September 1940

Dairy and hog farming in northeastern Iowa

R. K. Buck
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Dairy and Hog Farming in Northeastern Iowa

By R. K. Buck, J. A. Hopkins and C. C. Malone

AGRICULTURAL EXPERIMENT STATION
IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS

AGRICULTURAL ECONOMICS SUBSECTION
RURAL SOCIAL SCIENCE SECTION
DAIRY Husbandry SUBSECTION
ANIMAL Husbandry SECTION

AMES, IOWA
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</tbody>
</table>
SUMMARY

On Northeastern Iowa dairy and hog farms, highest returns were obtained where the number of milk cows equaled litters of pigs. This meant about 6 pounds of hogs were produced to each pound of butterfat. Where hog production was less, returns were lower. The butterfat-hog price ratio, during the years of the study, favored hogs, with 1 pound butterfat worth only 3.5 pounds of hogs.

Generally, the strictly dairy herds were more profitable than the dual-purpose herds, even though butterfat prices were unfavorable in comparison to beef, during the period studied. Income from beef in the dual-purpose herds was not enough to offset the lower sales of butterfat.

The dairy herds, with 16.6 cows, averaged 229 pounds butterfat sold or used in the household, and 493 pounds beef per cow, while the dual-purpose herds, with 14.1 cows, averaged 162 pounds butterfat output and 711 pounds beef per cow.

The hog enterprise consisted of 10 spring and 3 fall litters, averaging 1,420 pounds per litter. The milk cows furnished the hog enterprise an average of 5,370 gallons of skim-milk per farm or 30 gallons per 100 pounds of hogs produced. This home-produced protein, comprised about two-thirds of the protein supplement of the hog enterprise and was valued at about $81 per farm. Feed required per 100 pounds of hogs produced was lower on these dairy and hog farms than in other sections of the state. Two-thirds of the farmers were producing 100 pounds of hogs within the range of 385 to 531 pounds concentrates.

Although there were wide variations between farms in the efficiency of the poultry enterprise, it was an important source of income on most farms. Under the 1935-36 price relationships, poultry generally paid higher returns for feed fed than any other livestock.

On 10 farms where detailed labor records were kept, labor requirements per year were 143 hours per cow for the dairy enterprise, 31 hours per litter of pigs for the hog enterprise and 2.1 hours per hen for the poultry enterprise.

Regardless of the percentage of land in permanent pasture, the cropping system on the farms studied usually consisted of one-third corn, one-third small grain and one-third hay or rotation pasture. There were wide differences between farms in crop yields and also in the types of hay and rotation pasture. This meant considerable variation in the amount of available feed crops. Factors other than the cropping system, such as the abilities and preferences of the operator, avail-
able equipment and supply of family labor, were very im-
portant in the combination of livestock enterprises on a par-
ticular farm.

Corn comprised about 40 percent of the total feed units
produced; small grains, 13 percent; hay and pasture, 47 per-
cent. Almost equal numbers of feed units were composed
of grains and roughages. The dairy cattle on the dairy and
hog farms consumed about 55 percent of the total feed units
produced; hogs, about 29 percent; horses, 11 percent; and
poultry and sheep, 5 percent.

The type of livestock kept was influenced, to some extent,
by the proportions of grain and roughage produced. Where
more than the average percentage of total feed units was in
the form of roughage, there were relatively more milk cows.
Some farmers, however, supplemented their feed production
by buying additional grain. In these cases the additional
grain was generally used to raise more hogs.

The total capital managed on these farms varied from $33,-
330 on the larger and more intensive dairy farms to $17,590
on the smaller, less intensive ones. Of the total capital in-
vested, land and permanent improvements comprised about
71 percent; machinery, equipment and breeding stock, 14.5
percent; marketable livestock, feeds, seeds and cash, 14.5
percent.

There was a wide range between individual farms, but as
a group these northeastern Iowa farms compared quite favor-
ably in net cash income with farms in other sections of the
state.

A comparison of the high and low profit dairy-hog farms
shows that the high profit group had one-third larger farms,
4 percent more land in crops, a faster turnover of capital
invested, higher crop yields, more efficiency in both the dairy
and hog enterprises and greater efficiency in the use of labor
and machinery.
Dairy and Hog Farming in Northeastern Iowa

By R. K. Buck, J. A. Hopkins and C. C. Malone

This bulletin summarizes a study, made in 1935 and 1936, of the organization and management of 61 northeastern Iowa farms. Although concerned with the farm as a whole, it gives particular attention to the functions of the dairy and hog enterprises. Some of the questions considered include: What are the common cropping systems in this area, and how are they related to the livestock enterprises? What combinations of enterprises and what general policies give the greatest returns on these farms? In this area how wide a choice does the farmer have among livestock enterprises and to what extent can he shift from one to another as price relationships change?

The farms studied were located in six counties in the dairy section of northeastern Iowa. The results of the study apply particularly to the dairy and hog farms in the heavily shaded area of seven counties shown in fig 1 and, in lesser degree, to those in the more lightly shaded area.

Records were kept by the cooperating farmers on crop acreages and yields, livestock production, feed consumption, expenses and receipts. Detailed labor records were kept on 10 farms. All records were supervised by a fieldman who visited each farm several times a year to insure complete and uniform reports.

The farms studied averaged 35 acres larger and were somewhat higher in productivity than the average farms in the area. There is no way of knowing how the cooperating farmers compared with the average farmer in management ability.

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1 Project 377 of the Iowa Agricultural Experiment Station.

Practically all the farm products of this section of the state are marketed through livestock and livestock products. This livestock system (largely made up of dairy or dual-purpose cattle, and hogs), together with a good land-use program, a naturally productive type of soil and a fairly uniform seasonal rainfall distribution has enabled northeastern Iowa farmers to maintain their soil resources very well as compared with other sections of the state.

### TABLE 1. A COMPARISON OF FARMS INCLUDED IN THIS STUDY WITH ALL FARMS IN THE SEVEN-COUNTY AREA.

<table>
<thead>
<tr>
<th></th>
<th>Number farms</th>
<th>Average acres per farm</th>
<th>Percent land in rotation</th>
<th>Percent farms tenant operated</th>
<th>Livestock per 100 acres farm land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route farms 1935-36</td>
<td>61</td>
<td>206</td>
<td>69</td>
<td>41.2</td>
<td>18.6, 8.4, 4.7</td>
</tr>
<tr>
<td>All farms in seven-county area 1935*</td>
<td>17,284</td>
<td>171c</td>
<td>67</td>
<td>41.9</td>
<td>14.6, 7.9, 4.0</td>
</tr>
</tbody>
</table>

* Data on all farms in area were taken from the United States Census of Agriculture, Vol. 1, 1935.

* Milk cow and sow numbers on the route farms were taken as yearly averages; the census figures were as of Jan. 1, 1935.

* This includes only farms over 69 acres in size. The average size of all farms in the area (including those from 3 to 69 acres in size) was 150 acres.
THE CROP PRODUCTION SYSTEM

DESCRIPTION OF THE SOIL AND TOPOGRAPHY

The farms in this study are about equally divided between two of the major soil areas of the state, the Iowa drift and the Mississippi loess. The former occurs in the western half of the region and is characterized by undulating to gently rolling topography. The Mississippi loess occurs in the eastern half which is rolling to rough. Erosion is the principal soil hazard, and generally farmers have tried to minimize the hazard by using proper rotations (about one-third inter-tilled crops, one-third small grain and one-third hay or rotation pasture), by following control practices such as the use of grassed waterways and by utilizing all crops through livestock, thus returning fertility to the soil.

The prevailing 3-year rotation seems to be generally satisfactory for this area and, over a period of years, results in a relatively large, if not a maximum production of feed.

