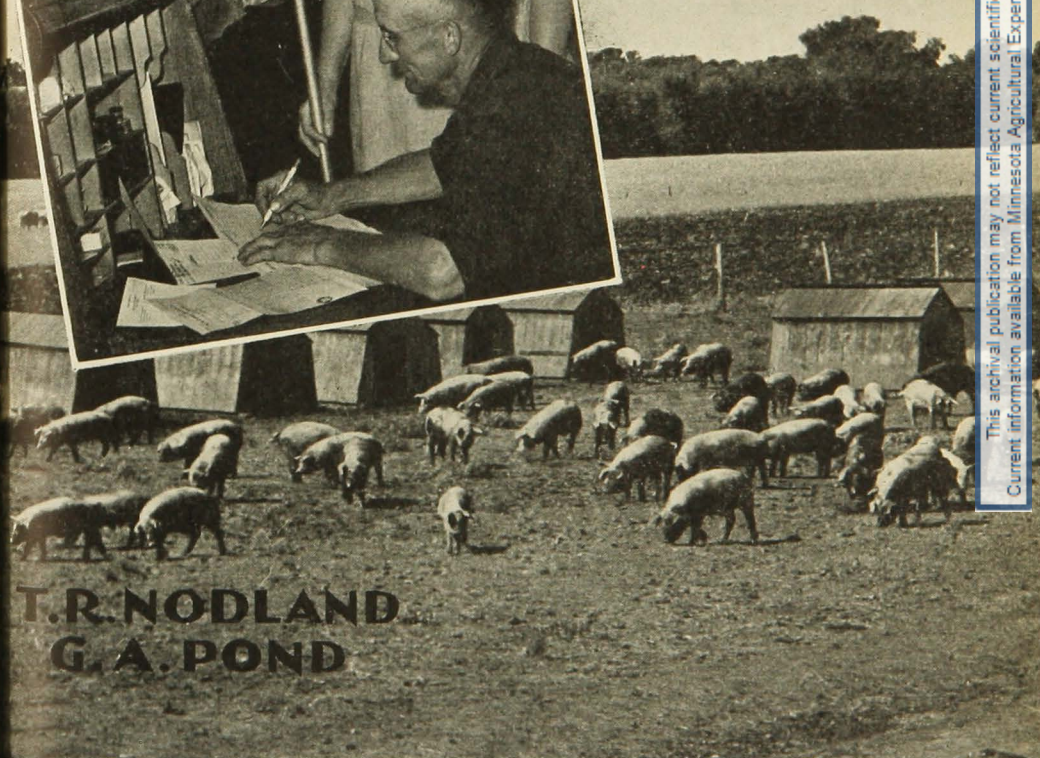


MANAGING HOGS for Greater Returns



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DURING recent years approximately one fifth of the total gross cash income of Minnesota farmers has been received from the sale of hogs.

In 1941, Minnesota farmers received \$108,700,000 from the sale of hogs, or 23.2 per cent of the total gross cash income obtained from the sale of 18 principal agricultural commodities (see accompanying table).

The high point occurred during the period 1925-29 when 24.3 per cent of the gross cash income was from the sale of hogs. In 1939 the United States Census reported production of hogs on 68 per cent of the farms.

Most of the commercial swine production is in the southern one third of the state.

Gross Cash Income from 18 Principal Farm Commodities in Minnesota, 1910-1941*

Year	Income from 18 commodities†	Income from hogs	Per cent hogs is of total income
	Million dollars	Million dollars	
1910-14 average	\$180.4	25.8	14.3
1915-19	330.4	63.0	19.1
1920-24	313.0	66.0	21.1
1925-29	408.1	99.2	24.3
1930-34	232.3	52.2	22.5
1935-39	310.9	65.5	21.1
1940	361.3	69.2	19.2
1941	467.7	108.7	23.2

* Cox, R. W., Waite, W. C., and Garver, W. B., Income and Expenditures of Minnesota Agriculture, Minnesota Agricultural Experiment Station Bulletin 366, 1943, page 9.

† Includes hogs, cattle, calves, lambs and sheep, chickens, turkeys, eggs, milk, butterfat, wool, wheat, corn, oats, barley, rye, flax, hay, and potatoes.

MANAGING HOGS

for

Greater Returns¹

T. R. Nodland and G. A. Pond

Introduction

Purpose of the Study—Farmers are not equally successful with the swine enterprise. Every study of farmers' records reveals a wide variation in the returns obtained from hogs among similar farms in the same general locality. Differences among farms in the return over feed cost of as much as six dollars for each 100 pounds produced are not unusual. Such differences are due in the main to differences in the organization of the enterprise and in the practices followed.

The general purpose of this study is to stress to farmers and others interested the value of farm records in analyzing the factors that affect economic returns from livestock production. The specific objective is to illustrate the method of procedure by analyzing the records of the hog enterprise kept by a group of southeastern Minnesota farmers for the purpose of ascertaining the relative importance of some of the factors and practices followed which account for the large

variations in the financial returns obtained by farmers. In so far as these factors and practices are within the control of the individual farmer such an investigation should enable farmers who are attempting to improve their swine enterprise to select those methods and practices which have proven most profitable.

Source of Data—The data used in this study are taken from farm records kept by farmers. The farmers included in this study were members of the Southeast Minnesota Farm Management Service, conducted cooperatively by the Department of Agriculture, University of Minnesota, and the Bureau of Agricultural Economics of the U. S. Department of Agriculture. A total of 1,419 yearly records of the swine enterprise were obtained from 10 counties for the years 1928 to 1937. The location of the counties from which records were obtained is shown in figure 1. There was some change in farms from year to year. In this study each yearly farm record is treated as a separate case.²

¹The authors wish to express their appreciation to the members of the Southeast Minnesota Farm Management Service for their cooperation in supplying the data during the 10 years of the study and to the fieldmen—R. C. Bevan, O. R. Shelley, and Glen Myers—who assisted and supervised the farmer cooperators in keeping their farm records. They are especially indebted to W. P. Ranney, formerly of the University of Minnesota, who participated in the summarization of the annual reports and in the preparation of the material for analyses. They also express their appreciation to C. W. Crickman of the Bureau of Agricultural Economics, United States Department of Agriculture, for his aid in planning the study and to S. A. Engene of the University of Minnesota for his valuable suggestions in the preparation of the manuscript. Completion of this study was made possible by workers supplied by Work Projects Administration, Official Project No. 65-1-71-140, Subproject 468, Sponsor: University of Minnesota.

²For this reason, the term "farm" as used in this bulletin usually refers to a yearly farm record, that is, one farm for one year. Thus the "1,419 farms" frequently mentioned is the cumulative total obtained by adding together for the 10 years the individual yearly totals of farms keeping records—approximately 142 farms per year for 10 years.

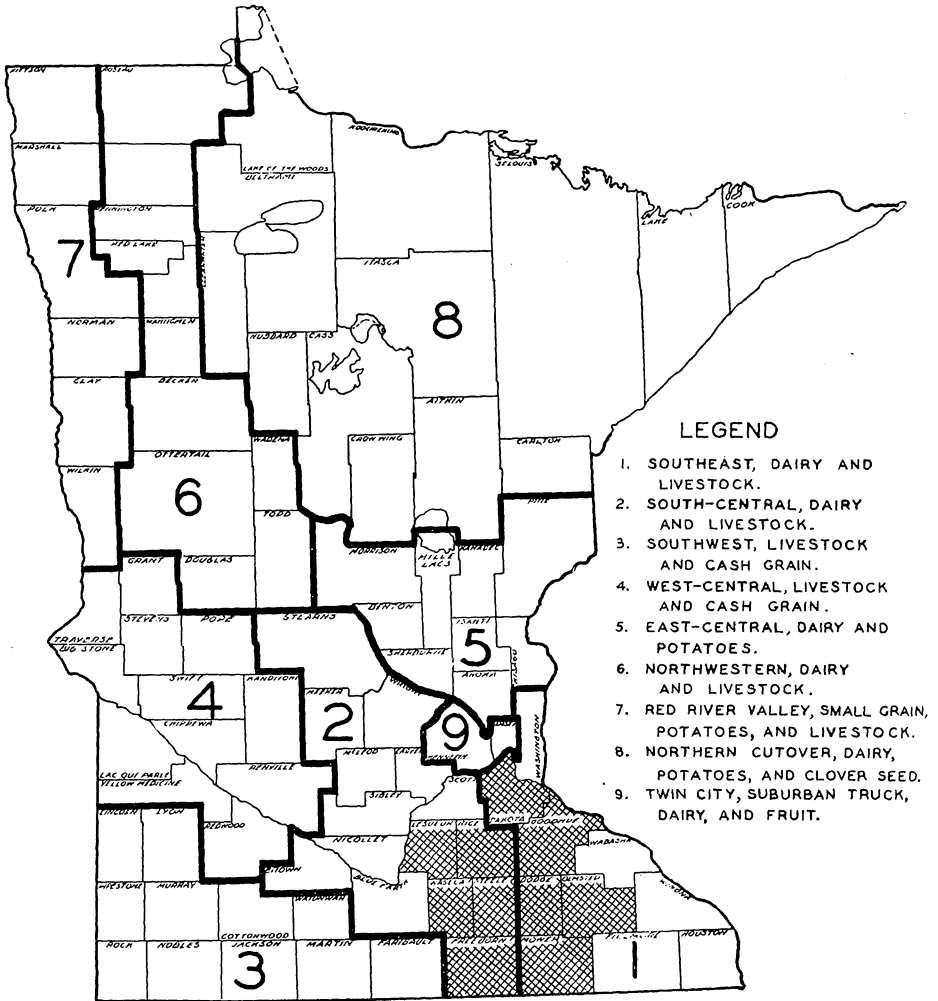


FIG. 1. Location of the farms studied

Dairying is the most important single source of cash income on the farms studied. However, the raising of hogs is important and ranks second to dairying, with 21 per cent of the cash income coming from the sale of hogs. Hogs make up an average of 17 per cent of the total animal units maintained on these farms. The total number of livestock kept increased materially from 1928 to 1931 and there-

