowa feeder¹² sums up the advantages as follows: saves manure, greater gains by cattle, greater gains by hogs following the cattle, easily bedded with no waste of fertility, saves expensive buildings. Mumford¹³ fed steers on both dirt and paved yards with the result that the steers fed on pavement brought ten cents per hundredweight more and the hogs gained one pound more per bushel of corn fed to steers than those fed on the dirt yards. This latter item, with pork at eight cents a pound, will amount to about \$1.50 per steer.

No comparisons are available from the data gathered on the Iowa and Minnesota farms.

¹⁰ Pennsylvania Bul. No. 112, 1911 - Feb. 25, 1916

¹¹ February 25, 1916

¹² Ohio Farmer - July 29, 1916

¹³ "Beef Production" - H.W.Mumford, 1907, pages 145-146



Figure 9 - Feeding shed and hay rack for cattle



Figure 10 - Concrete floor and carrier system for feeding cattle

Bulletin No. 108 of the Bureau of Animal Industry, U. S. Department of Agriculture, summarizes the experimental data on the feeding of steers in barns, sheds and open feed lots from the various experiment stations. Table XIX is made up from the data presented in that bulletin.

TABLE XIX

Shelter Experiments in Cattle Feeding

Station	Number of years	Pounds of feed per pound of gain		
		In barn pounds	In shed pounds	In open lot pounds
Ohio	2	10.2	10.5	
Minnesota	2	14.2	11.9	
Missouri	1	18.3	17.1	
Missouri	3	15.2	14.5	14.4
Pennsylvania	4	15.5	16.0	
Kansas	1	18.9		20.6
Missouri	1	18.2		20.8

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Equipment

The equipment used in meat production is usually of much less value than that used in milk production. This is especially true in feeding stock. The items of equipment included in the cost figures on this study were the feed bunks, racks, and troughs, wagons, sleds, forks, scoops, baskets, and lesser items used in feeding. As in the building charge, these items were often used for various kinds of stock for varying lengths of time and these factors were considered in arriving at the equipment cost.

The annual cost rate of the value of the equipment used in the farms studied was fixed arbitrarily at 15 per cent. This includes interest at five per cent and depreciation and repairs at



Figure 11 - An easily constructed home-made hog shelter that answers the purpose



Figure 12 - Showing feed yards, shelter shed, hay and grain bunks and concrete yard wall on an Iowa feeding farm

ten per cent. It is believed this is as fair an average rate as can be more or less arbitrarily selected. Table XX presents the equipment cost per head of stock and its relation to the total operating cost. It is seen to be a very small item of cost, being but 1.4 per cent of the cost of feeding cattle and only one-half of one per cent in hogs and sheep. No computation of this cost was made on the Iowa lots of stock studied.

TABLE XX

Equipment Cost per Head and Relation to Total Cost

	Cattle	Hogs	Sheep
Number of head	356	678	6120
Cost per head	\$0.41	0.03	0.01
Per cent of total cost	1.4	0.5	0.5

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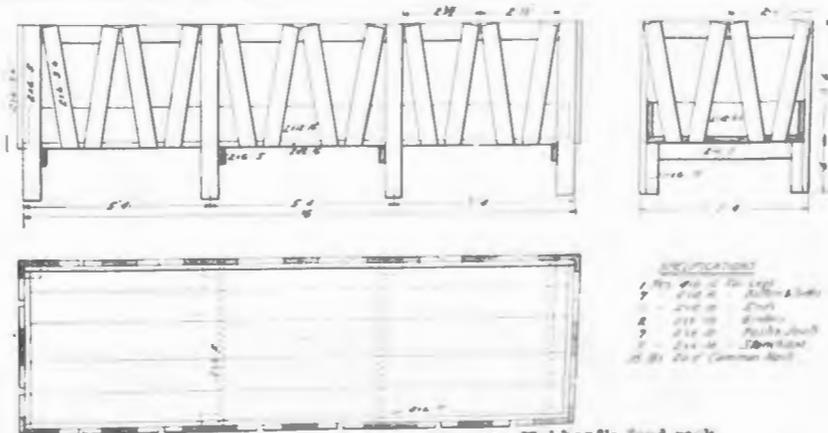
Compared to dairy stock production the charges for equipment and shelter are much lower in fat-stock feeding. From a three year average of the shelter and equipment cost per unit of dairy cattle on eight Minnesota farms it was found that the cost for shelter per cow ranged from \$2.30 to \$12.85 with an average of \$5.32. The equipment cost per cow ranged from 57 cents to \$8.12 with an average of \$2.86.

In Report No. 111 U. S. Department of Agriculture, entitled "Methods and Costs of Growing Beef Cattle in the Corn Belt States," the shelter and equipment cost is combined under the head of "Equipment." The following quotation is taken from page 38 of the report.

"The equipment charges were worked up in the following manner: First, the building charges were obtained by taking an inventory of that part of the buildings actually used by the cattle.



Figure 13 - Sheep shed and feeding racks for silage and grain



Plans and specifications for making Mr. Hubbard's feed rack

This rack is 16 feet long, 5 feet wide, and 5 feet high. The specifications for it are as follows:

- 1 piece 4 in. x 6 in. x 12 ft., for legs.
- 7 pieces 2 in. x 12 in. x 16 ft., for bottom and sides.
- 1 piece 2 in. x 12 in. x 10 ft., for ends.
- 2 pieces 2 in. x 6 in. x 16 ft., for girders.
- 7 pieces 2 in. x 6 in. x 10 ft., for posts and joists.
- 7 pieces 2 in. x 6 in. x 14 ft., for stanchions.

The openings through which the cattle place their heads are 6 inches wide below, and 16 inches above. The open end of the rack sets close to the gap through

Figure 14 - Plans for a cattle feeding rack for bundle corn

It was estimated that interest, taxes, insurance, and depreciation on the buildings would amount to approximately ten per cent.

Multiplying the total charge by this figure, the yearly charge for the herd is obtained. This yearly charge was divided by the total number of animal units using the building (considering three calves as equal to one animal unit), which gave the charge for each animal unit. The yard charges were figured in the same manner, except that a charge of six per cent was used to cover interest and taxes on land and the maintenance of fences and other minor equipment."

Summing up the equipment and shelter cost per yearling for all groups the Report says on page 56:

"The equipment charge ranges from 68 cents per head for beef calves, where a minimum amount of shelter is used, to \$1.16 for those of the dual-purpose group. Many of the beef calves were allowed to run in the open, while those in the dual-purpose group were usually kept in buildings. The equipment charge makes from 1 $\frac{1}{4}$ to three per cent of the total."

For a discussion of equipment for feeding cattle see chapter 21 - "Beef Production" by H. W. Mumford.

Marketing Costs

The important part that the marketing cost plays in the stock feeding business is generally known among feeders to amount to a considerable sum. It is doubtful if the farmer realizes just how much it costs him to market a steer. It was found in a study of two years' feeding operations in Iowa that eleven per cent of the total operating cost was made up of sale expenses. From a two year average of 949 steers the sale cost per head was \$3.54. This item of cost considered, shipping expenses, such as freight and terminal charges, commission, yardage, and feed at yards. It did

not include the value of the product that was lost by shrinkage enroute. When this item is included the total charge for marketing livestock assumes a large percentage of the value of the animals. The following gives an idea of the proportionate charges of the items that go to make up sale costs.

Marketing Costs per Head - Iowa Cattle

Number of cattle	Freight	Yardage	Feed	Commission	Total
676	\$2.98	\$0.25	\$0.20	\$0.55	\$3.98

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The freight charge depends on the weight and the distance shipped.

The sale cost of the stock on the Minnesota farms on record cannot be separated into the various costs of freight, yardage, feed, commission, etc., as accurately as were the Iowa steers. The following quotations regarding marketing costs at South St. Paul are taken from "The Marketing of Livestock" by D. A. Gaumnitz of the Campbell Commission Company.