Although farmers might be expected to modify their rotation to fit the topography of the land, this was not often done, and even the farmers on the rougher land—over 25 percent in permanent pasture—had cropping systems with approximately one-third corn, one-third small grain and one-third grass. Only two farms had less than 25 percent of their rotated land in corn; seven had less than 25 percent in small grain, and only two had less than 25 percent in hay and rotation pasture. The permanent pasture, however, varied from less than 1 percent to over 40 percent of the total farm land, and there was considerable variation in the kinds of small grains and rotation pasture. The difference in relative amount and type of roughage, including permanent pasture, made a difference in livestock systems. The farms with more pasture and roughage tended to keep more milk cows, relative to the number of hogs raised, while those with less pasture and more grain raised more hogs.

Another difference appeared when the farms were divided on the basis of the amount of corn raised. The smaller farms usually grew the most corn per 100 acres of cropland. There was little difference between the “high” and “low” corn farms in the combination of livestock enterprises or the number of livestock kept per 100 acres of farm land. The “high” corn farms, however, showed a tendency to feed cows and hogs more heavily.

For a complete description of the soils of this area the reader is referred to the Iowa Soil Reports for the counties of northeastern Iowa and to Brown, P. E. Soils of Iowa. Iowa Agr. Exp. Sta., Special Report No. 3. 1936.
VARIATIONS IN CROPPING SYSTEM AS RELATED TO THE LIVESTOCK SYSTEM

The relationship between cropping and livestock systems was studied on the farms, divided into three main groups. In the first group were six farms with beef cattle as the major enterprise, supplemented by hogs and milk cows. On the remaining 55 farms, hogs and dairy cattle were the major livestock enterprises. These farms were divided into two groups, chiefly on the basis of gross income from dairy products. Table 2 shows the cropping systems of these three groups of farms.

TABLE 2. VARIATIONS IN CROPPING SYSTEM AS RELATED TO THE LIVESTOCK SYSTEM.

Northeastern Iowa farms, average per farm 1935-36a.

<table>
<thead>
<tr>
<th></th>
<th>Dairy-hog farmsb</th>
<th>Beef-dairy-hog farms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over 25 percent</td>
<td>Under 25 percent</td>
</tr>
<tr>
<td></td>
<td>gross income from</td>
<td>gross income from</td>
</tr>
<tr>
<td></td>
<td>dairy products</td>
<td>dairy products</td>
</tr>
<tr>
<td>Number of farms</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>Total acres in farm</td>
<td>200</td>
<td>189</td>
</tr>
<tr>
<td>Percent in rotation land</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>Percent in permanent pasture</td>
<td>21</td>
<td>22</td>
</tr>
<tr>
<td>Percent rotated land in c</td>
<td>32</td>
<td>30</td>
</tr>
<tr>
<td>Corn</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Small grain</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>Hay and rotated pasture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a Includes the farms for which records were obtained both for 1935 and 1936. It will be noted that different tables contain data from different numbers of farms. In each case all farms were included from which pertinent data could be obtained on the subject under consideration.

b The dairy-hog farms were divided into two groups shown above chiefly on the basis of the percentage of gross income from sale of dairy products. Average percentage of income for the 2 years, 1935 and 1936, was used in classifying each farm. In a few cases, however, where the percentage was approximately at the dividing line, other factors such as the organization of the crop and livestock systems of the farms were also taken into consideration.

c The few acres of miscellaneous crops are not included.

Except that the larger beef enterprises were found on the rougher farms (averaging 34 percent of land in permanent pasture), there was no tendency for the cropping system to vary with the combination of livestock. The two groups of dairy-hog farms averaged about the same percentage of total land in rotation, and each had essentially a 3-year rotation of crops.

However, there were variations between groups in the utilization of the crops. The more specialized dairy farmers put 4 percent more of their corn acreage into the silo than did the others. Less than one-fourth of the farmers hogged down any corn and these only a few acres. One-half to two-thirds of the corn in each group was picked for grain.

Oats made up from two-thirds to three-fourths of the small grain acreage, with barley second in importance. Alfalfa,
red clover and soybeans were the principal hay crops. The dairy-hog farms which stressed dairying had approximately 14 percent more alfalfa than the ones less specialized.

Even with fairly uniform cropping systems, there were wide differences between farms in crop yields, resulting in differing supplies of feed. Nearly all these farms were self-sufficient in farm-raised feeds. Practically no crops were sold off the farm, and corn was the only crop purchased in any appreciable amount.

**TABLE 3. DISPOSITION OF TOTAL GRAIN AS RELATED TO TYPE OF LIVESTOCK SYSTEMS.**

Northeastern Iowa farms, average per farm, 1935-36.

<table>
<thead>
<tr>
<th>Dairy-hog farms</th>
<th>Beef-dairy-hog farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 25 percent</td>
<td>Under 25 percent</td>
</tr>
<tr>
<td>gross income</td>
<td>gross income</td>
</tr>
<tr>
<td>from dairy</td>
<td>from dairy</td>
</tr>
<tr>
<td>products</td>
<td>products</td>
</tr>
<tr>
<td>No. farms</td>
<td>27</td>
</tr>
<tr>
<td>Total acres per farm</td>
<td>200</td>
</tr>
<tr>
<td>Corn—total bu. fed</td>
<td>1,752</td>
</tr>
<tr>
<td>Oats—total bu. fed</td>
<td>1,062</td>
</tr>
<tr>
<td>Total grain feed units fed*</td>
<td>2,437</td>
</tr>
<tr>
<td>Percent fed to</td>
<td></td>
</tr>
<tr>
<td>Hogs</td>
<td>58</td>
</tr>
<tr>
<td>Milk cows</td>
<td>18</td>
</tr>
<tr>
<td>Other cattle</td>
<td>5</td>
</tr>
<tr>
<td>Horses</td>
<td>9</td>
</tr>
<tr>
<td>Poultry</td>
<td>10</td>
</tr>
</tbody>
</table>

* Does not include grain in silage. See appendix table A-2 for details of corn and oats disposition.

Although these were "dairy farms," about two-thirds of the corn fed as grain went to hogs. Milk cows and calves on the dairy-hog farms consumed 16 to 19 percent of the corn fed as grain—30 percent if corn fed as silage is included. On beef farms, 26 percent of the corn went to beef cattle and only 57 percent to hogs. (See appendix table A-2 for details of disposition of grain crops.)

Oats was an important part of the rations of the dairy cows, which consumed 31 percent of this crop on farms specializing in dairying though only 14 percent on the less specialized dairy farms. Most of the remaining oats were fed to horses and hogs. Soybeans provided a small amount of high-protein supplement and were consumed largely by the dairy cattle. On all farms, with all grains on a feed unit basis, cattle consumed from 21 to 29 percent; hogs, 52 to 60 percent; poultry and horses, 9 to 10 percent each.
Cattle were the principal consumers of roughage. They were fed all the silage, two-thirds to three-fourths of which went to the milk cows, in the two groups of dairy farms. The cows received over half the legume hay, composed largely of alfalfa, red clover and soybeans.

When butterfat prices are at all favorable, the dairy cow, with her great roughage-consuming capacity, gives good returns for these legume hays. On the dual-purpose and beef-dairy-hog farms, however, the fattening cattle are strong competitors for the high-quality hay. The hogs consumed some roughage, since many of these farmers followed the clean-ground system of hog raising, using alfalfa or red clover for hog pasture.

Pasture, mainly bluegrass, was an important feed crop on these farms. There was also some rotation pasture, which consisted largely of alfalfa, sweet clover and red clover. Because of fairly heavy and uniform rainfall distribution, permanent bluegrass pastures in northeastern Iowa are generally superior to those in other sections of the state. The milk cows and young dairy stock on the dairy-hog farms consumed from 75 to 85 percent of the pasture.