after remained practically constant except for 1935 which followed a year of severe drouth. The proportion of the animal units that were hogs began to decrease in 1932 because of low prices in 1931. Hog numbers were further reduced in 1934 and continued low during the balance of the period studied because of AAA restrictions.

Most of the farmers included in the farm management service are men of

more than average managerial ability and in general are on farms somewhat larger and more productive than the average of the area. Nevertheless the wide range in the return over feed (that is, return over feed cost) and in the practices followed by these farmers makes these records useful in determining the relative profitableness of management factors and practices.

Variations in Factors of Cost and Returns

The cost of producing hogs varies widely from year to year. The data in table 1 show the variation in some of the factors of cost and returns by years on the farms studied. The feed cost per 100 pounds of hogs declined steadily from \$7.98 in 1928 to \$2.83 in 1933 and thereafter increased to \$6.33 in 1937. In the production of hogs the cost of feed amounts from 75 to 90 per cent of the total costs, making feed by far the most important single item of cost.³ Man labor, the next largest cost, represents less than 10 per cent of the total cost. The others, namely, power, shelter, equipment, interest, and miscellaneous cash costs, are very minor. The charge for feed on the farms studied was computed on the basis of average farm prices in the area.

The net increase in the value per 100 pounds of hogs produced showed an even greater variation than the feed cost. The net increase in value represents the gross return and is calculated by subtracting the value of the purchases and the value of the beginning inventory from the combined value of the closing inventory, sales, and hogs butchered for home use. During two of the 10 years studied (1931 and 1932) the cost of the feed when charged for at

average prices exceeded the value of the hogs produced. In addition, other costs were involved in hog production. The price received per 100 pounds of hogs sold declined to a low of \$3.18 in 1932. During the same period the hog-corn price ratio increased from 11.4 in 1928 to 16.5 in 1933. This was due to the fact that the prices received for hogs on the market declined less than feed prices. The physical factors of production also varied widely from year to year. The number of pigs raised and the pounds of hogs produced per farm fell sharply in 1934 because of the government corn-hog program and the drouth.

Some farmers are much more efficient than others in hog production as indicated by wide differences in return over feed among farms in the same locality. In general the differences between farms in any one year are much wider than between years on the same farm. The former are due primarily to differences in efficiency of operation, and the latter primarily to variations in prices.

The facts presented in table 2 show the wide variation among farms in the group studied. In all of the 10 years studied, some farmers failed to receive a return from the hog enterprise sufficient to cover the estimated value of the feed. In 1928 there was a range of \$22.75 per cwt. of hogs produced between the most efficient and the least efficient producer. Occasionally the wider variations are due to losses which the individual cannot control, but in general most of the differences between farms are within the control of the farmer.

Variation in return over feed among farms is presented graphically in figure 2. Three years were selected which show the range during a year of high

³ Engene, S. A., Pond, G. A., and Anderson, A. W., A Preliminary Report of Livestock Costs and Returns from Data Secured in 1940 on the Farm Accounting Route in Winona County, Minnesota, Mimeographed Report No. 124 of the Division of Agricultural Economics, University of Minnesota, June 1941, page 13. Also Wilcox, R. H., Carroll, W. E., and Hornung, T. G., Some Important Factors Affecting Costs in Hog Production, Illinois Agricultural Experiment Station Bulletin 390, 1933, pages 18-20.

Table 1. Factors of Cost and Returns in Hog Production, 1928-1937

Items	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	10-year average
Number farms	122	168	174	143	142	104	116	145	147	158	142
Litters per farm											
Spring	6.5	7.1	7.5	9.4	7.9	7.2	5.2	4.6	6.1	6.2	6.8
Fall	3.4	3.2	3.1	4.9	3.7	5.1	2.2	2.8	3.4	3.0	3.5
Total	9.9	10.3	10.6	14.3	11.6	12.3	7.4	7.4	9.5	9.2	10.3
Litters per 100 acres.....	5.9	5.7	5.7	7.2	5.7	6.1	3.5	3.7	4.6	4.3	5.2
Pigs weaned per litter..	6.1	6.1	6.2	6.4	5.9	5.8	6.3	6.3	6.4	6.3	6.2
Hogs produced											
Per farm, cwt.	129.7	140.3	157.3	195.3	152.2	156.7	124.2	102.8	132.2	134.1	142.5
Per litter, lbs.	1,311	1,363	1,485	1,366	1,312	1,275	1,679	1,389	1,392	1,458	1,403
Per pig weaned, lbs..	215	223	240	213	222	220	267	220	218	231	227
Av. wt. hogs sold, lbs....	218	228	231	228	224	242	250	248	240	229	234
Feed per 100 lbs. gain											
Corn, lbs.	317	325	334	257	282	352	344	333	329	290	316
Small grain, lbs.	165	160	160	153	136	87	52	91	103	135	124
Commercial grain feeds, lbs.	13	6	4	15	17	7	10	16	13	14	12
Total grain and com. feeds, lbs.	495	491	498	425	435	446	406	440	445	439	452
Tankage, lbs.	1	1	1	3	3	2	2	3	3	3	2
Skim milk, lbs.	505	487	435	399	481	417	558	523	409	377	459
Per cent protein in total nutrients	13.6	13.1	12.8	13.6	13.8	12.9	13.8	13.8	13.1	13.2	13.4
Value feed per cwt. hogs											
Grain and com. feeds	\$6.38	\$5.83	\$5.02	\$3.20	\$2.52	\$2.28	\$3.74	\$4.55	\$5.33	\$5.54	\$4.44
Tankage and skim milk	1.33	1.25	1.10	.66	.51	.44	.86	.85	.79	.63	.84
Pasture .....	.27	.26	.20	.17	.11	.11	.11	.14	.15	.16	.17
Total feed cost, cwt. hogs	\$7.98	\$7.34	\$6.32	\$4.03	\$3.14	\$2.83	\$4.71	\$5.54	\$6.27	\$6.33	\$5.45
Net increase in value, cwt. hogs	\$8.52	\$9.80	\$8.01	\$3.79	\$2.58	\$3.36	\$5.67	\$9.52	\$9.44	\$8.81	\$6.95
Return over feed, cwt. hogs	\$.54	\$2.46	\$1.69	\$-.24	\$-.56	\$.53	\$.96	\$3.98	\$3.17	\$2.48	\$1.50
Price per cwt. hogs sold	\$8.23	\$9.60	\$8.94	\$5.33	\$3.18	\$3.42	\$4.01	\$8.73	\$9.26	\$9.47	\$7.02
Minnesota hog-corn price ratio	11.4	11.6	13.7	13.7	13.9	16.5	8.1	13.6	15.7	12.3	13.0

hog prices, one of low prices, and one of average prices. In all cases the trend is the same. A few farmers were very efficient and obtained very high returns over feed. A few were very inefficient and produced hogs at a loss. Even when the extremes are omitted from consideration, there is enough of a variation among the bulk of the farmers to warrant a careful study of the hog enterprise to determine the major management factors and practices responsible for the differences in returns.