"Switching. A fixed charge of \$2.50 per single deck and \$2.75 per double deck car of livestock, any size, is made by the St. Paul Bridge and Terminal Company for delivering the stock into the yards at South St. Paul from the trunk lines at St. Paul, while on cars delivered from the C.G.W. and C.R.I. & P. \$1.25 per single deck and \$1.50 per double deck is made. When two cars are furnished at the convenience of the railway company for one long one or a double deck the switch on one is usually absorbed by the billing lines. For exceptions to this rule see the tariffs of individual roads.

"Yardage. The Stock Yards Company's charges for

yardage are the same throughout the year. For cattle 25 cents, calves 15 cents (400 pounds and under), hogs 8 cents, and sheep 5 cents per head each. This charge entitles the shipper to yardage, sorting room, water, use of scale equipment, and such assistance in handling and looking after the feeding and such handling of stock as is not furnished by the commission man.

*Bedding and Feed. These are furnished and delivered to any pen at any reasonable time by the Stock Yards Company at the following prices: Bedding, 60 cents per bale; hay, one cent per pound; shelled dry sound corn in bushel sacks, 36 pounds net, \$1.00.

*Fire Insurance. The Live Stock Exchange has passed a rule whereby all stock is insured against fire at ten cents per car. The insurance premium is collected by the commission firm who receives the stock for sale. Any shipper not wishing this protection may avoid the premium charged in future by signing a written notice to that effect and depositing it with his commission man. The insurance is carried by a responsible insurance company.

*Shrinker. Fifteen cents per car is charged by the Livestock Exchange for the services of the shrinker.

Commissions

The commission for selling livestock on the South St. Paul market shall be governed by the following rates: (Fraction of one hundred pounds not considered and selling weights to govern the application of this rule. No sale shall be made for less than 50 cents.) Cattle, 30 cents per head; calves, 25 cents per head; hogs, 20 cents per head and sheep or goats, 15 cents per head.

*Charges for straight carloads. On single deck straight carloads (cattle and calves considered one species) the charges shall be:

"Cattle: Not less than \$10 nor more than \$14 per carload. Amount based on a charge of 50 cents per head for cattle and 25 cents for calves. Except on all weight in excess of 22,000 pounds, five cents per hundredweight additional shall be charged.

"Hogs: \$8.00 per carload. Except on all weight in excess of 17,000 pounds, five cents per hundredweight additional shall be charged.

"Sheep or Goats: Not less than \$8.00 nor more than \$10 per carload. Amount based upon a charge of 15 cents per head except on all weight in excess of 10,000 pounds, five cents per hundredweight additional shall be charged.

"On double deck straight carloads the charges shall be:

"Calves: Not less than \$12 nor more than \$18 per carload. Amount based upon charge of 25 cents per head, except on all weight in excess of 22,000 pounds a charge of five cents per hundredweight additional shall be made.

"Hogs: \$12 per carload, except on all weight in excess of 22,000 pounds a charge of five cents per hundredweight additional shall be made.

"Sheep or Goats: Not less than \$12 nor more than \$14 per carload. Amount based upon a charge of 15 cents per head, on all weight in excess of 22,000 pounds a charge of five cents per hundredweight shall be made additional.

"On Single Deck Mixed Carloads: Sheep, goats or hogs predominating, the charges shall be not less than \$8 nor more than \$15, excepting on all weight in excess of 17,000 pounds five cents per hundredweight shall be charged. In case cattle predominate the charge shall be not less than \$10 nor more than \$15, excepting on all weight in excess of 22,000 pounds, five cents per hundredweight additional shall be charged.

"On Double Deck Mixed Carloads: Sheep, goats or hogs predominating, the charges shall not be less than \$12 nor more than \$16, excepting on all weight in excess of 22,000 pounds an additional charge of five cents per hundredweight shall be made. In case cattle predominate, the charge shall not be less than \$12 nor more than \$18, excepting on all weight in excess of 22,000 pounds five cents per hundredweight additional shall be charged.

"Miscellaneous:

"(a) When part of a car is double decked apply established rate for animals on the temporary deck up to the double deck maximum of the species involved.

"(b) On carloads of livestock, having more than one owner, the charge for pro-rating shall be one-half cent per hundred pounds in addition to the regular commission. Where a portion of the car is turned over for sale by the consignee to another member of the Exchange the commission shall be charged pro-rata at the rate charged on the balance of the car; the consignee shall notify the member receiving such turned-over stock, the pro-rata rate to be charged.

"(c) Commission on livestock driven, hauled or shipped in by boat, shall be charged at the rate shown in Sections 1 and 2.

"(d) Milch cows to be estimated at 1,000 pounds each and calves at 100 pounds each if they are not weighed."

Of the ten lots of cattle that made up the 356 head reported in this data, four lots were sold on the farm leaving but six lots of steers on which marketing costs were obtained. This cost averaged but \$1.89 per head for the cattle owing to the number that were sold to local buyers and to the comparatively short distances from the feed lots to the South St. Paul market. In most cases

shrinkage estimate could not be accurately figured and this item is not included in the cost of \$1.89 per head. Applying the figures quoted from Farmers' Bul. No. 588, page 65, the shrinkage on the Minnesota steers would amount to four per cent of their live weight or about 45 to 50 pounds per steer. Estimating the home market price to be 75 cents below the market price the shrinkage would amount to approximately \$2.90 per head. This would increase the total amount to about 40 cents per hundredweight, including all costs. Table XXI presents the available data on the sale cost of the stock on record.

TABLE XXI

Marketing Cost per Head - Three Year Average

	Cattle	Hogs
Number of head	356	429
Cost per head	\$1.89	\$0.84
Per cent of total cost	6.4	14.3

The low cost of marketing cattle is explained by the fact that several of the lots were sold locally and thereby no shipping costs were incurred. The quoted cost represents the actual average cost to the producers. On those lots shipped to market the cost per head runs nearer \$3.50.

In this connection the cost per hundredweight of marketing stock through cooperative associations is of interest. As an example the figures are quoted from the Litchfield, Minnesota, Association for 1915.¹⁴

¹⁴ U.S. Dept. of Agriculture Report No. 113, page 25

TABLE XXIIOperation of Litchfield Livestock Shipping Association 1915

Kind of stock	Number	Weight pounds	Average weight pounds	Expense per hundred-weight cents
Cattle	2,028	1,707,195	841	28.5
Hogs	7,711	1,590,415	206	32.8
Sheep	375	41,290	110	46.0

Shrinkage Enroute

The item of shrinkage amounts to more than is usually considered; the following table shows the varying amount of shrinkage of cattle shipped an average distance of 400 miles. It will be noted that there were several records of exceptionally heavy shrinkage per head. When a loss of from 90 to 110 pounds is sustained per steer enroute to market the shipping cost becomes very large. Usually such shrinkage can be explained by the condition of the cattle, train wrecks or delays, bad storms or other circumstances beyond the control of the feeder. The manner of fitting for shipment during the last few feeds and also the treatment after reaching the stock yards are important factors that affect the rate of shrinkage. When the loss is considered excessive a claim is laid against the railroad company to cover the excessive shrinkage. Unless there is ample proof of the company being to blame there is little use of filing such claims. In Minnesota shipping it is doubtful if the shrinkage rate will often exceed four to five per cent of the live weight of the cattle.

TABLE XXIII

Shrinkage of steers on Iowa Farms Enroute to Market

Number of farm	Number cattle	Weight at market per head pounds	Shrinkage enroute per head pounds	Value of shrinkage per head*
1	106	1048	64	\$ 3.84
2	20	1154	64	3.52
6	18	1369	104	5.72
6	20	1204	72	4.68
7	54	1403	65	4.08
8	59	1194	81	4.46
9	43	1250	69	4.66
10	40	1048	92	5.29
10	18	1203	111	6.11
11	54	1327	100	6.25
12	38	1255	66	4.29
13	72	1278	70	3.32
14	20	1179	94	5.61
15	74	1155	72	4.49
27	71	824	38	2.26
Totals and averages	707	1200	77.4	\$4.57

From this it is noted that an average cost of around \$4.50 was lost by shrinkage in shipping cattle from central Iowa to Chicago.