TOTAL FEED UNIT PRODUCTION

The smaller farms operate more intensively, both in livestock and crop production. When the farms were classified on a basis of acreage, the smaller farms produced the most feed units per acre. Slightly less than half of the total feed units including pasture on these farms was in the form of grains. Corn alone, including grain and silage, comprised 33 to 42 percent in the three groups. Hay amounted to about one-fifth and pasture from a quarter to a third, as shown in table 4.

These farmers have worked out a fairly definite division of the grain between the different types of livestock. The advisability of shifting the allocation of grain between cows and hogs from year to year will be discussed later. In addition to the feeds raised, most of these farmers purchased small amounts of protein supplements for the milk cows and

\[\text{Feed production per acre was fairly similar to that on the average farm in this area of the state. Based on 1932 acreages and 1928-1932 average yields, the average farm in the Northeastern Dairy Area produced 3,310 total feed units or 21.6 feed units per acre of farm land. See Schickele, Rainer. Economics of agricultural land use adjustments. Iowa Agr. Exp. Sta., Res. Bul. 209: 413. 1937.}\]

One feed unit represents the feed equivalent of 1 bushel of corn.\[\text{See appendix table A-3.}\]
TABLE 4. FEED UNITS PRODUCTION AND DISPOSITION.
Northeastern Iowa farms, average per farm, 1935-36.

<table>
<thead>
<tr>
<th></th>
<th>Dairy-hog farms</th>
<th>Beef-dairy-hog farms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over 25 percent</td>
<td>Under 25 percent</td>
</tr>
<tr>
<td></td>
<td>gross income</td>
<td>gross income</td>
</tr>
<tr>
<td></td>
<td>from dairy</td>
<td>from dairy</td>
</tr>
<tr>
<td></td>
<td>products</td>
<td>products</td>
</tr>
<tr>
<td>Number of farms</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>Total acres</td>
<td>200</td>
<td>189</td>
</tr>
<tr>
<td>Percent land in crops</td>
<td>65</td>
<td>62</td>
</tr>
<tr>
<td>Feed units per acre farm land</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24.2</td>
<td>22.8</td>
</tr>
<tr>
<td>Total feed unit production</td>
<td>5,082</td>
<td>4,276</td>
</tr>
<tr>
<td>Percent, total</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Corn, grain</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Silage</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Small grain</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Hay</td>
<td>22</td>
<td>21</td>
</tr>
<tr>
<td>Pasture</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>Distribution of feed units</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>to livestock,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>percent to</td>
<td></td>
</tr>
<tr>
<td>Milk cows</td>
<td>39</td>
<td>32</td>
</tr>
<tr>
<td>Other cattle</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>Hogs</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Horses</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Sheep</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Poultry</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

* Grain and roughage feed units
  1 bushel corn = 1.0 feed units
  1 bushel oats = 0.47 feed units
  1 bushel barley = 0.76 feed units
  1 bushel wheat = 1.15 feed units
  1 bushel soybeans = 1.15 feed units
  1 acre rotation pasture = 27 feed units
  1 acre permanent pasture = 19 feed units

Pasture yields were increased over state averages in the same proportions as the average hay yields of those farms exceeded the state average.


hogs. Very few purchased appreciable amounts of farm-
raised feeds.

PROPORTION OF FEED RAISED IN FORM OF CORN

The relative number of milk cows kept per litter of pigs is influenced by the proportion of grain raised, particularly corn. On most farms, from 55 to 60 percent of the feed units, excluding pasture, was in the form of grain, the exact amount depending partly on the percentage of land in corn and oats, and partly on yields. On 33 of the farms, purchases or sales of grain amounted to less than 10 percent of the amount raised. On 11 of these, only half of the feed was in the form of grain, resulting in a relatively large number of milk cows (1.71 on an average) for each litter of pigs raised. At the other extreme were 11 farms producing two-thirds of their feed in the form of grain. These
raised about the same number of hogs but kept fewer milk cows—averaging 1.22 milk cows per litter of pigs, as shown in table 5.

On the first group of farms, an average of 12.9 milk cows were kept per 100 acres of cropland, compared to 9.3 on farms with the most grain. Also, the farms with the lowest proportion of grain fed their cows more roughage and less grain per head.

The possibility of buying or selling feed, however, offers a wide choice in grain-roughage feed combination. Thirteen of the farms bought considerable amounts of corn and consequently were able to raise more hogs than any other of the five groups shown in table 5. At the other extreme were four farms which sold corn and raised the fewest pigs.

### Table 5. Relative number of hogs and milk cows as related to proportion of feed raised as grain.

<table>
<thead>
<tr>
<th></th>
<th>Under 10 percent of grain bought or sold</th>
<th>Bought 10 percent or more</th>
<th>Sold 10 percent or more</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proportion of total feed units raised as grain&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lowest third</td>
<td>Middle third</td>
<td>Upper third</td>
</tr>
<tr>
<td>Number farms</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Av. percent feed units raised as grain&lt;sup&gt;c&lt;/sup&gt;</td>
<td>50</td>
<td>58</td>
<td>67</td>
</tr>
<tr>
<td>No. milk cows per litter pigs</td>
<td>1.71</td>
<td>1.20</td>
<td>1.22&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total acres</td>
<td>194</td>
<td>196</td>
<td>200</td>
</tr>
<tr>
<td>Acres in rotation</td>
<td>143</td>
<td>131</td>
<td>148</td>
</tr>
<tr>
<td>Percent rotation in corn</td>
<td>33</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Percent rotation in small grain</td>
<td>29</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Percent rotation in hay and pasture</td>
<td>38</td>
<td>37</td>
<td>31</td>
</tr>
<tr>
<td>Milk cows per 100 acres in rotation</td>
<td>12.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>11.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.3&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Litters pigs per 100 acres in rotation</td>
<td>7.6</td>
<td>9.7</td>
<td>7.8</td>
</tr>
<tr>
<td>Feed units raised&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Total grain and roughage</td>
<td>3.794</td>
<td>3.746</td>
</tr>
<tr>
<td></td>
<td>Grain</td>
<td>1.926</td>
<td>2.195</td>
</tr>
<tr>
<td></td>
<td>Roughage</td>
<td>1.868</td>
<td>1.551</td>
</tr>
<tr>
<td>Bu. corn bought&lt;sup&gt;a&lt;/sup&gt; or sold&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(a)102</td>
<td>(a)131</td>
<td>0</td>
</tr>
</tbody>
</table>

<sup>a</sup> Differences between the average number of cows per litter of pigs in these three groups were tested and the difference between the "lowest third" and the other two groups buying or selling under 10 percent of their grain were found to be statistically significant, (F = 4.08).

<sup>b</sup> Differences in number of milk cows per 100 acres in rotation were tested between these three groups and found to fall short of statistical significance (F = 2.50), whereas a value of F of 3.32 or more is required for significance.

<sup>c</sup> Pasture not included.
THE LIVESTOCK SYSTEM

There is a general similarity in the livestock systems in a given part of the state. The combinations vary from the grain-hog farms in the cash grain area, to the beef-raising hog farms in southern Iowa, and the dairy-hog combination of northeastern Iowa. The combination depends on the types of crops raised, the proportion of pasture to crop land and the relative prices of the various crop and livestock products in each area.

Roughage feeds and pasture must be marketed through livestock such as dairy cattle, beef cattle or sheep. In the area studied, with good markets for butterfat, superior summer pasture and favorable conditions for growing oats for the dairy ration, milk cows have an advantage over beef cattle or sheep. Incidentally, there is also a plentiful supply of cold well water which is helpful in cooling dairy products. The additional fact that dairying is already well established gives this area certain other advantages such as availability of good breeding stock and general familiarity of farmers with the problems of dairying.

Dairying, however, cannot profitably form the only income-yielding livestock enterprise in this area. The typical farm produces more grain than can be fed advantageously to milk cows handled by the farm family. On the farms studied, hogs were also a major livestock enterprise, making these farms more truly dairy-hog farms than dairy farms.