Large Enterprises Relatively More Profitable

The number of litters of pigs raised per farm is an indication of the size of the swine enterprise. Figure 3 shows the number of farms graphically arranged according to the number of litters raised. Forty-eight farmers did not keep sows for raising pigs but either purchased a few pigs or carried them over from the previous year. The tonnage of hogs produced in such cases was

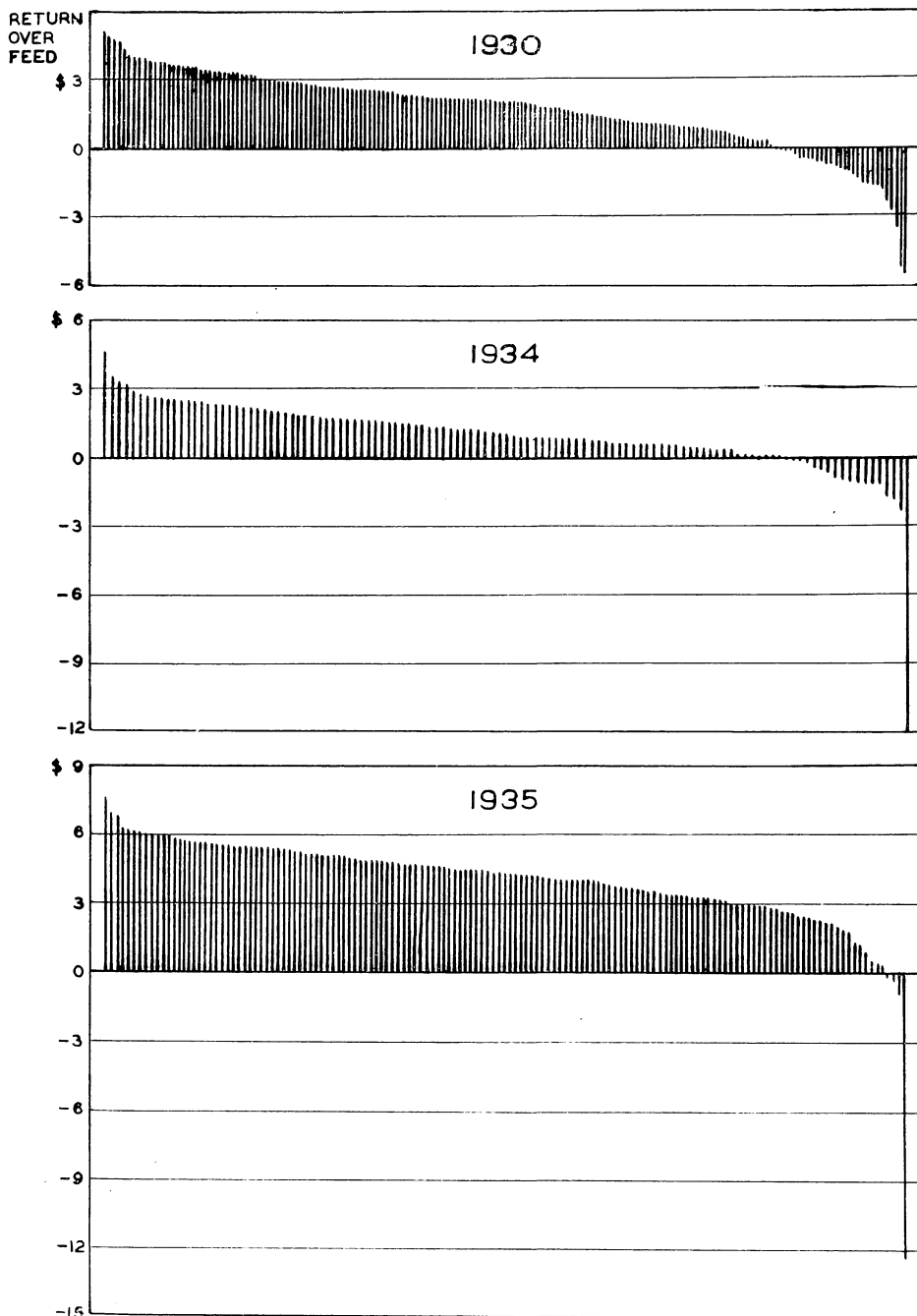


FIG. 2. Variations in returns above feed cost per 100 pounds of hogs produced, 1930, 1934, and 1935

Table 2. Return Over Feed per 100 Pounds of Hogs Produced, 1928-1937

Year	Highest	Average	Lowest	Range
1928	\$4.55	\$0.54	\$-18.20	\$22.75
1929	6.05	2.46	- 5.09	11.14
1930	5.11	1.69	- 5.47	10.58
1931	2.05	-.24	- 3.47	5.52
1932	1.19	-.56	- 4.86	6.05
1933	2.35	.53	- 5.12	7.47
1934	4.65	.96	-12.90	17.55
1935	7.58	3.98	-12.40	19.98
1936	6.56	3.17	- 4.20	10.76
1937	7.09	2.48	-14.25	21.34
Average	4.72	1.50	- 8.59	13.31

very small. One record showed 41 litters and another 42 litters raised. These represent the largest hog enterprises in this study. The majority of the farmers raised from 5 to 12 litters per year, 52 per cent of the farms falling within this range.

The number of litters of pigs raised

is related to return over feed. The 227 farmers raising four litters or fewer showed the lowest returns (table 3). The small herds had a small proportion of the hogs raised under a two-litter system, which means the overhead cost of keeping the sows and boar would be charged against fewer litters. More feed was required to make 100 pounds gain when only a few litters were raised. This is due in part to the fact that farmers with only a few hogs paid very little attention to good hog pastures and also a less efficient use was made of the skim milk. The value of skim milk is assumed to be constant regardless of the quantity fed. On most of these farms skim milk is a by-product which has to be fed on the farm. If only a few hogs are raised there is a tendency to feed more than the hog can use profitably at the price charged.

Farmers with the larger number of litters make greater use of the two-litter system. This serves to spread the

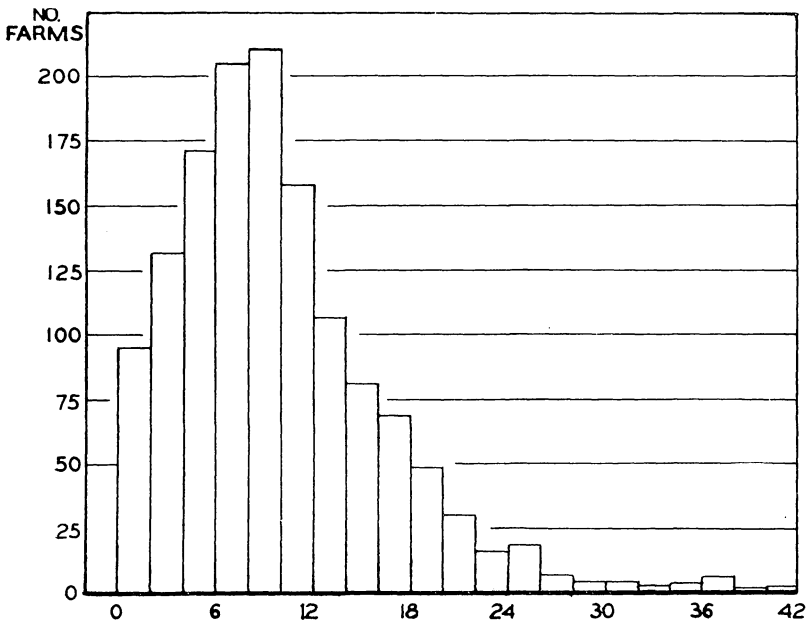


FIG. 3. Distribution of farms according to number of litters of pigs raised per year

Table 3. Relation of Number of Litters of Pigs Raised to Various Swine Production Factors, 1928-37*

Range	Average	Number of litters	Return over feed per cwt. hogs	Lbs. feed per cwt. hogs†	Lbs. skim milk per cwt. hogs	Per cent protein in ration	Kind of pas- ture‡	Sani- tation§	Per cent death loss	Pigs weaned per litter	Per cent fall litters	Per cent gilts	Avg. wt. hogs sold
0	0	48	\$0.75	558	517	13.4	2.7	3.0	2.5	.....	.....	.....	238
1-4	2.7	227	1.09	539	534	13.7	2.2	2.3	5.0	6.6	28	62	234
5-8	6.6	376	1.59	499	518	13.8	1.8	2.2	6.4	6.4	31	61	236
9-12	10.4	369	1.65	500	448	13.3	1.8	2.2	6.3	6.1	33	54	232
13-16	14.3	188	1.65	497	382	13.0	1.7	2.1	6.4	6.1	34	52	230
17-20	18.3	116	1.71	491	373	13.0	1.7	1.9	6.0	6.0	37	53	231
21 and more	26.3	95	1.44	499	295	12.5	1.5	2.0	6.4	5.9	42	51	231

* A consistent pattern is followed in the arrangement of tables except that certain factors showing little or no relationship in the particular table have been omitted to save space.

† Nine pounds of skim milk were assumed as equal to one pound of concentrates.

‡ Pasture was coded numerically as follows: legumes 1; rape and small grain 2; bluegrass and timothy 3; and no pasture 4.

§ The degree to which sanitation practices were followed was coded numerically: complete sanitation 1; partial sanitation 2; and no special sanitation practices 3.

cost of keeping breeding stock over a larger number of litters.

In general, farmers producing large numbers of hogs should have an advantage over those with small enterprises that is not considered in the return over feed. With larger numbers, more efficient use can be made of man labor, buildings, and equipment. The large producers can afford to install water systems, self-feeders, and other labor-saving devices. They can afford to move the hogs out into the pastures and haul feed and supplies some distances. The large producer is apt to pay more attention to sanitation and disease control.