*Value of shrinkage taken at home value per pound. The shrinkage amounted to six per cent of the home weight.

The following table¹⁵ presents the most complete data obtainable on the subject of shrinkage of beef cattle in transit. The figures for hogs and sheep are not based on a sufficient number of shipments to warrant publication.

TABLE XXIV

Shrinkage of Beef Cattle in Transit

Time in transit and class of cattle	Shrinkage per cent	Time in transit and class of cattle	Shrinkage per cent
Less than 24 hours		From 30 to 48 hours	
Range cows	3.58	Cottonseed-meal steers	5.40
Mixed range cattle	2.14	From 36 to 72 hours	
Mixed corn-fed cattle	3.91	Range steers	5.40
Mixed silage-fed cattle	2.05	Range cows	4.84
Less than 36 hours		Mixed range cattle	3.88
Range steers	3.65	Over 72 hours	
From 24 to 36 hours		Range steers	5.47
Range cows	3.46	Range cows	3.96
Mixed range cattle	6.37	Mixed range cattle	7.00
Mixed corn-fed cattle	4.11	From 60 to 120 hours	
Mixed silage-fed cattle	3.57	Beet-pulp cattle	5.40

Farmers' Bul. No. 588¹⁶ says in regard to shrinkage in shipping to market: "The shrinkage in weight varies according to distance shipped, the preparation of the cattle, size of the cattle, and numerous other factors, and is therefore hard to estimate accurately. The shrinkage in shipping cattle from Iowa to Chicago

¹⁵ U.S. Dept. of Agriculture Report No. 113 - 1916 - page 36

¹⁶ Farmers' Bul. No. 588, - June 1914 - page 19

or from points in Kansas to Kansas City, would be from $3\frac{1}{2}$ to five per cent of their live weight, with an average of about four per cent cent."

When cattle are sold at home they are usually held for 12 hours without feed or water before weighing or are weighed direct from the feed lot and a four per cent shrinkage deducted. The shrinkage in shipping is usually very little in excess of this amount. The feeder should therefore count on about four per cent shrinkage on the finished animal when considering the cost of feeding.

Charges for Market Service

The following description of market costs and service is taken from "Meat Situation in the United States," U. S. Dept. of Agriculture Report No. 113, pages 39 to 41. This discussion is of value as being an average of all leading markets with special charges considered.

"The terminal facilities at all the centralized livestock markets which do a large volume of business are operated either by a traffic department of the stockyard company or by a terminal railroad company. The stockyard companies at all of the large markets are either directly or indirectly owners and operators of the terminal equipment. At the smaller markets where this is not true the facilities are owned and operated by one or more large railroad companies, or by a joint holding or joint operating company of two or more of the railroads entering the city in which the market is located.

At almost all of these markets the terminal companies make a switching charge for the use of the terminal facilities. This fee is paid finally by either the railroad or the shipper of

stock. The amount of the terminal switching charge usually paid by shippers is \$2 per car. In addition to this charge, some of the railroads at certain of the markets pay the terminal company a trackage fee, but in all of the instances reported to this office these charges are absorbed by the railroad.

Most of the large markets have an unloading and loading charge averaging approximately 50 cents for each service, but this in the majority of cases is assessed only on through shipments stopped for feed and water and generally is absorbed by the railroads.

Dock men of the stockyard company unload the stock and place the animals in pens adjacent to the unloading platforms. The stockyard company also is supposed to drive the animals to the pens of the commission companies, but in practice the commission firms often do their own yarding. The maximum, minimum and usual charges made for this service are shown in Table XXV.

TABLE XXV

Stockyards: Yardage Charges per Head

<u>Kind of animal</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Usual</u>
Cattle	\$0.45	\$0.06	\$0.25
Hogs	.08	.03	.08
Sheep	.06	.02	.05

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The minimum yardage charge on every class of stock, except calves, occurs at yards owned and operated by railroad companies; and besides the per head yardage charges here given, a few of the markets have a maximum yardage charge based upon a carload. The usual charge at those markets which quote a car rate for yardage is \$8 per car on cattle and hogs and \$10 on sheep.

The range of charges for feed at the various markets is presented in Table XXVI.

TABLE XXVI

Stockyards: Feed Charges

Kind of feed	Unit	Maximum	Minimum	Usual
Corn	bushel	\$ 2.00	\$ 1.00	\$ 1.25
Oats	"	1.00	.75	.75
Wheat	"	1.50	1.50	1.50
Barley	"	1.20	1.20	1.20
Native hay	cwt.	2.00	1.00	1.50
Timothy hay	"	1.75	1.25	1.50
Prairie hay	"	1.25	1.00	1.00
Clover hay	"	1.50	1.25	1.50
Alfalfa hay	"	1.50	1.00	1.25
Mixed hay	"	1.50	1.25	1.50
Straw	"	1.50	.80	1.00

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Commission charges for selling stock are shown in Tables XXVII, XXVIII and XXIX.

TABLE XXVII

Stockyards: Commission Charges per Head

Kind of animal	Maximum	Minimum	Usual
Cattle	\$ 1.00	\$ 0.50	\$0.60
Hogs	.25	.10	.20
Sheep	.20	.10	.10

- - - - -

This table does not cover the commission charges of all markets, owing to variations in the basis of such charges in some instances. The charges for selling cattle at one market are based

upon the value of the animal, being 50 cents per head of \$20 value and under, 75 cents per head for a value between \$20 and \$35, and \$1 per head for over \$35. At three markets the commission charge on hogs is two per cent of the amount of the gross sales, while at a fourth market the charges are from 35 to 50 cents per head, according to the number sold. The commissions for selling sheep are as shown in Table XXVII with the exception of one market where the charges vary from 15 to 25 cents per head.

TABLE XXVIII

Stockyards: Commission Charges for Single Deck Car

<u>Kind of animal</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Usual</u>
Cattle	\$20.00	\$ 6.00	\$12.00
Hogs	20.00	5.00	8.00
Sheep	20.00	5.00	8.00

TABLE XXIX

Stockyards: Commission Charges for Double Deck Car

<u>Kind of animal</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Usual</u>
Hogs	\$30.00	\$10.00	\$12.00
Sheep	30.00	10.00	12.00

The charges quoted for selling single and double deck cars of livestock apply to those containing the normal number of animals.

Five markets have a fee for weighing stock. Three of these charge ten cents per head on cattle, one charges 25 cents per car on all kinds of stock, and one charges five cents per head on cattle, one cent on hogs and one-half cent on sheep. Four of the markets having such charges are located in the eastern part of the United States and one in the south.

An inspection for the purpose of determining the dockage in weight on all sales of hogs involving "stags" and "piggy" sows is made by representatives of the livestock exchange. The usual fee is 15 cents per car, although the charges at different markets range by fives from nothing to 25 cents per car. The usual maximum dockage which is allowable is 80 pounds for "stags" and 40 pounds for "piggy" sows. At some markets hogs which have an abnormal development or diseased condition of some part are docked from 20 to 40 pounds."

Risk

This factor of cost has not been expressed as such in the data presented. It does not appear as any specific money cost or as a certain per cent of the total cost. In the lots of stock on record the deaths of stock were simply ignored and any receipts for the product, such as hides or pelts, were added to the income. Very few cattle were lost in the feeding, although in several lots one or two steers died and their hides were the only source of income. The weight was always recorded and the gain made considered in computing gains on feed consumed. The number of stock of each kind was too small to afford any authentic data as a figure to use in estimating such risk.