Even with these two types of livestock, each farmer must still find the most favorable combination for his particular farm. Further, this optimum balance varies from year to year along with the relative prices of hogs, dairy products and feed.

CHANGES IN LIVESTOCK PRODUCTION IN NORTHEASTERN IOWA

The livestock system in this area, as well as the cropping system, was pretty much in its present form by 1890 (see fig. 2). Milk cow numbers, after doubling during the 1880's, showed no significant change for the next 40 years. Hog numbers fluctuated more widely, with a less pronounced upward trend than for the state as a whole. From 1930 to 1935, with butterfat prices relatively higher than hog prices and with the adoption of the government corn-hog program, hog numbers fell 32 percent, while milk cows increased 39 percent. The increase in milk cows was more rapid than for the state as a whole.

See appendix table 3 for disposition of roughage crops.
From 1920 to 1934 there was an increase of 160 percent in Iowa creamery butter production. This was partly caused by a favorable relationship of butterfat to grain prices, as well as to hog and beef prices. The increase in number of milk cows from 1920 to 1935, shown in fig. 2, does not truly reflect the great increase in dairying. Many milk cows of the beef breeds were replaced by cows of the dairy type which, together with heavier feeding and better care, increased the
average butterfat production per cow over 40 percent during the 15-year period.7

THE CATTLE ENTERPRISES

DAIRY CATTLE
(DAIRY AND DUAL-PURPOSE BREEDS)

The strictly dairy herds varied from 7 to 34 milk cows, with an average of 16.6. Butterfat output per cow ranged from 122 to 353 pounds, averaging 229. The predominating breed was Holstein, although there were a few Guernseys, Jerseys, Brown Swiss and grade cows of various breeds. There were also 15 dual-purpose dairy herds averaging 12.1 cows milked with 2 additional cows kept to raise calves. These herds averaged 711 pounds of beef produced and 162 pounds butterfat sold or used in the household per cow. Practically all were of the Milking-Shorthorn breed. Table 6 summarizes income and feed costs per cow for the two types of herds.

Under the beef and butterfat price relationship of 1935 and 1936, the strictly dairy herds were more profitable than the dual-purpose herds. Returns per $100 of feed and pasture were higher in the dairy herds, and after deduction for the value of feed and pasture, interest, depreciation, etc., a balance of $8.50 more per cow was left to pay for labor than on the dual-purpose farms. A part of this difference is offset by the higher labor requirement of the dairy cows. There was, however, a wide variation in profits between individual farms in each group.

Since feed costs comprise such a large part of the costs in dairy production, it is important to examine the milk cow rations. The strictly dairy cows were fed more heavily than the dual-purpose cows. For each pound of butterfat produced, the dual-purpose herds were fed an average of 5 pounds of concentrates, 16 pounds silage and 26 pounds dry roughages. The strictly dairy herds averaged 8 pounds of concentrates, 24 pounds silage and 16 pounds dry roughages.

In dual-purpose herds, the calves were used mainly as a means of marketing roughages. In the average herd, about 170 bu. corn, 140 bu. oats, 15 tons silage, 8 tons legume hay and 15 tons of other roughages plus pasture were fed to the calves. Practically none of the farmers sold the calves as feeder calves, and none fed them out as fat yearlings. According to the most common practice, the calves were fed chiefly on roughage during the winter and then sold sometime from February to late spring, weighing from 600 to 750 pounds.

---

TABLE 6. INCOME AND FEED COSTS IN DAIRY AND DUAL-PURPOSE HERDS.

<table>
<thead>
<tr>
<th></th>
<th>Dairy herds</th>
<th>Dual-purpose herds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number farms</td>
<td>36</td>
<td>15</td>
</tr>
<tr>
<td>Average number cows milked</td>
<td>16.6</td>
<td>14.1</td>
</tr>
<tr>
<td>Pounds butterfat output per cow&lt;sup&gt;b&lt;/sup&gt;</td>
<td>229</td>
<td>162&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Pounds beef per cow</td>
<td>433</td>
<td>711</td>
</tr>
<tr>
<td>Labor income per cow</td>
<td>$17.89</td>
<td>$9.36</td>
</tr>
<tr>
<td>Income per cow from entire herd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy products&lt;sup&gt;b&lt;/sup&gt;</td>
<td>87.52</td>
<td>51.49</td>
</tr>
<tr>
<td>Beef income&lt;sup&gt;c&lt;/sup&gt;</td>
<td>31.17</td>
<td>49.05</td>
</tr>
<tr>
<td>Total</td>
<td>118.69</td>
<td>100.65</td>
</tr>
<tr>
<td>Feed and pasture to all cattle, per cow</td>
<td>84.32</td>
<td>76.48</td>
</tr>
<tr>
<td>Total returns per $100 feed fed to all cattle</td>
<td>141</td>
<td>131</td>
</tr>
<tr>
<td>Pounds feed fed per milk cow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grain</td>
<td>1,424</td>
<td>722</td>
</tr>
<tr>
<td>Protein supplement</td>
<td>384</td>
<td>85</td>
</tr>
<tr>
<td>Silage</td>
<td>5,488</td>
<td>2,664</td>
</tr>
<tr>
<td>Legume hay</td>
<td>2,526</td>
<td>2,617</td>
</tr>
<tr>
<td>Other hay</td>
<td>369</td>
<td>549</td>
</tr>
<tr>
<td>Corn stover</td>
<td>547</td>
<td>1,023</td>
</tr>
<tr>
<td>Feed value per milk cow&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grain and proteins</td>
<td>$23.00</td>
<td>$10.52</td>
</tr>
<tr>
<td>Roughages</td>
<td>31.44</td>
<td>24.44</td>
</tr>
<tr>
<td>Pasture</td>
<td>7.31</td>
<td>7.35</td>
</tr>
<tr>
<td>Total</td>
<td>61.75</td>
<td>42.31</td>
</tr>
</tbody>
</table>

<sup>a</sup> Output per cow was figured on the basis of the average of 12.1 cows that were milked. Two cows were kept to raise calves. Beef per cow and income per cow in dual-purpose herds are based on 14.1 cows, i.e., on total number of cows in the herds.

<sup>b</sup> This item includes butterfat sales and the value of dairy product used in the home and fed to livestock.

<sup>c</sup> This item includes the sale of breeding stock and inventory increase in value of young cattle.

<sup>d</sup> Feed prices based on farm prices for the area for 1935 and 1936.

- Corn $ .72 per bu.  
- Oats .36 per bu.  
- Oilmeal 2.18 per cwt.  
- Bran 1.50 per cwt.  
- Silage $4.50 per ton  
- Alfalfa hay 12.50 per ton  
- Mixed hay 9.00 per ton  
- Timothy hay 7.50 per ton

This raises the question, did these calves, handled as they were in the dual-purpose herds, give as high returns for the feed consumed as would specialized beef or dairy cattle for roughage or hogs for the grain? Comparisons with the more specialized types of enterprises in this and in other studies indicate that they did not. These farmers apparently did not consider the alternatives of purchasing corn in order to put the calves into higher condition, or the purchasing of corn and additional calves to feed out with their own calves. For those farmers who do not want to engage in specialized dairy production or who want maximum flexibility in farm organization for adjustment to changing prices, there is considerable advantage in the dual-purpose herd.
THE BEEF-DAIRY ENTERPRISE

Separate herds of beef and dairy cows were maintained on six farms, and data for these are shown in table 7. These were large, rough farms with considerable pasture and roughage. Much of the corn raised on these farms went to the fattening cattle, while a large part of the lower grade roughages were fed to the beef cows. Beef and hogs each furnished about one-third of the total farm income, while dairy products furnished one-eighth.