Feeding Efficiency

Quantity of Feed Consumed—One of the principal factors responsible for the variations between farms in the return over feed secured from hogs was the quantity of concentrates required to produce 100 pounds of hogs. Except for the relatively small quantity of nutrients obtained from pastures, the

quantity of concentrates consumed represents an excellent measure of efficiency in feeding hogs. On these farms the pasture charge, based on the number of months hogs had access to pasture, amounted to only 3 per cent of the total estimated value of the feed consumed. There was a considerable variation from farm to farm in the feed secured from pasture. However, the average quantity of feed secured in this manner was relatively small.

A large quantity of skim milk was available on these farms for feeding to hogs. In addition, some farmers purchased considerable quantities of buttermilk from the local creameries. Buttermilk is almost identical to skim milk in composition and feeding value and was included with skim milk in this study. In the calculation of total concentrates consumed, skim milk and buttermilk have been changed to a concentrate equivalent by assuming nine pounds of these feeds to be equal to one pound of concentrates.⁴ Under ideal feeding conditions using the proper proportions of skim milk to other concen-

⁴ Ferrin, E. F., Buttermilk and Pasture Crops for Growing-Fattening Pigs, Mimeographed Report No. H-74 of the Division of Animal and Poultry Husbandry, University of Minnesota, October 1939, page 3.

trates it may be valued somewhat higher. Under actual farm conditions a large quantity of skim milk may be available at the time hog numbers are low, so that the full feeding value of skim milk is not always utilized.

The relationship of quantity of feed consumed to return over feed per 100 pounds of hogs produced is presented in table 4. The most efficient group of hog feeders produced 100 pounds of hogs with 512 pounds less feed than the least efficient producers. Using the average production of 14,250 pounds of hogs per farm, the difference in return per herd between the two extremes amounts to \$714. The average return over feed for the 115 farmers who fed over 700 pounds of concentrates to produce 100 pounds of hogs was —\$2.03. In other words they failed to cover the cost of feed. In addition, there are the expenses of labor, equipment, buildings, and miscellaneous cash costs to be met.

The quantity of feed consumed was related to several swine production factors. The consumption of skim milk was highest for the farms with a high feed cost. In many cases, more skim milk was produced than the hogs and other livestock were able to utilize efficiently. In such instances it was a matter of making some use of this important by-product rather than wasting it

entirely. The per cent protein in the ration declined with an increase in feed in spite of the increased rate of feeding skim milk. The proportion of the concentrates that came from skim milk—the principal high protein feed—became less as the rate of feeding was increased. At the present time, with the increasing need for dried skim milk, many farmers have available a market outlet for it. Wherever this is the case, the amount of skim milk fed to hogs is likely to be limited to the minimum protein needs or eliminated altogether if some other protein concentrate is available at lower cost.

The herds with the higher feed requirements also had a higher death rate, a smaller number of pigs weaned per litter, and the hogs were sold at a lower average weight per head. This probably reflects the quality of the general care the hogs received. Farmers who were careless in the feeding of hogs probably were careless in the handling of the small pigs to the extent that it affected the number weaned per litter. A high death loss also results in a high rate of feeding because the feed consumed by hogs that die as well as the feed of the sows has to be charged to the pigs remaining in the herd.

The farmers who fed large quantities of concentrates to produce 100 pounds

Table 4. Relation of Amount of Feed Consumed per 100 Pounds of Hogs Produced to Various Swine Production Factors, 1928-37

Range	Pounds feed per cwt. hogs		Return over feed per cwt. hogs	Lbs. skim milk per cwt. hogs*	Per cent protein in ration	Kind of pas- ture†	Sani- tation score‡	Per cent death loss	Pigs weaned per litter	Num- ber lit- ters	Per cent fall lit- ters	Avg. wt. hogs sold	Index of price re- ceived
	Aver- age	Num- ber farms											
399 and less	352	285	\$2.98	383	14.3	1.8	2.2	4.9	6.6	9.3	34	234	100
400-499	448	510	2.09	420	13.4	1.7	2.1	5.4	6.4	10.7	34	236	100
500-599	543	343	1.13	498	13.1	1.9	2.2	6.4	6.0	11.1	32	233	100
600-699	637	166	.36	528	12.8	2.1	2.2	6.2	5.9	9.6	33	228	101
700 and over	864	115	—2.03	596	12.3	2.0	2.3	9.4	5.9	6.2	25	225	99

* Nine pounds of skim milk were assumed as one pound of concentrates.

† Pasture was coded numerically: legumes 1; rape and small grain 2; bluegrass and timothy 3; and no pasture 4.

‡ The degree to which sanitation practices were followed was coded numerically: complete sanitation 1; partial sanitation 2; and no special sanitation practices 3.

Table 5. Relation of Per Cent Protein in the Ration to Various Swine Production Factors, 1928-37

Range	Average	Number farms	Return over feed per cwt. hogs	Lbs. feed per cwt. hogs*	Lbs. skim milk per cwt. hogs	Kind of pasture†	Sanitation score‡	Per cent death loss	Pigs weaned per litter	Number litters	Per cent fall litters	Avg. wt. hogs sold	Index of price received
11.4 and less	10.6	272	\$1.03	572	186	1.8	2.2	6.0	6.1	10.0	26	234	99
11.5-12.9	12.2	364	1.40	525	327	1.8	2.1	5.7	6.2	11.7	32	230	100
13.0-14.4	13.5	425	1.65	488	459	1.8	2.1	6.1	6.3	10.2	32	238	100
14.5-15.9	15.0	170	1.84	477	639	1.9	2.1	5.2	6.3	9.0	40	228	100
16.0-17.4	16.5	108	1.71	465	825	1.9	2.3	7.0	6.3	8.2	36	234	101
17.5 and over	19.3	80	1.82	440	1,093	1.9	2.2	6.4	6.2	6.1	42	225	104

* Nine pounds of skim milk were assumed as one pound of concentrates.

† Pasture was coded numerically as follows: legumes 1; rape and small grain 2; bluegrass and timothy 3; and no pasture 4.

‡ The degree to which sanitation practices were followed was coded numerically: complete sanitation 1; partial sanitation 2; and no special sanitation practices 3.

of hogs raised fewer fall litters. In the two-litter system the sows raise a litter of pigs in the early spring and another in the late summer or fall. Thus the overhead cost of maintaining the sows and boars is charged to a larger number of litters and tends to reduce the feed requirement needed to produce 100 pounds of hogs.

Protein in the Ration—Another important reason for the variation among farmers in the returns secured from hogs is the proportion of protein in the digestible nutrients. An intelligent choice of feeds is essential if the growing and fattening of swine is to be profitable. Protein is one of the essentials in a good swine ration and one that is frequently skimmed. Swine are fed principally on the farm-raised grains. With the exception of soybeans, which are of very minor importance as a grain crop on these farms, the grains are all too low in the quantity and quality of the proteins to make a well-balanced ration. In this dairy area, skim milk supplied most of the additional protein needed during the period covered by this study. A small quantity of tankage and other purchased high-protein concentrates was fed.

The question of how much protein to feed is a difficult one to answer. The data in table 5 show that the feeding of liberal quantities of protein was accompanied by a low feed requirement. To produce 100 pounds of hogs with a ration containing 10.6 per cent protein required 572 pounds of concentrates. But on farms where the average digestible protein content of the ration was 19.3 per cent, only 440 pounds of concentrates were required to produce a hundredweight of hogs. Whereas the farmers feeding the ration containing only 10.6 per cent protein received \$1.03 return over feed per 100 pounds produced, the farms feeding the 19.3 per cent protein ration made a return of \$1.82.

Pound for pound, a high-protein feed is usually higher in price than farm-raised grains. A point is eventually reached where adding protein to a ration increases the cost more than it saves in feed or speeds up growth. In this study return over feed increased with every increase in the proportion of protein up to approximately 15 per cent of the digestible nutrients. Beyond 15 per cent the additional protein did not improve the ration enough to increase the return over feed.

Table 6. Relation of Pounds of Skim Milk Consumed Per 100 Pounds Hogs Produced to Various Swine Production Factors, 1928-37

Range	Average	Number farms	Return over feed per cwt. hogs	Lbs. feed per cwt. hogs*	Lbs. feed other than skim milk	Per cent protein in ration	Kind of pas-ture†	Sani-tation score‡	Per cent death loss	Pigs weaned per liter	Number lit-ters	Per cent fall lit-ters	Per cent gilts	Avg. wt. hogs sold
0	0	79	\$1.32	529	529	11.0	2.2	2.2	6.5	6.4	6.0	29	69	223
1- 199	128	227	1.74	495	481	11.6	1.7	2.1	5.8	6.3	12.6	30	62	234
200- 399	303	403	1.82	486	452	12.6	1.8	2.1	5.6	6.3	11.8	31	58	233
400- 599	491	340	1.54	496	441	13.6	1.8	2.2	5.6	6.2	9.9	35	53	234
600- 799	689	183	1.40	517	440	14.6	1.8	2.2	6.0	6.2	8.4	35	54	232
800- 999	881	93	1.07	520	422	15.9	1.9	2.2	6.6	6.2	7.5	34	51	227
1,000-1,199	1,087	50	.61	577	456	16.9	2.1	2.2	9.0	6.0	6.3	40	53	237
1,200 and more	1,583	44	-.16	666	490	17.8	2.0	2.3	7.2	5.6	5.3	40	57	244

* Nine pounds of skim milk were assumed as one pound of concentrates.