In sheep feeding the death rate varied from two to five per cent in the Iowa investigations and from one to $2\frac{1}{2}$ per cent of those on record in Minnesota. Sheep men figure on from two to five per cent loss in cornfield feeding, especially with lambs. The largest single death loss in the sheep feeding operations in the Minnesota study was caused by the suffocation of a number of sheep when the self-feeder had been allowed to become empty and after filling the sheep rushed at the feed in such a mass as to cause the death of 36 head in a very few moments.

Cotton & Ward¹⁷ have the following to report on the subject of risk.

"The term 'risk', as used in this report, designates the loss by death which is not covered by insurance. Where animals that were lost were insured, these were considered as having been sold to the insurance companies. In most instances the losses incurred were not due to any lack of care on the part of the owners, but rather to circumstances which could not have been forestalled. Consequently, it was thought best not to figure this loss against any individual farm or group of farms, but rather to pro-rate it equally among all. The risk was obtained by finding the total value of all cows lost and dividing this figure by the total number of cows on which records were obtained. The average risk, based on the two years' records, amounted to 43 cents a cow, there being a loss of approximately eight-tenths of one per cent."

The losses from disease and exposure for cattle, hogs and sheep in the United States are given for three years.¹⁸

TABLE XXX

Per Cent of Loss in Numbers

<u>Year</u>	<u>Cattle</u>	<u>Hogs</u>	<u>Sheep</u>	<u>Lambs</u>
1912	4.2	8.9	7.3	8.1
1913	3.4	11.0	4.9	5.6
1914	3.0	11.9	4.3	4.9

The largest losses occur on the range, from birth to six months of age.

¹⁷ U. S. Dept. of Agriculture Report No. 111 - page 28

¹⁸ U. S. Dept. of Agriculture Report No. 109 - page 278

In raising calves to the yearling stage a common calf crop is 75 per cent of the number of cows bred and carried through the year. A large Texas company¹⁹ figures that a 75 per cent calf crop is very liberal. They report an average loss per head of \$1.00 from six months to one year of age and in growing from a yearling to three years they estimate a five per cent loss amounting to \$2.71 per head. Another large raiser of calves in Texas²⁰ reported but a 60 per cent calf crop in 1915-16, but he usually obtained from a 70 to 75 per cent crop.

Cotton & Ward report in their investigation²¹ that 92.1 per cent of the cows raised calves in the double-nursing group while 83.9 per cent was the average in the dual-purpose group. These were the two extremes but it should be noted that these were well cared for cows of small lots in the corn belt and not with large numbers under range conditions.

Summary of Operating Costs

Bringing together the various costs of feeding stock on the basis of money cost per head and the relations of each factor to the total, Tables XXXI, XXXII and XXXIII and Figures 15 to 20 are presented.

¹⁹Breeders' Gazette - April 20, 1916

²⁰Mr. Lyster of Falfurios, Texas in paper presented at the Marketing Conference, Chicago, December 10, 1916

²¹U. S. Dept. of Agriculture Report No. 111 - page 7

TABLE XXXI

Operating Cost per Head of Cattle

	Total number head	Number lots	Feed	Labor	Inter-est	Shel-ter	Equip-ment	Sale	Total	Average pounds gain per head
Minn. 1913-14-15	356	9	\$23.21	\$1.47	\$1.62	\$0.79	\$0.41	\$1.89	\$29.39	233.5
Iowa 1910-11	1898	46	27.14	1.37	1.25	----	----	3.54	33.29	303

Relation of Each Cost to Total Cost

	Total number head	Number lots	Feed %	Labor %	Inter-est %	Shel-ter %	Equip-ment %	Sale %	Total %
Minn. 356	9	79.0	5.0	5.5	2.7	1.4	6.4	100	
Iowa 1898	46	80.9	4.4	3.7	---	---	11.0	100	

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Feed cost is seen to range around 80 per cent of the operating cost. The next highest cost is that of marketing, leaving from 10 to 13 per cent of miscellaneous costs.

TABLE XXXII

Operating Cost per Head of Hogs

	Total number head	Number lots	Feed	Labor	Inter-est	Shel-ter	Equip-ment	Sale	Total
Minn. 1913-14-15	678	5	\$4.45	\$0.22	\$0.15	\$0.17	\$0.03	\$0.84	\$5.86
Iowa 1910-11	405	6	3.71	0.29	1.11	----	----	0.56	4.67

Relation of Each Cost to Total Cost

	Total number head	Number lots	Feed %	Labor %	Inter-est %	Shel-ter %	Equip-ment %	Sale %	Total %
Minn. 678	5	76.0	3.7	2.6	2.9	0.5	14.3	100	
Iowa 405	6	79.4	6.2	2.5	---	---	11.9	100	

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With hogs, as was noted in cattle, feed is by far the largest cost and marketing again rates second, both of these charges together constituting around 90 per cent of the total operating cost.

TABLE XXXIII

Operating Cost per Head of Sheep

	Total number head	Num- ber lots	Feed	Labor	Inter- est	Shel- ter	Equip- ment	Sale	Total
Minn. 1913-14 14-15	6120	3	\$1.97	----	\$0.10	\$0.07	\$0.01	---	\$2.15
Iowa 1910-11	5824	6	1.10	0.05	0.06	----	----	0.28	1.46
<u>Relation of Each Cost to Total Cost</u>									
			%	%	%	%	%	%	%
Minn.	6120	3	91.6	---	4.6	3.3	0.5	----	100
Iowa	5824	6	75.3	3.4	3.8	---	---	17.5	100

The low cost of feeding sheep in Iowa was accounted for by cornfield feeding with cheap roughage and also with lower market prices of feed than now exist. Most of the lots were fed on short time, the average number of days being approximately 100. One lot was fed but 60 days. The Minnesota groups were fed on screenings and silage with clover hay and straw for an average of 136 days.

Reduced to cost per pound of gain the various items appear in Tables XXXIV and XXXV.