TABLE 7. BEEF-DAIRY ENTERPRISE, PRODUCTION AND INCOME.
Northeastern Iowa farms, average per farm, 1935-36.

| Number of farms | 6 |
| Size of farm, acres | 312 |
| Percent land in crops | 56 |
| Number milk cows | 12.0 |
| Number beef cows | 13.5 |
| Number cattle sold | 26.6 |
| Total pounds butterfat sold or used | 2,208 |
| Total pounds beef produced | 19,040 |
| Total dairy income | $708 |
| Total beef income | 1,988 |

These farmers believed they were getting greater returns by feeding separate beef and dairy herds, rather than combining the two in a dual-purpose herd. Dual-purpose cows, however, do have certain advantages over separate herds of beef and dairy cows; a shift can be made in the proportions of beef and dairy production by shifting feed and labor, whereas with separate beef and milk herds, a shift may mean selling part of one of the herds or cutting the feed of high-producing milk cows until they yield less than full capacity.

HOG ENTERPRISE

What costs and returns may a farmer in this section expect from his hog enterprise? The production and returns from 53 hog enterprises (excluding those few where a large number of feeder pigs were purchased) are summarized in table 8.

An average of 10 spring and 3 fall litters per farm per
TABLE 8. THE HOG ENTERPRISE—INCOME AND COSTS.

<table>
<thead>
<tr>
<th>Number of farms</th>
<th>53</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
</tr>
<tr>
<td>Number spring litters</td>
<td>10.0</td>
</tr>
<tr>
<td>Number fall litters</td>
<td>3.0</td>
</tr>
<tr>
<td>Total number pigs weaned</td>
<td>82.0</td>
</tr>
<tr>
<td>Total pounds pork produced</td>
<td>17,902</td>
</tr>
<tr>
<td>Average weight hogs sold, pounds</td>
<td>239a</td>
</tr>
<tr>
<td>Efficiency measures</td>
<td></td>
</tr>
<tr>
<td>Pigs, weaned per litter</td>
<td>6.3b</td>
</tr>
<tr>
<td>Pounds gained per day, spring pigs</td>
<td>1.0</td>
</tr>
<tr>
<td>Pounds hogs produced per litter</td>
<td>1,420</td>
</tr>
<tr>
<td>Death loss per 1,000 pounds pork produced, pounds</td>
<td>21</td>
</tr>
<tr>
<td>Pounds feed per 100 pounds hogs produced</td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>352 (6.3 bu.)c</td>
</tr>
<tr>
<td>Small grain</td>
<td>69</td>
</tr>
<tr>
<td>Protein supplements</td>
<td>24</td>
</tr>
<tr>
<td>Skim milk (dry basis, 0.8 lb. per gal.)</td>
<td>24</td>
</tr>
<tr>
<td>Total concentrates</td>
<td>458</td>
</tr>
<tr>
<td>Total feed and pasture value per 100 pound hog</td>
<td>$6.26d</td>
</tr>
<tr>
<td>Income</td>
<td></td>
</tr>
<tr>
<td>Sale price per cwt.</td>
<td>$8.98*</td>
</tr>
<tr>
<td>Net hog increase</td>
<td>1,686</td>
</tr>
<tr>
<td>Hog income per litter</td>
<td>130</td>
</tr>
<tr>
<td>Returns per $100 feed fed</td>
<td>150</td>
</tr>
</tbody>
</table>

* The standard deviation is 23.99 pounds
b The " " is .93 pigs
c The " " is 1.30 bushels
d The " " is $1.08
f The " " is .36

year produced 9 tons of hogs, or 1420 pounds per litter. The average of 6.3 pigs weaned per litter and a gain of 1.0 pound per day compares favorably with averages in other Iowa farm management studies. The sale weight per head ranged from 197 to 302 pounds per hog, with approximately two-thirds of the farmers marketing between weights of 215 and 260 pounds (including sows and gilts as well as market hogs).

Although the hogs consumed over 1,100 bushels of corn per farm, this grain made up a smaller part of the hog ration than in other sections of the state. These farmers fed relatively more small grain and skim milk, the latter averaging 30 gallons per 100 pounds of gain.

Over a ton of commercial protein supplements, mainly tankage and oilmeal, was purchased per farm, and provided about half as much protein as the skim milk for the hogs.

The 458 pounds of concentrates used per 100 pounds of gain on the entire herd is lower than was found in most of the
earlier Iowa studies.  

Although available data are limited, it is apparent that Iowa farmers have, in general, increased their feeding efficiency in producing hogs during the past 20 years. However, there was a considerable variation in feeding efficiency. Ten of the 53 hog enterprises produced 100 pounds of hogs with less than 400 pounds of concentrates; 31 required from 400 to 500 pounds, and 12 required over 500 pounds. At least a part of the high average feeding efficiency in hog production results from the supply of good-quality protein supplement furnished by the dairy enterprise.

THE POULTRY ENTERPRISE

Most of the farms had poultry enterprises which provided a minor source of income. Production per hen averaged 119 eggs but varied from 67 to 172. Eggs provided approximately four-fifths of the poultry income and, incidentally, 1 dozen out of every 8 produced was used in the home.

There was also a wide range among farms in the feed per hen, including the feed to young chickens. This varied from 59 to 207 pounds, and returns per $100 of feed ranged from $87 to $215. Average returns under the favorable 1935-36 price relationships amounted to $152, which was higher than for any other livestock. However, wages for labor has to come out of this figure, and poultry requires much care.

---

A comparison of feed consumption per 100 pounds of hogs and of pounds of gain produced per litter in earlier studies:

<table>
<thead>
<tr>
<th>Year of study</th>
<th>Number records</th>
<th>Pounds concentrates per 100 lbs. hogs produced</th>
<th>Pounds hogs produced per litter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeastern Iowa study(^a)</td>
<td>1935-36</td>
<td>53</td>
<td>458(^e)</td>
</tr>
<tr>
<td>Farm Business Associations(^b)</td>
<td>1938</td>
<td>498</td>
<td>441(^e)</td>
</tr>
<tr>
<td>Southern Iowa study(^c)</td>
<td>1932-33</td>
<td>51</td>
<td>438(^e)</td>
</tr>
<tr>
<td>Webster County study(^d)</td>
<td>1928-30</td>
<td>113</td>
<td>549</td>
</tr>
<tr>
<td>Iowa County study(^e)</td>
<td>1925-27</td>
<td>59</td>
<td>518</td>
</tr>
<tr>
<td>Humboldt County study(^f)</td>
<td>1922-24</td>
<td>159</td>
<td>529</td>
</tr>
</tbody>
</table>

\(^a\) Farms included in present study.  
\(^b\) Iowa Farm Business Association reports for 1938.  
\(^e\) In these three studies, hogs have not been charged with corn picked up behind steers. To be comparable with the other studies for which data are given, the total pounds of concentrates in the northeastern Iowa study should be increased by 3 to 5 pounds; figures in the southern Iowa study by 14 or 15 pounds, and the Farm Business Association figures by 8 to 10 pounds.
TABLE 9. POULTRY ENTERPRISE.
Northeastern Iowa farms, 1935-36.

<table>
<thead>
<tr>
<th></th>
<th>Average per farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number farms</td>
<td>47</td>
</tr>
<tr>
<td>Number laying hens</td>
<td>169</td>
</tr>
<tr>
<td>Eggs produced per hen</td>
<td>119</td>
</tr>
<tr>
<td>Total dozen eggs sold</td>
<td>1,487</td>
</tr>
<tr>
<td>Total dozen eggs used in home</td>
<td>200</td>
</tr>
<tr>
<td>Egg sales</td>
<td>$318</td>
</tr>
<tr>
<td>Poultry sales</td>
<td>104</td>
</tr>
<tr>
<td>Price received per dozen eggs</td>
<td>.21</td>
</tr>
<tr>
<td>Feed per hen, pounds</td>
<td></td>
</tr>
<tr>
<td>Grain</td>
<td>96</td>
</tr>
<tr>
<td>Supplement (dry basis)</td>
<td>22</td>
</tr>
<tr>
<td>Milk</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>122</td>
</tr>
<tr>
<td>Total feed cost per hen</td>
<td>$1.73</td>
</tr>
<tr>
<td>Total income per hen</td>
<td>$2.67</td>
</tr>
<tr>
<td>Returns per $100 feed fed</td>
<td>152</td>
</tr>
</tbody>
</table>

* The standard deviation is 27.08 eggs
b The standard deviation is 28.33 pounds
c The standard deviation is $32.02

Seventy percent of the feed for poultry was raised on the farm. The average enterprise of 169 hens used approximately 185 bushels of corn, 142 bushels of oats, 27 bushels of barley and 889 gallons of skim milk, as well as 1.9 tons of purchased supplements.