† Pasture was coded numerically as follows: legumes 1; rape and small grain 2; bluegrass and timothy 3; and no pasture 4.

‡ The degree to which sanitation practices were followed was coded numerically: complete sanitation 1; partial sanitation 2; and no special sanitation practices 3.

Certain other relationships may be noted. The group feeding protein in the largest proportions raised relatively few litters. The farms studied were dairy farms and generally had a large quantity of skim milk to feed. Thus a large quantity of skim milk was fed per 100 pounds of hogs, increasing the relative amount of protein consumed.

Use of Skim Milk—Because of its palatability and the relatively large content of high quality proteins, skim milk is a very valuable feed for hogs. However, on many farms it is fed beyond the point of its most efficient use and sometimes to a point where it ceases to be profitable (table 6). On the farms included in this study the maximum return over feed was secured when skim milk was fed at the rate of approximately 300 pounds for every 100 pounds gain in weight.

The amount of concentrates saved by using skim milk in the ration varies with the quantity consumed. The greatest proportional saving occurs when less than 200 pounds is fed for each 100 pounds gain in weight. Because of its bulkiness a point is eventually reached in feeding large amounts

of skim milk beyond which a hog cannot consume enough milk to obtain the necessary nutrients.

If an excess of skim milk is fed, full use cannot be made of the proteins it contains. A more detailed inspection of the data shows that proteins from other sources in addition to that contained in milk are desirable. The records were sorted into groups similar in rate of skim milk feeding. Regardless of the level of skim milk feeding, an increase in the proportion of the digestible nutrients that was protein reduced the total quantity of feed consumed and increased the return over feed.

One basis for placing a value on skim milk is the value of the feed saved by the use of milk in the ration (table 7). A ration containing an average of 128 pounds of skim milk for each 100 pounds gain in weight resulted in a saving of 71 cents in the total feed cost. At this rate of feeding, 100 pounds of skim milk was worth 55 cents. Although much larger amounts can be fed when a surplus is available, the amount consumed in addition to that needed to balance a ration will be worth less as a feed. Farmers who fed an average of 1,583 pounds of milk for each 100

Table 7. Value of Skim Milk for Hogs, 1928-37

Range	Average	Feeds other than skim milk		Value of 100 lbs. skim milk
		Pounds	Cost	
0	0	529	\$5.77	\$
1- 199	128	481	5.06	0.55
200- 399	303	452	4.68	0.36
400- 599	491	441	4.58	0.24
600- 799	689	440	4.45	0.19
800- 999	881	422	4.52	0.14
1,000-1,199	1,087	456	4.49	0.12
1,200 and over	1,583	490	4.77	0.06

pounds gain in weight of their hogs received only 6 cents for each 100 pounds of skim milk. The monetary value of 100 pounds of skim milk will of course fluctuate with the value of the other feeds saved.

Use of Pasture—Pasture is an aid in maintaining good health and a factor in reducing the amount of grain needed by hogs. The data in table 8 show the farms divided into four groups on the basis of the kind of pasture. All legumes were included in one group. Rape and small grain were combined in another group because in most instances rape was reported in a mixture with small grain. Farms on which bluegrass and timothy pasture were used and the farms on which pasture was not available make up the remaining groups. No information was available on the quality, stand, or acres pastured. Although

this classification is very rough, the kind of pasture had some influence on the feed consumed and the returns received. The hogs raised without pastures needed the largest quantity of feed to produce 100 pounds of hogs and their owners received the lowest return over feed. The group having access to legume or rape and small grain pastures yielded the highest average return over feed and used the smallest amount of feed. Bluegrass and timothy pastures, although better than none, did not approach the legumes or rape and small grain pastures in production and in economy of gains. During July and August most of the bluegrass and timothy pastures are very unpalatable and unsatisfactory.

Good pasture is an excellent source of good-quality protein. However, an increase in protein in the ration saved feed and increased return over feed

Table 8. Relation of Kind of Pasture to Various Swine Production Factors, 1929-37

Kind of pasture	Number of farms	Return over feed per cwt. hogs	Lbs. feed per cwt. hogs*	Lbs. skim milk per cwt. hogs	Per cent protein in ration	Sanitation score†	Per cent death loss	Pigs weaned per litter	Number of litters	Per cent fall litters	Per cent gilts	Avg. wt. hogs sold
Legume	569	\$1.70	486	460	13.5	2.0	6.4	6.3	10.9	33	58	236
Rape and grain	208	1.70	491	437	13.3	2.2	6.3	6.2	10.2	33	62	236
Bluegrass and timothy	158	1.37	509	480	13.5	2.2	5.7	6.2	9.9	37	48	229
None	115	1.22	522	470	13.4	2.3	6.5	6.3	7.3	40	48	236

* Nine pounds of skim milk were assumed as one pound of concentrates.

† The degree to which sanitation practices were followed was coded numerically: complete sanitation 1; partial sanitation 2; and no special sanitation practices 3.

Table 9. Relation of Method of Feeding to Various Swine Production Factors, 1931-32

Method of feeding	Number farms	Return over feed per cwt. hogs	Lbs. feed per cwt. hogs*	Lbs. skim milk per cwt. hogs	Per cent protein in ration	Sanitation score†	Per cent death loss	Pigs weaned per litter	Number litters	Per cent fall litters	Avg. wt. hogs sold	Index of price received
Self-fed	44	\$1.41	465	348	13.8	1.8	6.0	6.0	17.6	31	242	101
Part self-fed	100	1.23	467	427	13.8	2.0	5.2	6.4	12.6	36	225	99
Hand-fed	131	.84	498	477	13.7	2.1	6.2	6.0	11.5	33	221	100

* Nine pounds of skim milk were assumed as one pound of concentrates.

† The degree to which sanitation practices were followed was coded numerically: complete sanitation 1; partial sanitation 2; and no special sanitation practices 3.

regardless of the kind of pasture used. This fact was brought out when the data on farms using the various kinds of pasture were further sorted on the basis of the proportion of protein in the ration. The difference in favor of high-protein rations was not as large when the hogs were on legume pastures as when pastures were not used. The herds which had access to legume pasture and which were also fed a high-protein ration required 459 pounds of concentrates to produce 100 pounds gain in weight as compared to 518 pounds for the herds receiving the same kind of pasture but fed a low-protein concentrate ration. This is a saving of 59 pounds of feed. The saving in feed between a high- and low-protein ration for hogs with access to rape and small grain pasture was 64 pounds; for hogs on bluegrass or timothy pasture, 85 pounds; and for hogs not on pasture, 83 pounds.

Self-Feeding—Whenever rapid gains are desired, self-feeding is generally considered economical. It is also a labor-saving system. Information on the use of the self-feeding system was secured on some of the farms during 1931 and 1932. The data in table 9 show results secured by the 44 farmers who self-fed all the feeds to swine. On nearly 50 per cent of the farms no self-feeding was practiced. For this latter group the re-

turn over feed was the smallest and a comparatively large quantity of concentrates was required to produce 100 pounds gain in weight. Approximately one third of the farmers used self-feeders for a portion of the feeding period or for a portion of the feeds.

Swine Sanitation and Disease Control

Prevention of diseases and parasite infestation is necessary for profitable hog production. For many of the diseases and parasites there is no satisfactory remedy after infection has once set in. Old hog lots which have become badly infested with worms and germs are a source of much trouble. As a preventive measure, the McLean County system of swine sanitation was devised. Its principal features are (1) thoroughly cleaning and scrubbing the farrowing pens with boiling lye water, (2) washing the sides and udders of the sows with soapy water before placing them in the farrowing pens, (3) keeping the sow and pigs from the old lots until they can be transferred to a clean pasture (one not used by hogs for at least a year), and (4) keeping the pigs on clean pasture until they are at least 4 months of age. By this time they are reasonably resistant to infection from the filth-borne diseases and parasites.⁵

⁵ For a more complete discussion of this topic, see Zavoral, H. G., Hog Health Makes Wealth, University of Minnesota Agricultural Extension Bulletin 119, Revised April 1939.

Table 10. Relation of Sanitation to Various Swine Production Factors, 1928-37

Group	Degree of sanitation Score	Number farms*	Return over feed per cwt. hogs	Lbs. feed per cwt. hogs†	Lbs. skim milk per cwt. hogs	Kind of pas-ture‡	Per cent pro-tein in ration	Per cent death loss	Pigs wean-ed per lit-ter	Num-ber lit-ters	Per cent fall lit-ters	Avg. wt. hogs sold	Index of price re-ceived
Complete	1	303	\$1.63	502	443	1.6	13.4	5.1	6.5	11.2	32	231	101
Partial	2	533	1.67	495	425	1.8	13.2	6.8	6.2	11.1	36	235	100
None	3	527	1.35	515	494	2.0	13.5	5.9	6.2	9.2	31	232	99

* The information was not available on 56 farms.