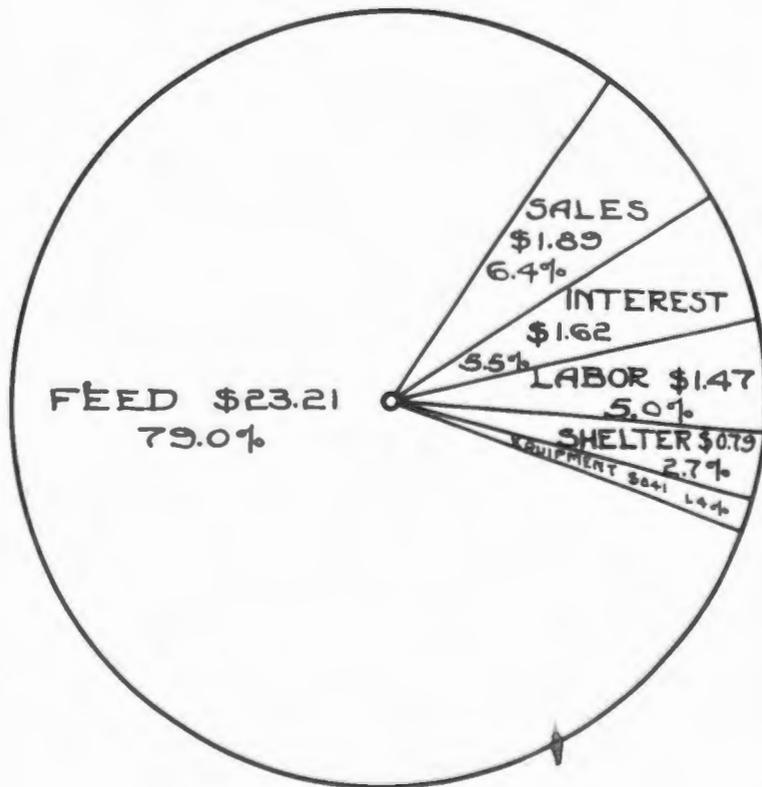


Figure 15 - Cost of producing gains on cattle per head.
Minnesota feeding

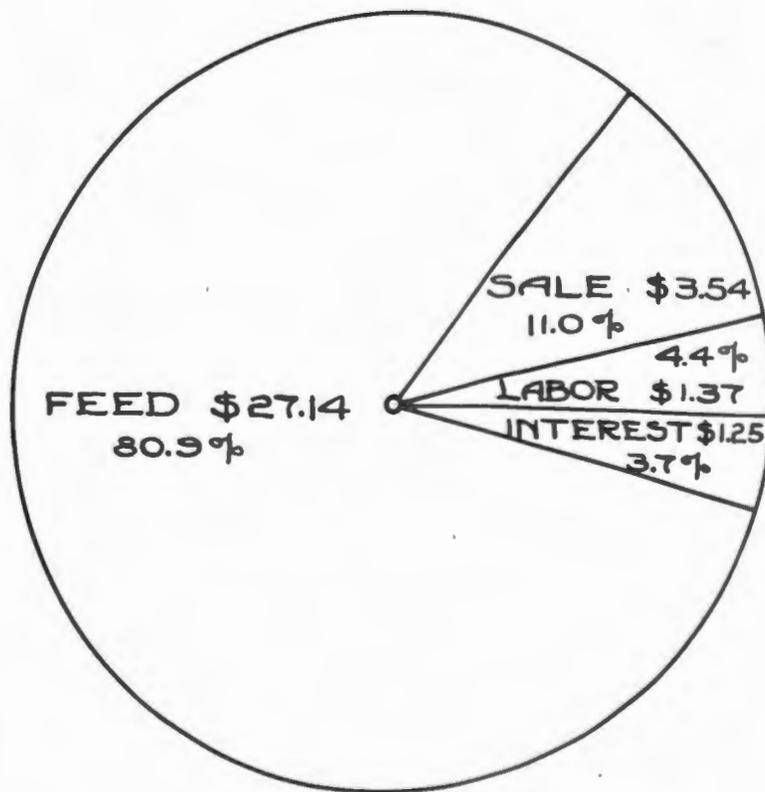


Figure 16 - Cost of producing gains on cattle per head.
Iowa feeding.

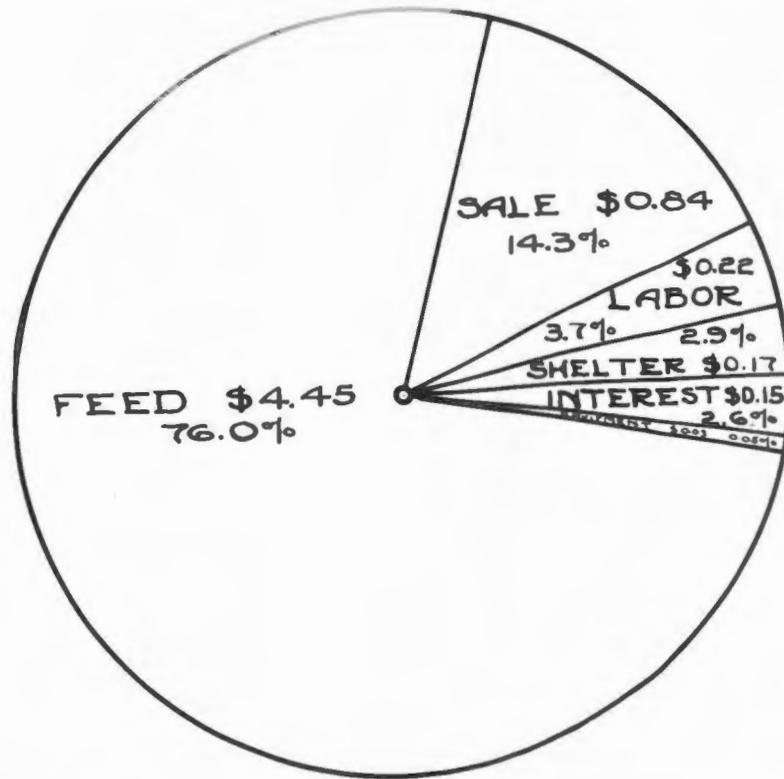


Figure 17 - Cost of producing gains on hogs per head.
Minnesota feeding.

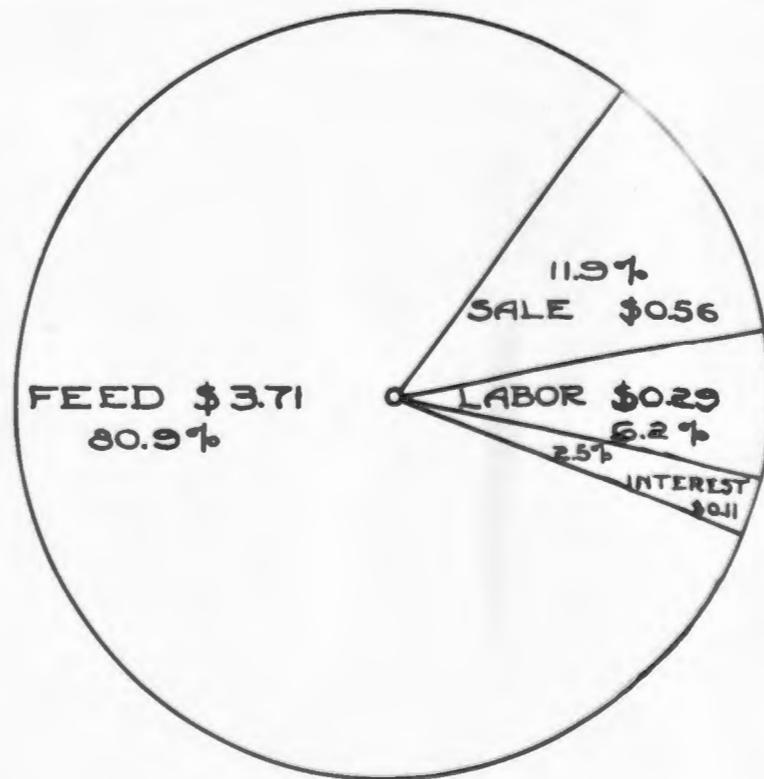


Figure 18 - Cost of producing gains on hogs per head.
Iowa feeding.

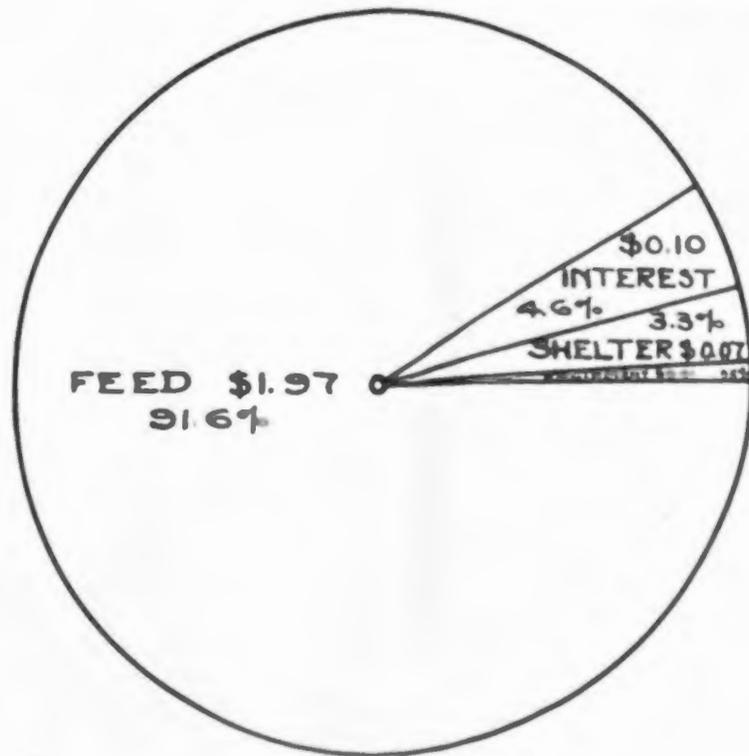


Figure 19 - Cost of producing gains on sheep per head.
Minnesota feeding.