Poultry are next to the dairy enterprise in intensity of man-labor requirements. The 10 farms which kept detailed labor records had an average of 178 hens. One hour per day was spent on the poultry enterprise, or 2.1 hours per hen per year. These 178 hens required 40 percent more labor than the average hog enterprise of 8.5 litters on the same farms.

SOURCES AND UTILIZATION OF LABOR

SOURCE OF LABOR

Ten of the dairy farmers kept detailed records of the labor used on their farms. The results are summarized in figs. 3 and 4. The total labor used per farm was equivalent to about two men working 9 hours per day the year around. The operator himself provided slightly over half, and other members of the family furnished approximately 23 percent of the total labor supply. Several of the farmers had grown sons at home. Hired labor amounted to approximately 22 percent and was most important from March to October.

These farmers worked long hours as indicated by the average of 12½ hours per working day from May to November,
Fig. 3. Source of labor by months

while from December to April it varied from 9 to 11 hours. Part of the heavier labor requirements in the spring and summer months was met by working longer hours. 

9 The average length of working day by months is:

<table>
<thead>
<tr>
<th>Month</th>
<th>Average Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>8.5 hours</td>
</tr>
<tr>
<td>Feb</td>
<td>9.1 hours</td>
</tr>
<tr>
<td>Mar</td>
<td>9.8 hours</td>
</tr>
<tr>
<td>Apr</td>
<td>11.7 hours</td>
</tr>
<tr>
<td>May</td>
<td>12.5 hours</td>
</tr>
<tr>
<td>June</td>
<td>12.8 hours</td>
</tr>
<tr>
<td>July</td>
<td>12.6 hours</td>
</tr>
<tr>
<td>Aug</td>
<td>12.4 hours</td>
</tr>
<tr>
<td>Sept</td>
<td>12.2 hours</td>
</tr>
<tr>
<td>Oct</td>
<td>12.5 hours</td>
</tr>
<tr>
<td>Nov</td>
<td>12.3 hours</td>
</tr>
<tr>
<td>Dec</td>
<td>11.0 hours</td>
</tr>
</tbody>
</table>
The monthly labor requirements of the main livestock enterprises are shown in fig. 4. The dairy was a heavy user of labor throughout the year, particularly in the winter season. Hogs showed little variation in labor requirement from month to month, but poultry required considerable extra labor in the spring to care for chicks.

The dairy-hog combinations on these farms worked out well in making full utilization of farm-raised feeds and available labor. The hog enterprise requires a small number of hours of labor but a large amount of corn, while dairy cows have a high labor requirement in comparison to the amount of feed consumed. Thus, 131 hours of labor per year were used per dairy cow (with a range from 106 to 184) as compared to 30 hours per litter of pigs. The entire dairy enter-
prise required 143 hours per cow in the milking herd. Feed and pasture consumption per milk cow for the three groups of dairy farms averaged $50 to $70, compared to about $90 per litter of pigs raised. While feed costs make up from 80 to 85 percent of the total costs in producing hogs, they comprise from 50 to 60 percent of the total costs of producing butterfat. Amounts of labor used on these farms per livestock unit are shown in table 10.

### Table 10. Total Man-Labor Requirement Per Unit of Livestock on 10 Northeastern Iowa Dairy-Hog Farms, 1935.

<table>
<thead>
<tr>
<th>Unit of Livestock</th>
<th>Average minutes per day</th>
<th>Average hours per year</th>
<th>Approx. hours per unit product*</th>
</tr>
</thead>
<tbody>
<tr>
<td>One milk cow</td>
<td>22</td>
<td>131</td>
<td>0.6 per lb. b. f.</td>
</tr>
<tr>
<td>One head young cattle</td>
<td>2</td>
<td>12</td>
<td>2.2 per cwt. gain</td>
</tr>
<tr>
<td>One litter of pigs**</td>
<td>5</td>
<td>31</td>
<td>0.2 per doz. eggs</td>
</tr>
<tr>
<td>One hundred hens</td>
<td>34</td>
<td>210</td>
<td></td>
</tr>
</tbody>
</table>

* Applying the average output per head or production per litter to the hours per head or litter on these 10 farms.

** Includes sow and pigs.

The combination of livestock enterprises

Practically the entire income on these northeastern Iowa farms is secured from the sale of livestock or livestock products. Consequently, the efficiency with which the various livestock enterprises are handled and the proportion in which they are combined are two of the most important factors affecting farm profits. This makes it imperative that a farmer study the comparative costs and returns on each of his livestock enterprises in order to obtain the most profitable balance.

A comparison of costs and returns on the dairy, hog and poultry enterprises

A comparison is made in table 11 of the costs and returns on the dairy, hog and poultry enterprises on the 36 farms with strictly dairy herds. For every cow and calf on these farms there were .8 litters of pigs and 10 hens or a ratio of 1 pound of butterfat produced to 2.2 pounds beef, 5 pounds hogs and 5 eggs.

The capital investment per farm in milk cows and bull was four times as great as that in sows and boar, and almost eight times greater than the investment in hens and roosters. The investment, including building and equipment, amounted to $168 for each cow, $52 for each litter of pigs and $2.50 for each hen. The rate of turnover on capital invested was greatest on the hog enterprise with $256 of gross income per $100 invested. Poultry followed with $107 and the dairy came third with $70 per $100 of investments. Thus, with
### TABLE 11. A COMPARISON OF COSTS AND RETURNS ON THE DAIRY, HOG AND POULTRY ENTERPRISES.

Thirty-six northeastern Iowa dairy-hog farms, average 1935-36.

<table>
<thead>
<tr>
<th></th>
<th>Dairya</th>
<th>Hog</th>
<th>Poultry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of enterprise</td>
<td>16.6 cows</td>
<td>13.4 jitters</td>
<td>167 hens</td>
</tr>
<tr>
<td>Total product sold or used on farm</td>
<td>3,809 lbs. butterfat</td>
<td>19,036 lbs. hogs</td>
<td>1,550 doz. eggs</td>
</tr>
<tr>
<td>Capital investment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock, breeding animals</td>
<td>$1,005</td>
<td>$250</td>
<td>$130</td>
</tr>
<tr>
<td>Buildings and equipment</td>
<td>1,789</td>
<td>453</td>
<td>284</td>
</tr>
<tr>
<td>Total investment</td>
<td>2,794</td>
<td>703</td>
<td>414</td>
</tr>
<tr>
<td>Total income</td>
<td>1,970b</td>
<td>1,802</td>
<td>443</td>
</tr>
<tr>
<td>Income for each $100 investment</td>
<td>70</td>
<td>256</td>
<td>107</td>
</tr>
<tr>
<td>Percent contribution to total farm income</td>
<td>41</td>
<td>37</td>
<td>9</td>
</tr>
<tr>
<td>Expenses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed and pasture</td>
<td>$1,399</td>
<td>$1,174</td>
<td>$279</td>
</tr>
<tr>
<td>Interest on livestockc</td>
<td>50</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Interest on blggs. and equipment</td>
<td>90</td>
<td>23</td>
<td>14</td>
</tr>
<tr>
<td>Depreciation on buildings and equipmentd</td>
<td>80</td>
<td>36</td>
<td>16</td>
</tr>
<tr>
<td>Cash expenses</td>
<td>54</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Total expenses</td>
<td>1,673</td>
<td>1,260</td>
<td>321</td>
</tr>
<tr>
<td>Balance left to pay labor</td>
<td>$297</td>
<td>542</td>
<td>122</td>
</tr>
<tr>
<td>Returns per $100 feed fed</td>
<td>141</td>
<td>153</td>
<td>155</td>
</tr>
</tbody>
</table>

- **a** Includes the milk cows and young stock, i.e., total cattle enterprise.
- **b** Of this amount, $1,453 was credited to milk cows and $517 to young stock.
- **c** Interest is figured at 5 percent on breeding stock only, cows, sows, hens, etc.
- **d** No depreciation charges were made against breeding stock nor was any credit given for manure.
- **e** The amount left over after all charges except labor are deducted from income.
- **f** These figures apply only to the dairy, hog and poultry enterprises on these 36 farms which had strictly dairy enterprises.