† Nine pounds of skim milk were assumed as one pound of concentrates.

‡ Pasture was coded numerically as follows: legumes 1; rape and small grain 2; bluegrass and timothy 3; and no pasture 4.

Sanitation Score—The extent to which proper sanitation methods are followed is another reason for the variation among farms in the returns secured from hogs. The farms included in this study were given a numerical rating according to completeness of the sanitation system used. A rating of "1" was assigned to those farmers practicing a complete sanitation system; a rating of "2" was given to cases where the McLean system was partially followed; and a rating of "3" was assigned to cases where no special sanitation practices were followed. There was no significant difference between the group of farms practicing complete or partial sanitation, either in the quantity of feed required to produce 100 pounds gain or in the other swine production factors (table 10). It is probable that the farmers who followed a system of

partial sanitation observed the more important sanitation practices. On the farms where no special swine sanitation practices were followed, the hogs required a larger amount of feed to make 100 pounds gain and the return over feed was substantially lower.

Per Cent Death Loss—There was a considerable range in the amount of death loss among the swine herds on the farms studied (table 11). Much of it represented the loss of small pigs soon after birth. On some farms, however, older animals died from cholera or other causes. In either case the overhead charge of feeds consumed by pigs that die and the feed of the breeding herd has to be borne by the remaining pigs. Consequently a high death loss is associated with a high feed charge for each 100 pounds of marketable hogs.

Table 11. Relation of Amount of Death Loss to Various Swine Production Factors, 1928, 1931, 1934, and 1937

Range	Per cent death loss Average	Number farms	Return over feed per cwt. hogs	Lbs. feed per cwt. hogs*	Lbs. skim milk per cwt. hogs	Per cent pro-tein in ration	Kind of pas-ture†	Sani-tation score‡	Pigs wean-ed per lit-ter	Num-ber lit-ters	Per cent fall lit-ters	Avg. wt. hogs sold	Index of price re-ceived
2.4 and less	0.9	184	\$1.47	483	474	13.8	1.9	2.2	6.4	9.6	31	243	100
2.5-12.4	6.6	253	1.18	493	438	13.4	1.9	2.3	6.3	11.1	31	228	100
12.5 and over	20.2	102	1.00	516	446	13.5	1.9	2.2	6.1	9.3	32	239	100

* Nine pounds of skim milk were assumed as one pound of concentrates.

† Pasture was coded numerically as follows: legumes 1; rape and small grain 2; bluegrass and timothy 3; and no pasture 4.

‡ The degree to which sanitation practices were followed was coded numerically: complete sanitation 1; partial sanitation 2; and no special sanitation practices 3.

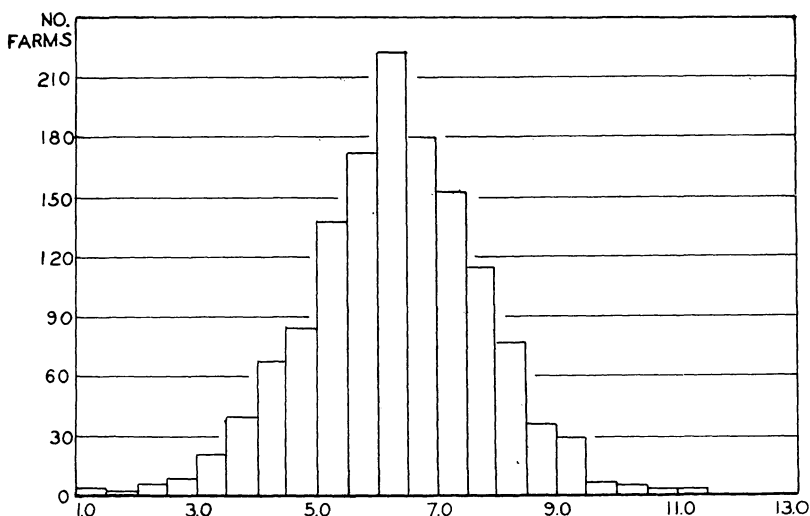


FIG. 4. Distribution of farms classified according to the average number of pigs weaned per litter

Size of Litters

One of the most important factors helping to reduce the overhead cost of maintaining the breeding herd is the number of pigs weaned per litter. Variations in litter size are due primarily to the differences among farms in the number of pigs saved during farrowing and up to weaning time. The variation in pigs weaned per litter among these farms is shown in figure 4. The largest concentration of cases occurred about the range of 6 to 6.5 pigs weaned per

litter. The lowest average number of pigs weaned per litter reported was 1.5 and the highest average was 11.5. The range for individual sows would of course be even larger.

During the 10 years studied, the farms on which the pigs weaned per litter averaged 6 or above produced 100 pounds of hogs with the smallest amount of feed and with the greatest return over feed (table 12). On the other hand, on the farms where only 4.9 or fewer pigs were weaned per litter, 66 pounds more feed were required to pro-

Table 12. Relation of Number of Pigs Weaned Per Litter to Various Swine Production Factors, 1928-37

Pigs weaned per litter	Average	Number farms	Return over feed	Lbs. feed per cwt. hogs*	Lbs. skim milk per cwt. hogs	Per cent protein in ration	Sanitation score†	Per cent death loss	Number litters	Per cent fall litters	Avg. wt. hogs sold	Index of price received
Range												
4.9 and less.....	4.1	232	\$0.80	555	494	13.3	2.3	8.2	10.9	31	247	97
5.0-5.9	5.5	309	1.49	510	492	13.5	2.2	6.6	10.9	36	237	99
6.0-6.9	6.4	400	1.74	490	430	13.3	2.1	4.9	11.5	32	232	101
7.0 and more	7.8	430	1.76	489	432	13.4	2.1	5.6	8.7	32	223	101

* Nine pounds of skim milk were assumed as one pound of concentrates.

† The degree to which sanitation practices were followed was coded numerically: complete sanitation 1; partial sanitation 2; and no special sanitation practices 3.

Table 13. Relation of the Proportion of the Total Litters that Are Fall Farrowed to Various Swine Production Factors, 1928-37

Range	Per cent fall litters Average	Number farms	Return over feed	Lbs. feed per cwt. hogs*	Lbs. skim milk per cwt. hogs	Per cent protein in ration	Kind of pasture†	Sanitation score‡	Per cent death loss	Pigs weaned per litter	Number litters	Avg. wt. hogs sold	Index of price received
0	0	332	\$1.09	545	426	12.9	1.7	2.2	5.8	6.4	6.4	237	99
1-25	20	163	1.56	489	405	13.1	1.8	2.1	6.2	6.0	11.6	239	99
26-50	41	689	1.71	491	464	13.5	1.8	2.1	6.2	6.2	12.2	228	101
51-75	61	124	1.85	485	489	13.8	1.8	2.1	5.6	6.4	12.1	231	101
76 and more	97	63	1.17	529	579	14.0	2.2	2.1	7.5	6.2	5.1	248	95

* Nine pounds of skim milk were assumed as one pound of concentrates.

† Pasture was coded numerically as follows: legumes 1; rape and small grain 2; bluegrass and timothy 3; and no pasture 4.

‡ The degree to which sanitation practices were followed was coded numerically: complete sanitation 1; partial sanitation 2; and no special sanitation practices 3.

duce 100 pounds of hogs and the return over feed was \$0.96 per 100 pounds less than the group with the highest pigs weaned per litter. This represents a substantial reduction in returns for the operator. The cost of labor, equipment, buildings, etc., would remain practically the same. It takes little or no extra time to feed a sow and 8 pigs than a sow and 4 pigs. Likewise, when the pigs are weaned and are being fattened for market it will not take much more time and equipment to take care of 80 hogs than 40.

The farmers who raised fewer pigs per litter sold the hogs at a higher average weight per head. Part of the difference in sale weights may be due to the larger proportion of sows sold in the group having the small litters. The higher weights may be due also to an attempt to increase the total pounds of hogs produced by feeding longer.

Fall Litters

The data in table 13 show the relationship of per cent of fall litters to return over feed and the various swine production factors. Fall litters are profitable when the practice is a part of the system of raising two litters of pigs per year. Raising only fall pigs or only spring pigs was less profitable.

Where the farmer is equipped to raise fall litters, the two-litter system is most profitable in southeastern Minnesota. A great deal of skim milk is available for feeding to hogs on these farms throughout the year. A more economical use can be made of the skim milk if a fairly uniform number of hogs is kept on these farms during the year.

There are other advantages to the two-litter system. In general it requires less feed to produce 100 pounds of hogs. First, the overhead charge of keeping the sows is lessened somewhat. Second, the pigs are fed more heavily and pushed more rapidly to an early market before the next litter arrives. This is borne out by the higher price received on the two-litter farms. Also, rapid gains are generally economical gains.