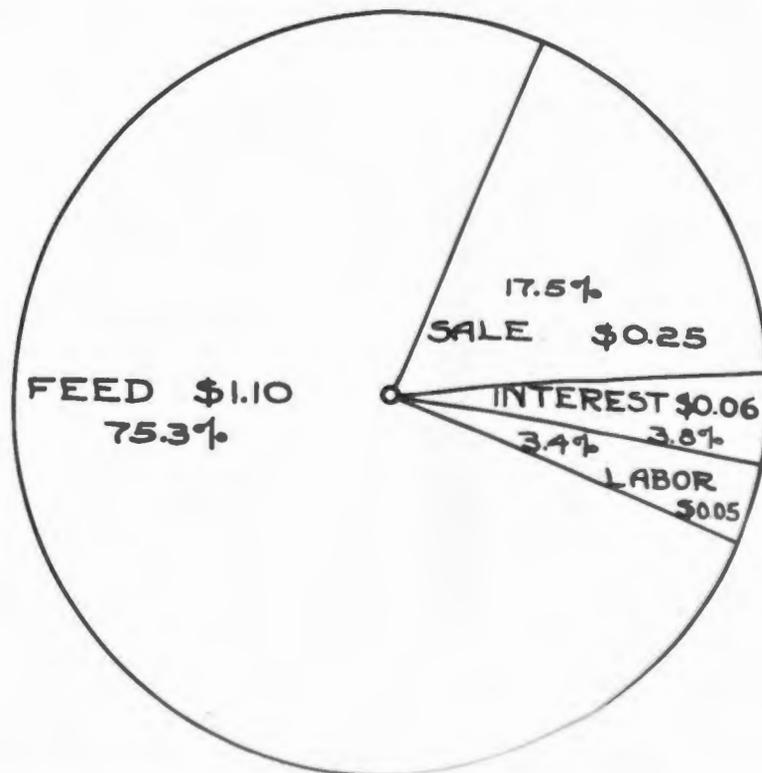


Figure 20 - Cost of producing gains on sheep per head.
Iowa feeding.

TABLE XXXIV

Cost per Pound of Gain in Cattle - Minnesota Farms 1913

Num- ber of farm	Num- ber head	Total gain per head pounds	Gain per head daily pounds	Cost per pound of gain						
				Feed cents	Labor cents	Shel- ter cents	Equip- ment cents	Inter- est cents	Sale cents	Total cents
4	25	318	1.6	6.2	0.9	0.20	0.15	0.44	1.20	9.1
5	72	339	1.6	10.5	.6	.17	.03	.60	.45	12.4
<u>1914</u>										
4	41	274	1.5	7.5	.7	.24	.17	.66	1.40	10.6
9	28	258	1.8	10.0	.2	.14	.25	.82	1.30	12.7
5	69	134	.9	12.3	.6	.43	.09	1.10	----	14.5
<u>1915</u>										
12	35	144	1.2	10.9	.8	.22	.52	.90	2.40	15.7
15	27	99	1.2	12.5	.8	2.10	.22	.70	----	16.3
9	31	326	1.4	8.7	.4	.11	.19	.70	1.10	11.2
14	28	219	1.5	12.0	.7	.82	.18	.70	----	14.4
Three year avg.			1.45	9.9	.6	.34	.18	.70	1.2	12.6

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The average cost of 12.6 cents per pound is believed to be very representative of this class of stock for the period studied. The lot of calves fed for baby beef produced gains at the rate of 7.8 cents per pound, the feed alone costing but 6.3 cents. As an example of how variable the cost per pound of gain is an example may be cited of one lot of cows and heifers of 72 head fed 227 days with an average gain per day of but one-half pound per head. This was due to poor cows, bulls running with the cattle and heifers being bred too young. The feed cost per pound of gain was 29.4 cents and the total cost was 33.7 cents per pound. These are the

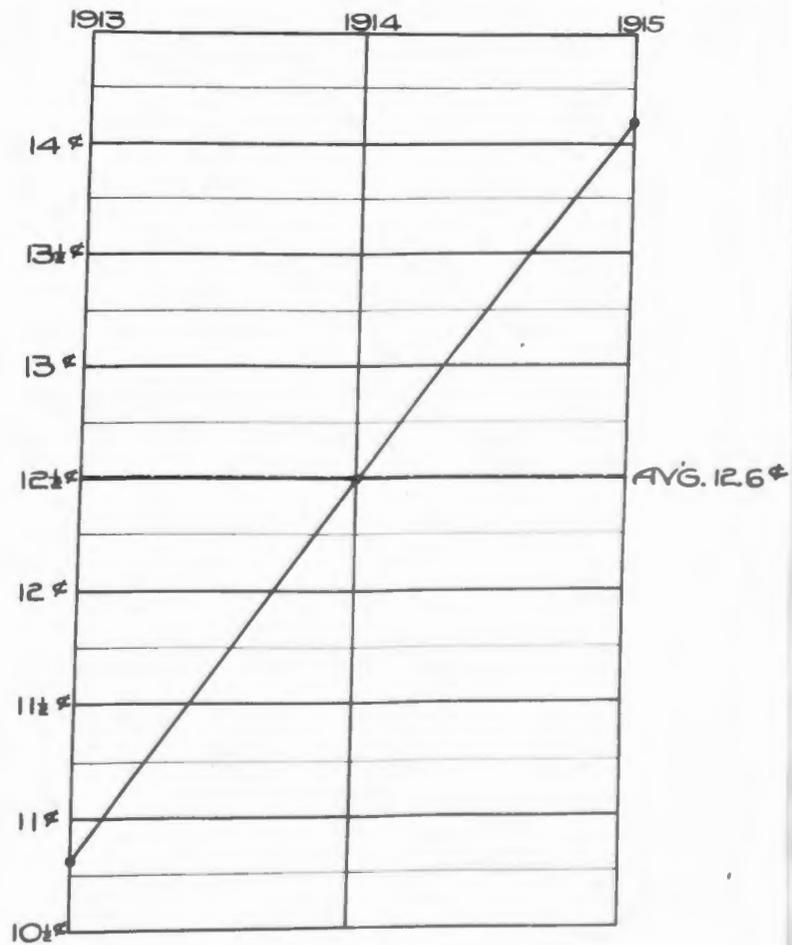


Figure 21 - Cost per pound of gain on cattle.
Minnesota feeding.

exceptions that should be noted when an average is considered.

Table XXXV presents the average cost per pound of gain for the hogs and sheep on record on Minnesota farms.

TABLE XXXV

Average Cost per Pound of Gain on Pigs and Sheep

Items	Cost per pound pork cents	Cost per pound mutton cents
Feed	3.30	7.60
Labor	.16	----
Interest	.11	.40
Shelter	.12	.27
Equipment	.03	.03
Sale	<u>.62</u>	<u>----</u>
Total	4.34	8.30

The total average cost per pound of gain on cattle in the Iowa study amounted to 11 cents for the 1828 head for the years 1910 and 1911. The cost per pound of pork and mutton for those studied (number given in other tables) was 4.2 cents and 9.7 cents, respectively. These costs correspond fairly closely to those quoted for the Minnesota study.

"Margins" in Cattle Feeding

The margin or spread required in feeding cattle is the difference between the original cost of the cattle laid down in the feedyard and the price received at the selling point. This difference must pay all shipping costs both ways, or one way if the stock is raised or bought at home, all operating costs and leave a balance for profit if the operation is to be successful. The margin is variable, depending mainly on the quality of cattle, initial cost and weight, rate of gain, and cost of feed.

Table XXXVI illustrates the factors concerned in the required margin on the Minnesota lots of cattle. A total of 531 head is concerned in this average, several lots being included that are not in the other tables.