The 1935-1936 price relationships (which were favorable to hogs), the rate of turnover of capital was 3.7 times faster in the hog than in the dairy enterprise. The dairy requires a considerably larger investment in working and fixed assets per $100 of gross income than either the hog or poultry enterprise.10

On the other hand, feed costs comprised a greater proportion of the total costs on the hog than on the dairy enterprise. Direct cash expenses, which included veterinarian,
medicine, feed grinding, cow testing association fees, registration fees, equipment repairs and miscellaneous expenses were greater on the dairy enterprise than on either of the others but were not very large on any.

After all other charges were deducted, the hog enterprise earned considerably more per man-hour of labor than either the dairy or poultry enterprises. With an average of 143 hours per year per cow, 31 hours per litter of pigs and 2.1 hours per hen, the average farmer on these 36 dairy-hog farms received about $0.12 per hour for labor on the dairy with no credit for manure included, (19 cents per hour if $10 manure credit per cow is included), $1.30 per hour on hogs and $0.35 per hour on poultry.

Poultry gave the greatest return for each $100 of feed with hogs next highest and then dairy. As a measure of profit between enterprises, returns per $100 feed fed is somewhat misleading; it does not take into account the other charges such as interest, depreciation, cash expenses and labor costs. In 1935 and 1936 it required about $120 returns for each $100 of feed fed to the dairy to pay all the cash expenses, interest and depreciation charges, but with nothing left to pay labor; whereas $107 returns for each $100 feed fed to hogs paid all other charges except labor. As a rough guide in comparing the enterprises, the dairy would have to yield at least 25 percent greater returns per $100 of feed fed than the hog enterprise to show the same wage per hour of labor. Two factors should be kept in mind, however: The dairy utilizes a large amount of family labor which may have no alternative use, and much of the roughage and pasture fed to the dairy cow has little market value or even alternative use on the farm. Thus, the returns for $100 of feed cannot be used as the sole guide to profitable feed utilization.

A comparison between the two enterprises is most beneficial when it considers the allocation of items such as grains which could be utilized by either cows or hogs. Grain fed to hogs brought a higher price than that fed to milk cows on most of these farms in 1935 and 1936. Even if this relationship held over a period of years, however, it does not mean that the dairy-hog farmer in this area should feed all his grain to hogs. He should attempt to get the highest returns for all the feed units he produces—roughage as well as grain. This usually means feeding a part of the grains to the milk cows in order to get greater returns from the non-marketable roughages and pasture. There is a range within which farmers can shift such factors as grain and labor, from milk cows to hogs or vice versa, in order to get the greatest farm profits as price relationships change.
THE OPTIMUM COMBINATION OF LIVESTOCK ENTERPRISES

Does the combination of livestock enterprises differ on the farms making the most money from that on the low-profit farms? How important is the combination of livestock enterprises in influencing farm profits? It was assumed that those farmers making the most profit would most nearly have the optimum combination of livestock enterprises. The livestock organization of the 36 farms having strictly dairy enterprises is shown in table 12, with the farms grouped according to profits.

TABLE 12. COMBINATION OF LIVESTOCK ENTERPRISES ON HIGH MEDIUM AND LOW-PROFIT DAIRY-HOG FARMS.

<table>
<thead>
<tr>
<th>Northeastern Iowa farms, 1935-36.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>High-profit group</strong></td>
</tr>
<tr>
<td>Farm profits*</td>
</tr>
<tr>
<td>Number of farms</td>
</tr>
<tr>
<td>Size of farm, acres</td>
</tr>
<tr>
<td>Butterfat output per cow, lbs.</td>
</tr>
<tr>
<td>Livestock and livestock products per 100 acres land</td>
</tr>
<tr>
<td>Milk cows</td>
</tr>
<tr>
<td>Young cattle</td>
</tr>
<tr>
<td>Litters of pigs</td>
</tr>
<tr>
<td>Hens</td>
</tr>
<tr>
<td>Ewes</td>
</tr>
<tr>
<td>Butterfat, lbs.</td>
</tr>
<tr>
<td>Hogs, lbs.</td>
</tr>
<tr>
<td>Pounds hogs per pound butterfat</td>
</tr>
<tr>
<td>Gross farm income</td>
</tr>
<tr>
<td>Percent from:</td>
</tr>
<tr>
<td>Dairy products</td>
</tr>
<tr>
<td>Hogs</td>
</tr>
</tbody>
</table>

*The amount left to pay the farmer for his management of the whole farm. See table 15 for derivation of this factor.

The high-profit group, averaged over $2,000 return for management, compared to $800 for the medium and $60 for the low-profit group. The high-profit farms were not the largest ones, nor did they employ the most labor; but they had gross incomes over twice as large as the low-profit farms and one-third more than the intermediate group. They probably had more efficient cows as well as better-fed cows, as indicated by the margin over the other two groups in output per cow.

There was a difference in the combination of livestock between the three groups, especially in the dairy-hog relationship. The high-profit group combined the dairy and hog en-
enterprise at the ratio of one milk cow to one litter of pigs. They produced 6 pounds of hogs to 1 pound of butterfat with hogs furnishing 40 percent of the gross farm income and dairy products 27 percent. The least profitable group of farms kept more cows relative to hogs (one and six-tenths milk cows to one litter of pigs) and dairy products and hogs furnished almost equal shares of gross farm income.

A majority of the farms included in this study had a fairly consistent balance between the dairy and hog enterprises. On only one farm did dairy products furnish more than 50 percent of the farm income, and on only one did the hogs furnish over 50 percent. Only 12 of the 36 dairy-hog farms secured over one-third of the farm income from dairy products, while 25 secured over one-third of the farm income from hogs.

Generally speaking, during years when butterfat prices are favorable relative to hog prices (1 pound of butterfat worth from $5\frac{1}{2}$ to $6\frac{1}{2}$ pounds of hogs), an Iowa dairy-hog farmer who has a fairly flexible farm organization and is attempting to maximize farm profits would produce more butterfat and fewer hogs, but during years when hog prices were more favorable than butterfat (1 pound butterfat worth from $3\frac{1}{2}$ to $4\frac{1}{2}$ pounds of hogs), he would increase the hog and decrease the butterfat production. Under the favorable hog prices of 1935-36 the higher the ratio of hog to butterfat output (within the range shown by these farms), the more profitable the farm. Under ordinary price relationships, however, and particularly on farms with a large amount of roughage and pasture land, the point of optimum relationship between the two enterprises is likely to be reached with fewer hogs produced.