Gilts Compared with Older Sows for the Breeding Herd

In table 14 the records are sorted into five groups according to the proportion of the sows that are gilts. From these data it appears that it would be more profitable for farmers to keep about 50 per cent of the sows as gilts each year. This allows the operator to sell the sows that prove to be nonbreeders or

Table 14. Relation of the Proportion of the Sows that Are Gilts to Various Swine Production Factors, 1928-37

Range	Per cent gilts	Num- ber farms	Re- turn over feed	Lbs. feed per cwt. hogs*	Lbs. skim milk per cwt. hogs	Per cent pro- tein in ration	Kind of pas- ture†	Sani- tation score‡	Per cent death loss	Pigs wean- ed per lit- ter	Num- ber lit- ters	Per cent fall lit- ters	Avg. wt. hogs sold
	Aver- age												
0	0	194	\$1.31	513	531	13.9	2.1	2.2	5.7	6.6	8.5	38	223
1-39	26	210	1.65	501	458	13.2	1.5	2.1	6.8	6.3	12.4	40	225
40-69	55	455	1.70	491	458	13.5	1.8	2.2	6.1	6.2	11.9	39	231
70-99	79	188	1.52	500	411	13.0	1.6	2.1	6.1	6.0	12.4	28	242
100	100	324	1.35	524	431	13.0	1.8	2.2	5.9	6.2	6.9	19	241

* Nine pounds of skim milk were assumed as one pound of concentrates.

† Pasture was coded numerically as follows: legumes 1; rape and small grain 2; bluegrass and timothy 3; and no pasture 4.

‡ The degree to which sanitation practices were followed was coded numerically: complete sanitation 1; partial sanitation 2; and no special sanitation practices 3.

poor breeders and replace them with gilts. By this system the sows which produce very good litters and take good care of their litters are retained as long as they are useful.

Marketing

Price Received for Hogs Sold—There is a consistent relationship between price received per 100 pounds of hogs sold and return over feed (table 15). A part of this variation in price received is within the control of the individual farmer. The highest average prices during the year are reached in August and early September when the receipts of hogs on the market are generally low. During the late fall and early winter the large number of spring pigs marketed depresses prices.⁶ The farmer who has the facilities and feed to raise early litters and market them early usually secures the highest price.

There is a close relationship between price received and several swine production factors. The proportion of protein in the total digestible nutrients was highest for the group receiving the highest prices. This indicates that adequate protein in the ration received attention from those attempting to secure

rapid gains and reach an early market. The two-litter system is also conducive to high prices. To make room for the fall pigs the spring litters are pushed along as rapidly as possible and are sold on a higher market. The average weight of the hogs when sold has a good deal of influence on the price received. The heavier hogs sell lower than the lighter weights. A few farmers sold gilts and boars for breeding purposes at prices somewhat higher than that paid by the regular markets. In general, breeding stock are sold at the lighter weights.

Average Weight of Hogs Sold—During the 10-year period, 1928-37, the highest return over feed was secured when hogs were marketed at an average weight of 200 to 275 pounds (table 16). In general the lighter weights received the higher price per 100 pounds. However, less feed was required to produce 100 pounds of hogs when they were fed to an average of 200 to 275 pounds than when fed to heavier or lighter weights. Since the farmer is interested in getting the most economical production he is sometimes better off to take a slightly lower price if he can thereby secure the most profitable production.

⁶ Waite, Warren C., and Cox, Rex W., Seasonal Variations of Prices and Marketings of Minnesota Agricultural Products, 1921-35, University of Minnesota, Technical Bulletin 127, March 1938, page 25.

Table 15. Relation of Average Price Received for Hogs Sold to Various Swine Production Factors, 1928-37

Index of price received													
Range	Average	Number farms	Return over feed	Lbs. feed per cwt. hogs*	Lbs. skim milk per cwt. hogs	Per cent protein in ration	Kind of pasture†	Per cent death loss	Pigs weaned per liter	Number liters	Per cent fall liters	Per cent gilts	Avg. wt. hogs sold
89 and less	83	138	\$0.50	522	453	13.0	2.0	6.4	5.8	8.3	31	63	256
90-96	94	334	1.17	507	493	13.4	1.7	6.3	6.1	9.6	29	61	239
97-103	100	515	1.70	503	424	13.2	1.8	5.9	6.2	10.7	31	57	233
104-110	106	271	1.83	503	452	13.6	1.8	5.1	6.4	10.2	37	52	223
111 and more...	119	149	2.01	511	525	14.0	1.9	7.0	6.7	10.8	36	49	215

* Nine pounds of skim milk were assumed as one pound of concentrates.

† Pasture was coded numerically as follows: legumes 1; rape and small grain 2; bluegrass and timothy 3; and no pasture 4.

Table 16. Relation of Average Sale Weights to Various Swine Production Factors, 1928-37

Average weight hogs sold														
Range	Average	Number farms	Return over feed	Lbs. feed per cwt. hogs*	Lbs. skim milk per cwt. hogs	Per cent protein in ration	Kind of pasture†	Per cent death loss	Pigs weaned per liter	Number liters	Per cent fall liters	Per cent gilts	Index of price received	
149 and under	119	39	\$0.65	582	627	14.3	1.8	5.6	6.7	7.8	43	42	104	
150-174	163	49	1.08	563	472	13.4	2.1	7.0	6.9	8.6	31	47	101	
175-199	189	165	1.27	523	429	13.2	2.0	6.4	6.4	9.7	33	48	102	
200-224	213	328	1.66	498	456	13.6	1.8	5.2	6.4	10.6	35	54	101	
225-249	237	416	1.70	494	442	13.3	1.8	5.5	6.2	11.0	32	59	101	
250-274	260	236	1.61	491	459	13.2	1.7	6.3	6.1	10.1	29	61	100	
275-299	285	99	1.34	506	489	13.3	1.7	6.1	5.7	9.8	33	64	97	
300 and over	346	75	0.80	540	500	13.3	1.9	9.3	5.4	6.5	33	67	91	

* Nine pounds of skim milk were assumed as one pound of concentrates.

† Pasture was coded numerically as follows: legumes 1; rape and small grain 2; bluegrass and timothy 3; and no pasture 4.

Cumulative Effect of Excelling in a Number of Management Factors

The relation of several swine production factors to return over feed has been discussed in the preceding sections. Some of the factors were found to have a considerable influence on the return over feed secured from hogs while others showed little or no relationship. Because of the large number of interrelationships between these factors, the exact relationship between any one factor and returns could not be determined. However, when the combined or

cumulative influence of several factors on returns is shown, the interrelationships become more marked.

To show the combined effect of several factors on returns the following have been selected for illustration: (1) the pounds of feed needed to produce 100 pounds of hogs, (2) per cent protein in the ration, (3) the extent to which sanitation methods and practices have been followed, (4) percentage death loss, (5) number of pigs weaned per liter, and (6) the price received per 100 pounds of hogs sold. Several factors other than these six selected were important but either the information was not complete for all the farms in any one year or they did not lend themselves to this type of an analysis.

The combined effect of high rankings in several factors is very marked. The 59 farmers who excelled in all six factors received a return over feed of \$2.79 for every 100 pounds gain in weight (figure 5). The 40 farmers who were below the average in all six factors did not receive an income sufficiently large to cover the value of the feeds consumed. The average production of hogs per year on the farms studied was 14,250 pounds. For the average production the cumulative effect from excelling in the six factors amounts to approximately \$475 per farm.

These six factors alone are responsible for a considerable proportion of the variation among farmers in the return over feed secured from hogs. In so far as the farmer has the resources, he will be well paid for his efforts to improve his efficiency in these factors.

Using Records to Increase Returns from Hogs

The averages or ranges for the principal management factors affecting returns from hogs secured in this study provide the farmer a standard or yardstick with which to make comparisons of his efficiency in production with that achieved by a number of farmers operating under similar conditions. However, before a farmer can make the most effective use of these data, it is essential that he have records covering his swine enterprise and preferably his entire farm business.