TABLE XXXVI

Margins Required per Hundredweight

Num- ber of farm	Num- ber head	Num- ber days fed	Average initial weight pounds	Gain per head daily pounds	1913		Margin re- quired	Remarks
					Initial cost per cwt.	Final cost per cwt.		
1	23	527	847	0.9	\$4.60	\$5.20	\$0.60	Good gains on pasture
2	45	124	875	2.2	6.12	7.25	1.13	
3	22	217	839	2.1	5.79	6.18	.39	Good gains on pasture
4	25	160	909	1.6	6.01	6.86	.85	
5	72	215	970	1.6	6.20	7.59	1.39	
Average		224	908	1.5	5.92	6.94	1.02	
					1914			
4	47	185	806	1.5	7.00	7.96	.96	
9	25	151	981	1.8	7.10	8.39	1.29	
10	56	158	891	1.8	6.81	7.87	1.36	
5	69	166	916	.9	5.88	6.54	.86	Heavy silage fed
Average		166	885	1.4	6.40	7.52	1.12	
					1915			
14	28	149	871	1.5	6.50	7.74	1.24	
12	35	119	1056	1.2	6.46	8.02	1.56	
15	27	83	800	1.2	6.50	7.63	1.13	
9	31	231	800	1.4	6.54	7.99	1.45	
16	13	150	978	1.7	7.23	8.30	1.07	
16	13	150	964	1.8	7.23	8.37	1.14	
Average		147	905	1.4	6.63	7.96	1.33	
Three year average		181	899	1.46	6.29	7.42	1.13	

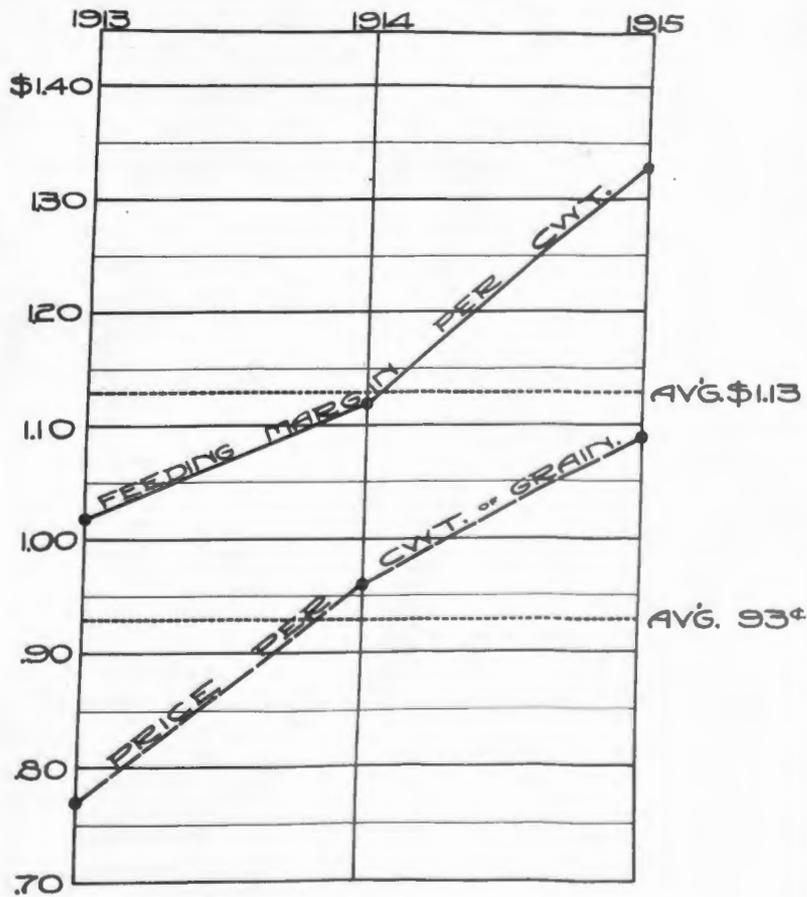


Figure 22 - Feeding margin per hundredweight of steers compared to price per hundredweight of grain. Minnesota feeding.

It is noted that the price of grain increased about as the margin and the figure illustrates how important is the grain feeding of cattle in determining the necessary margin.

From table XXXVI it is seen that the cattle should have averaged \$7.42 per hundredweight as a selling price in order to break even on the operation. This meant a margin of \$1.13 per hundredweight. The most expensive year was the feeding season of 1914-15 when \$1.33 per hundredweight was required to pay expenses. From Table XXXVIII it is noted that the average sale price was \$7.19 per hundredweight on 356 head of the 531 in the "Margin" tabulation. In the season of 1914-15 when a sale price of \$7.96 per hundredweight was required but \$7.00 was obtained thus incurring a loss of 96 cents per hundredweight.

In the Iowa feeding work the margin required on the 955 head fed in 1910 was \$2.03 per hundredweight. Corn was worth from 40 to 60 cents per bushel and over 80 per cent of the heavy grain ration was corn. In 1911 this margin was reduced to \$1.35 per hundredweight on 963 steers of about the same weight and quality. Corn had dropped to 35 cents per bushel in that season.

Income From the Stock Fed

A study of the income per hundredweight or per pound received from the cattle on record illustrates the common statement that the feeding of cattle is a speculative business. Upon a favorable market, more than any other factor, depends the financial success of feeding. Many lots of stock are bought right and fed economically only to be sold on a falling market and a loss incurred. With high priced feeds increasing the risk it is small wonder that many former feeders are not now in the business.

Table XXXVII presents the gross income received per head, per hundredweight and per pound on the Iowa stock.

TABLE XXXVII

Income per Head, Huddredweight and Pound

Stock	Year	Num- ber head	Income			Average	
			per head	per cwt.	per pound		
Cattle	1910	935	\$78.42	\$6.52	\$0.065	Per head	\$79.80
"	1911	963	81.13	6.22	.062	" cwt.	6.36
"	1911	963	81.13	6.22	.062	" pound	0.063
Hogs	1910	141	15.48	7.97	.079	" head	16.31
"	1911	280	16.72	7.60	.076	" cwt.	7.73
"	1911	280	16.72	7.60	.076	" pound	0.077
Sheep	1910	2963	5.11	6.55	.065	" head	5.03
"	1911	2948	4.95	5.87	.056	" cwt.	6.20
"	1911	2948	4.95	5.87	.056	" pound	0.062

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The income from the stock on record on Minnesota farms is presented in Table XXXVIII. For the purpose of comparison each year is shown separately.

TABLE XXXVIII

Income per Head, Huddredweight and Pound

Stock	Year	Num- ber head	Income			Average	
			per head	per cwt.	per pound		
Cattle	1913	97	\$96.73	\$7.51	\$0.075	Per head	\$82.22
"	1914	138	82.00	7.48	.075	" cwt.	7.19
"	1915	121	70.84	6.56	.065	" pound	0.072
Hogs	1913	429	21.37	8.25	.082	" head	20.06
"	1914	249	17.81	7.91	.079	" cwt.	8.09
"	1914	249	17.81	7.91	.079	" pound	0.081
Sheep	1913	1880	7.85	7.13	.071	" head	7.18
"	1914	2111	6.89	6.62	.066	" cwt.	7.40
"	1915	2129	6.88	8.74	.087	" pound	0.074

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Return for Each Dollar's Worth of Feed Consumed

In the operation of fattening stock the cost of feeding and selling are usually the two factors of cost considered. It is the usual practice to allow the manure credit to offset the labor, interest and other indirect charges. A common method of expressing the profitableness of the operation is in the return obtained for each one dollar spent for feed. Table XXXIX shows the return per dollar spent for feed when only the selling cost is considered and also when the other costs are charged.

TABLE XXXIX

Return for Each Dollar Spent for Feed for Cattle

Year	Number of farm	Number head	Number days fed	Return per \$1.00 of feed		Remarks
				Manure to balance all but sale	All other costs deducted	
1913	2	45	124	\$1.32	\$1.22	No building or equipment cost
"	1	23	527	2.51	2.06	
"	3	22	217	2.33	2.18	No building or equipment cost
"	4	25	160	1.89	1.61	
"	5	72	215	1.00	.87	
1914	4	41	185	1.21	1.02	
"	9	28	151	1.17	1.04	
"	10	56	158	.95	---	No labor, bldg. or equipment cost
"	5	69	166	1.09	.91	
"	11	60	166	.99	.75	
1915	14	28	149	..67	.48	
"	12	35	119	..19	- .14	
"	15	27	83	- .09	- .40	
"	9	31	231	.88	.73	
"	16	13	150	1.10	.89	No building or equipment cost
- - - - -						

The return for each dollar spent for feed for hogs and sheep in the Minnesota studies indicates a very nice profit. No labor or other costs are deducted and therefore the returns are comparable with the first column of returns in the preceding table on cattle. The average return for \$1.00 spent for feed for two years for 782 hogs was \$2.30. For the sheep on record in 1913 the return was \$1.50 for each \$1.00 in feed, in 1914 it was \$1.37, and in 1915 it reached the good mark of \$1.73.

Hogs Following Cattle in the Feed Lot

The gains made by hogs following cattle in the feed lot very often make the cattle feeding operation financially successful. Operators expect to make a large part of the cash returns in this way and large feeders have declared themselves as being satisfied to break even on cattle feeding and make their money on the hogs back of the steers.

It was very difficult to obtain accurate hog gains on many of the feeding lots because of the many changes in the number of hogs and the difficulty of obtaining weights at the end of the feeding periods. The data from eight lots of steers on the Minnesota farms show a cash return per steer for pork gains of \$3.58. At seven cents a pound this means a pork gain of 51.1 pounds per steer. This shows then that a profit was made on the cattle and hogs in 1913 and 1914 of about \$3.00 per steer, but the pork gains in 1915 were not sufficient to make up the large losses on the cattle. The above pork gains expressed in the per cent of steer feed they paid for indicates that 15 per cent of the feed cost was paid for by the pork gains. On the average these steers each consumed 2246 pounds of grain and the pork gains were made at the rate of 2.2 pounds of pork for each 100 pounds of grain consumed by the steers.

On the Iowa farms from the data on approximately 1500 hogs following 960 steers on feed for each of the two years shows a profit per hog of \$6.67 in 1910 and of \$3.33 per hog in 1911. In every case where a loss was incurred in the cattle feeding operation the hogs more than made up the loss. Usually one and one-half 100 pound hogs are allowed back of a steer on full feed of ear corn and are fed some extra to obtain maximum pork gains. In these studies where it required $4\frac{1}{2}$ pounds of grain per pound of pork with hogs fed alone, this feed was reduced to 2.8 pounds with $1\frac{1}{2}$ hogs to the steer.

Experiments in cattle feeding have contributed considerable data on the subject of hog gains. Mumford²² found that ordinarily two to three 100 pound hogs are allowed back of a 1000 pound steer on a full feed of snapped corn; $1\frac{1}{2}$ hogs when ear corn is fed; one hog to the steer with shelled corn, and one-third to one-half a hog with ground or crushed corn as the steer feed.

At the Missouri station²³ pigs back of steers on rations in which ear or shelled corn predominated gained at the rate of from 1.5 pounds to 2.9 pounds of pork per bushel of corn consumed by the steers. Indiana²⁴ reports from 1.7 pounds to 2.5 pounds per bushel of corn. Mumford, in Illinois Bul. No. 103, shows from nine to 16 per cent of the steer feed cost was paid for by the pork gains and a gain of 1.6 to 3.6 pounds of pork per hundredweight of corn consumed. Further work in Indiana²⁵ indicated that hogs back of calves gained at the rate of one pound per bushel of corn

²² Feeds and Feeding - Henry and Morrison, page 495

²³ Missouri Bul. No. 112 - 1913

²⁴ Indiana Bul. No. 130 - 1908

²⁵ Indiana Bul. No. 146

consumed; with yearlings the gain was 1.8 pounds per bushel, and with two year old steers it was 2.5 pounds.

Value of the Manure from Cattle

There were no attempts made to estimate the amount or value of the manure produced by the stock in this investigation. The amount produced varies with the system of feeding and bedding and whether paved yards or sheds are used. It has been estimated that a 1000-pound steer will produce from two to 2½ tons of manure, including the bedding, in a three month feeding period. It has also been placed at four tons in a six months feeding season.²⁷

The value varies with almost every farm and depends on the feeds used, the method of caring for it, the amount of bedding used, where and how it is applied, the cost of hauling, and the elements required by the soil covered. The ordinary price is from \$1.00 to \$1.50 per ton if the haul is not too great. Records are available to show that an application of eight tons of manure increased crops in a rotation to the value of \$2.17 per ton of manure. At two to three tons per steer this would give an indirect by-product of from \$4.00 to \$6.00 per steer in a feeding season.

Profits and Losses

Bringing together the total costs from Tables VI, VII, XXXI, XXXII, and XXXIII, and the income from Tables XXXVII and XXXVIII, the gains and losses are shown. For means of comparison the years are shown separately with an average of the years concerned for both the Iowa and Minnesota records. The Iowa tabulations of cost do not include any shelter or equipment cost which on the Minnesota farms amounted to \$1.20 per steer, 20 cents per hog and eight cents per head of sheep.

²⁶ U.S. Dept. of Agriculture Farmers' Bul. No. 588, page 10

²⁷ Beef Production, H. W. Mumford, 1907 - pages 12 and 13

TABLE XLProfits and Losses per Head - Iowa Farms

Year	Kind of stock	Number per head	Income per head	Cost per head	Profit per head	Loss per head
1910	Cattle	981	\$78.42	\$76.37	\$ 2.05	
1911	"	963	81.13	81.91		\$0.78
1910	Hogs	141	15.48	10.23	5.25	
1911	"	280	16.72	13.94	2.78	
1910	Sheep	2963	5.11	5.11	Even break	
1911	"	2948	4.95	4.90	.05	

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This profit, except on hogs in 1910, was not enough to make very much money on cattle in the feed lot without the added income from hogs following the steers. In 1910 there were 1504 hogs following the 961 steers with a profit per head of \$6.67 which greatly increased the returns for the entire feeding operation. In 1911 on practically the same number of hogs following the steers the profit per hog was \$3.33 which made the operation a profitable one inasmuch as the loss per steer was 78 cents.

In this study the cost of production is the principal expression of the investigation, yet the question of income and profit or loss is an important one. It should be borne in mind that there are by-profits or values in stock feeding that may make it successful even though no direct money profits are received.

Table XLI presents the relation between the cost and income on the Minnesota lots of stock.

TABLE XLIProfits and Losses per Head - Minnesota Farms

Year	Kind of stock	Number head	Number lots	Income per head	Cost per head	Profit per head	Loss per head
1913	Cattle	97	2	\$96.73	\$97.49	\$	\$ 0.76
1914	"	138	3	82.00	82.50		.50
1915	"	121	4	70.84	84.60		13.76

1913	Hogs	429	3	21.37	14.70	6.67	
1294	"	249	2	17.81	12.72	5.09	

1913	Sheep	1880	1	7.85	6.69	1.16	
1914	"	2111	1	6.89	6.20	.69	
1915	"	2129	1	6.88	5.53	1.35	

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The largest loss was in 1915 when the initial cost of cattle and feed was comparatively high and the market was poor for the finished product. Because of the indirect profits there was in reality a small margin of profit for the two years 1913 and 1914. Considering feed as the only cost as is usually figured there would have been a return over feed of \$6.18 per steer as an average for the two years. It is noted that the hogs and sheep returned a very nice profit over all costs.

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