The effect of improvement in the management and practices followed can be brought out by an example on an individual farm. The relative ranking of Farm A in each of the six factors discussed in the previous section and its return over feed are shown for the

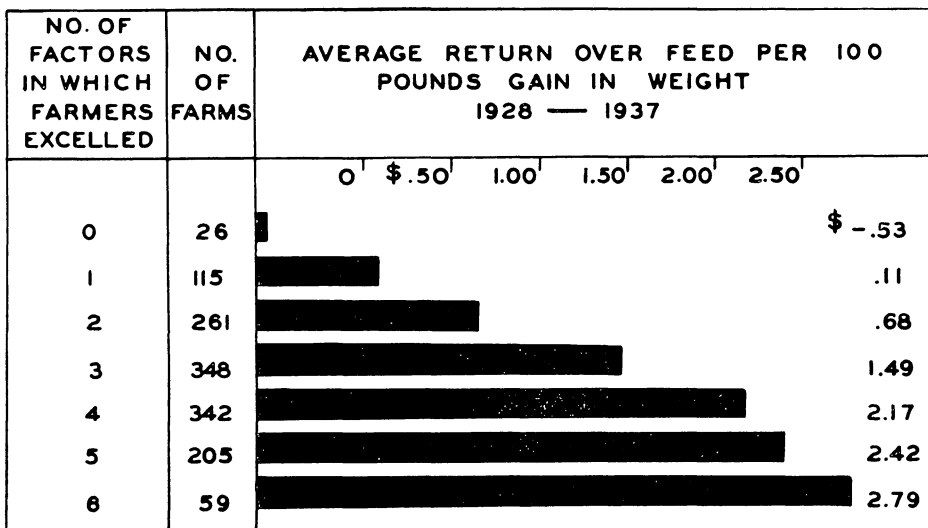


FIG. 5. Average return over feed per 100 pounds of hogs produced on farms grouped according to number of selected factors in which the farmer was above average, 1928-1937

The factors used as a basis for this chart are: (1) pounds of feed needed to produce 100 pounds of hogs, (2) per cent protein in the ration, (3) the extent to which sanitation methods have been followed, (4) percentage death loss, (5) number of pigs weaned per litter, and (6) price received per 100 pounds of hogs sold.

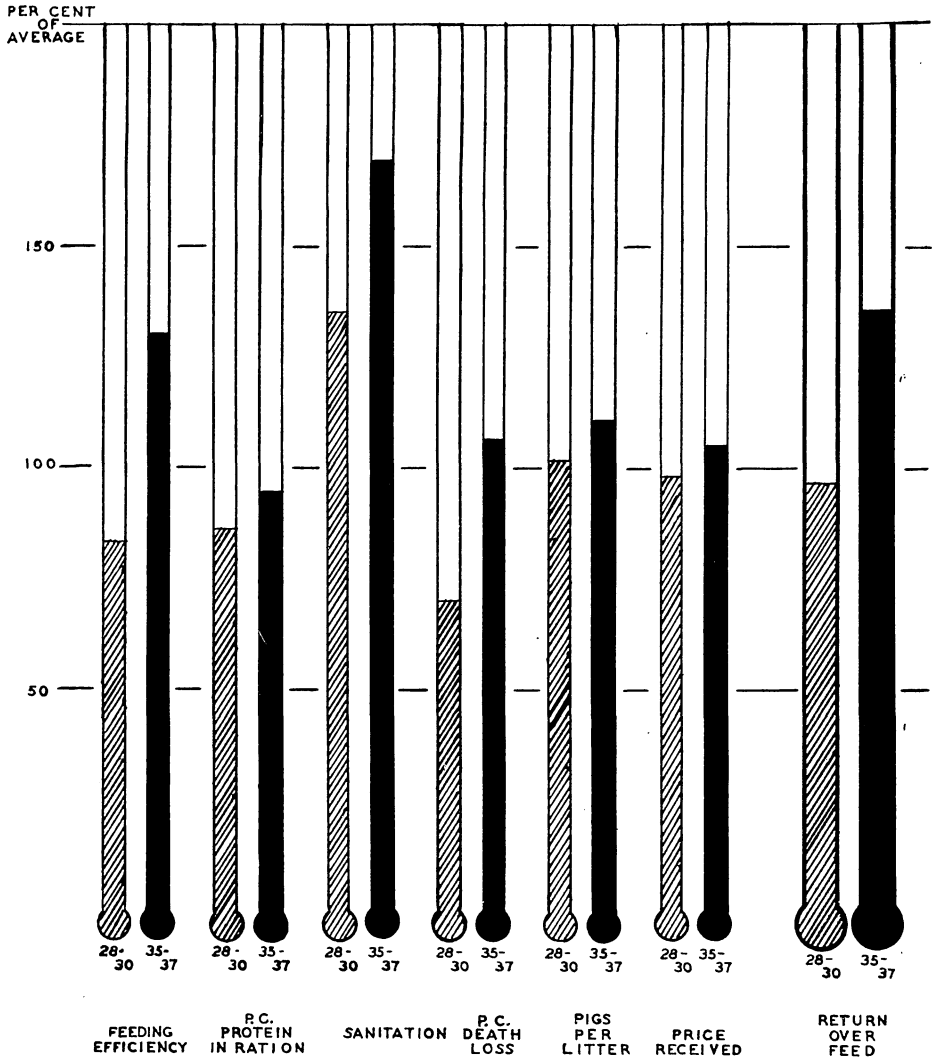


FIG. 6. Improvement in various swine production practices and in return over feed per 100 pounds produced shown on one farm from 1928-1930 to 1935-1937 (All measurements are in terms of percentages of the average of all farms covered by this study in 1928 to 1930 and 1935 to 1937)

years 1928 to 1930 and 1935 to 1937 in thermometer chart form in figure 6. Considerable improvement was made in three of the factors relative to the average; a somewhat smaller improvement was made in the remaining three factors. The return over feed increased

from 92 per cent to 131 per cent of the average return.

When this farmer started to keep records in 1928, his return over feed was slightly less than that of all farmers in the Southeast Farm Management Service. In three of the factors considered—

feeding efficiency, percentage of protein in the ration, and percentage of death loss—he was distinctly below the average of the group. The number of pigs per litter and the price he received for hogs sold was approximately the average for the group and in sanitation methods he was well above the average. By a careful analysis of his methods and by the adoption of practices that had proven successful on other farms included in the study, he was able to increase his relative ranking in each of the six factors. By 1935 he was able to bring all but one of the factors above the average for the entire group and to make a substantial increase in the relative returns from his hogs—from 92 per cent to 131 per cent. This amounts to an increase of \$1.25 in the return over feed per 100 pounds on the basis of

1935-37 prices or \$178 per year for the average size of hog enterprise. This is rather substantial remuneration for the effort and expense involved in keeping the records and applying them to the improvement of his practices.

The fact that a record is available does not in itself insure improvement and increased returns. A definite effort must be made to improve those practices which contribute to a higher return before a farmer can profit by the use of records. No two farmers think exactly alike, manage their farming operations in the same manner, nor have the same resources. Consequently, it is highly important that each farmer study his own business and compare his results with those secured by other farmers operating under similar conditions.

Summary

- Approximately one fifth of the total gross cash income of Minnesota farmers comes from the sale of hogs. In 1939 the United States Census reported 68 per cent of the farms as raising hogs. Improvement in the management of the swine enterprise is of vital importance as a means of increasing the earnings of many farmers.
- It is the purpose of this study to analyze the swine enterprise on a group of farms to determine the major factors and practices followed which account for the large variations occurring among farmers in the returns secured.
- In general, the larger hog enterprises were most profitable. The farmers raising four litters or less per year received the lowest return over feed.
- The wide variations in the feeding methods followed by farmers had a marked influence on the variations occurring in the returns secured from

hogs. The major factors affecting feeding efficiency were the quantity of feed necessary to produce 100 pounds of hogs; the proportion of protein in the total digestible nutrients; and the use of skim milk, pasture, and self-feeding. The most efficient group of hog feeders produced 100 pounds of hogs with 512 pounds less feed than the least efficient producers and received approximately \$5.00 more return over feed per 100 pounds of hogs produced. Increasing the proportion of the protein in the ration up to approximately 15 per cent of the total nutrients resulted in a considerable saving of feed and a higher return over feed. Skim milk was the principal high-protein feed used on these farms. Skim milk is a bulky feed and large quantities were available on some farms. It was frequently fed in larger quantities than the hog can utilize effectively, and sometimes it was even fed to a point where it ceased to

yield any return. Legume or rape and small grain pastures reduced the amount of concentrates needed by hogs and also increased the return over feed. Self-feeding proved to be an economical method of feeding.

● Less feed was required and the return over feed was highest where some sanitation methods or practices were followed than where no care was given in this respect. A high death loss was associated with a high feed charge for each 100 pounds of marketable hogs produced. The overhead charge of feeds consumed by pigs to the time of their death has to be covered by the marketable hogs.

● A large number of pigs weaned per litter is an important factor contributing to a reduction in the overhead cost of maintenance of the breeding herd.

● Raising fall litters was a profitable practice when it was a part of the system of raising two litters of pigs per year. Raising only fall litters or only spring litters was relatively unprofitable on these dairy farms.

● The highest returns were secured by those farmers who kept approximately 50 per cent of the sows as gilts. This allowed the operator to cull out the sows that proved to be poor breeders.

● There was a difference of approximately \$1.50 per 100 pounds produced in the return over feed received by the 10 per cent of the farmers receiving the lowest average price as compared to the 10 per cent receiving the highest average price. Hogs marketed at weights ranging from 200 to 275 pounds gave the highest return over feed.

● Superior accomplishment in each of the six more important factors in the management of the swine herd had a cumulative effect in increasing the returns secured. The farmers who were better than average in all six factors received a return of \$2.79 per 100 pounds as compared to a loss of \$0.53 for the group who were below average in all of the six factors.

● An important objective of studies of this nature is to demonstrate the value of records of the farm business as a basis for improving financial returns.