The dairy and hog enterprises supplement each other so closely on many northeastern Iowa farms that it is difficult to consider them separately. It would probably be more realistic to speak of the dairy-hog enterprise rather than of each as a single unit.\(^\text{11}\)

\(^{11}\) There are but few completely "specialized" dairy farms in Iowa; that is, farms where the dairy is the single source of income. Of the 950 Iowa farmers who kept farm business records in 1937 in cooperation with the Agricultural Experiment Station, 195 farms had dairy as a major livestock enterprise. On all but 10 of these it was combined with at least one other major livestock enterprise. Hogs comprised the other enterprise in three-fourths of the cases and furnished the greater portion of the farm income on half of the farms. In the dairy regions of Minnesota and Wisconsin, this enterprise furnished a larger proportion of the farm income (Appendix table A-4). If an Iowa dairy farm were transplanted to one of these states it would probably be considered a general livestock farm. With climate and soil more favorable to corn production, most Iowa dairymen have found it more profitable to organize a dairy-hog type of business with each of these two enterprises of major importance rather than to utilize most of their resources through the milk cows. This has forced them to sacrifice in efficiency in the dairy, but it has given them certain definite advantages, particularly in alternatives for the use of their resources, as well as reducing to some extent the risk of price changes in individual products.
From farm to farm in northeastern Iowa, the number of milk cows and hogs generally varies together. Thus, it is shown in fig. 5, that if one farm has five more milk cows than another, it probably has also four to six more litters of pigs.

**FACTORS REQUIRING FLEXIBILITY IN THE DAIRY-HOG COMBINATION**

The most profitable combination of livestock enterprises changes from year to year with the prices of feeds and labor on the one hand and prices of livestock products on the other. Assuming that a dairy-hog farmer desires to operate a flexible livestock system, what are some of the factors upon which he must base his decisions in making changes?

**THE BUTTERFAT-GRAIN PRICE RATIO**

One of the indicators that Iowa dairymen watch is the relationship between butterfat and feed prices. Since the

![Fig. 5. Relationship between cows milked and litters of pigs.](image-url)
roughage feeds usually have no other market than the dairy, the more important relationship is that between butterfat and grain prices. The average butterfat-grain price ratio from 1910-38 is shown in fig. 6. The farther the curve is above the horizontal line (which represents the average butterfat-grain price ratio from 1920 to 1929) the more profitable it is to convert grain into butterfat.

From 1910 to 1920, grain was generally high in price relative to butterfat, and during this period the number of cows milked in the state and the production of butterfat remained fairly constant. But from 1920 to 1934, taking the period as a whole, butterfat prices were high relative to grain prices, and creamery butter production more than doubled. From 1931 to 1934, grain was cheaper relative to butterfat than in any other period in the last 28 years, and dairying in Iowa continued to expand at a rapid rate.

Likewise the hog-corn price ratio with which most farmers are familiar is an excellent indication of the profitableness in feeding corn to hogs. But it is difficult for a farmer to

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12 The butterfat-grain ratio is the price of 1 pound of butterfat divided by the price of a pound of grain; it is the number of pounds of grain required to equal the value of 1 pound butterfat. The grain ration of 60 percent corn and 40 percent oats was suggested by the Dairy Husbandry Section of Iowa State College. The butterfat price is the farm price of butter, but since a pound of butter is exchanged for a pound of butterfat at most creameries, the two prices are practically the same in all except years of extremely high or low butter prices.
use these two ratios separately to determine the most profitable combination of milk cows and hogs or to determine when to shift grain or labor from one enterprise to the other. He needs, instead, a ratio between the prices of butterfat and hogs.

**THE RELATIONSHIP BETWEEN BUTTERFAT AND HOG PRICES**

A more direct comparison of hog and butterfat prices may be made by observing the number of pounds of pork that 1 pound of butterfat would buy in different years. From 1910 to 1920, butterfat was low in price compared to hogs, 1 pound of butterfat being worth less than 4 pounds of hogs. From 1920 to 1934, a pound of butterfat was worth more than 4 pounds of hogs in 12 out of the 15 years. This was particularly true during the depression years 1932, 1933 and 1934, when 1 pound of butterfat was worth 6 pounds of hogs. Partly as a result, this 15-year period was one of great expansion in the dairy business. With the ensuing recovery in hog prices during 1935 to 1937, 1 pound of butterfat would buy only $3\frac{1}{2}$ pounds of hogs and this marked an expansion in hog production relative to dairying.

Within limits this butter-hog price ratio should help a farmer in deciding when to shift grain from hogs to milk cows or vice versa. According to the price outlook, it seems likely that when a pound of butterfat is worth more than 5 or $5\frac{1}{2}$ pounds of hogs, a dairy-hog farmer may well consider increasing milk production relative to hogs, but when a pound of butterfat appears likely to be worth less than 4 pounds of hogs for a considerable period, then he should consider increasing hog production relative to milk production.

A fairly close relationship between the butterfat-grain ratio and the butterfat-hog ratio is shown in fig 6. This is because there is a close correlation between grain and hog prices. In some years, however, there are wide differences between the two ratios. In 1937, for instance, butterfat was low in price relative to the price of grains, indicating that it was unprofitable to convert grain into butterfat. In that year, however, hogs were also relatively low compared to grain prices; thus it was most profitable to sell the corn as grain, but if fed to livestock on a dairy-hog farm, converting the grain into hogs would give a higher return than would the dairy production.

How do Iowa dairy-hog farmers respond to changing price relationships? Taking the state as a whole, farmers are fairly conscious of relative price changes. A period of several months of a favorable hog-corn price ratio is followed by increased hog production. Dairymen respond to long-time price
trends, but relatively little to short-time changes. For instance, from 1920 to 1934, prices were generally favorable to the dairy, and dairy production increased greatly throughout the period, with little variation from year to year. This lack of short-time flexibility is largely explained by the long-time character of the enterprise, the large amount of fixed capital investment required, the time needed to build up a profitable herd, the large labor requirement and the type of managerial skill required.

The average northeastern Iowa dairy-hog farmer with a strictly dairy herd tends to lay out a certain farm organization and then keeps dairy production fairly uniform from year to year unless there is a wide and persistent change in price relationships. Hog production, however, can be varied more easily from one year to the next. Farmers with dual-purpose dairy herds or those with the beef-dairy combinations have considerably greater range in flexibility than the more specialized dairyman.

How can a dairy-hog farmer adjust his business during a period of 3 or 4 years, such as 1931-1934, when butterfat prices are unusually high compared to hog prices? The obvious course would be to increase milk production relative to hogs as quickly as possible. This could be done by feeding more grain to cows, milking a cow or two that had nursed calves, buying an extra cow or two, feeding hogs to lighter weights and keeping fewer sows to breed for the next pig crop.

If the opposite condition existed, as during 1935-37, when hogs were unusually high-priced relative to butterfat, it would probably not pay to sell any very good cows, but a few of the poorest cows could be sold with no major disturbance to the dairy enterprise, and also a larger proportion of the grain supply could be shifted to hogs. Hog production could be increased on short notice by feeding the current crop of pigs to heavier weights, or in less than a year the number of hogs could be increased by keeping back more gilts for breeding.

The relationship between butterfat and hog production on Iowa dairy-hog farms is not a constant one. The most profitable combination of the two enterprises depends upon several factors, but primarily upon the relationship between butterfat and hog prices, though of course beef prices are an important factor on farms with dual-purpose herds. A shift in emphasis from one enterprise to the other for the short run can be made most economically by shifting the supplies of grain and labor. This range of flexibility is narrower, however, in the more highly specialized dairy herds.
### TABLE 13. INVESTMENTS IN LIQUID, WORKING AND FIXED ASSETS.

Northeastern Iowa farms, average per farm, 1935-36.

<table>
<thead>
<tr>
<th>Dairy-hog farms</th>
<th>Over 25 percent gross income from dairy products</th>
<th>Under 25 percent gross income from dairy products</th>
<th>Beef-dairy-hog farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of farms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash and accounts receivable</td>
<td>27</td>
<td>$28</td>
<td>6</td>
</tr>
<tr>
<td>Cattle, fat and young</td>
<td>464</td>
<td>499</td>
<td>1,048</td>
</tr>
<tr>
<td>Poultry</td>
<td>138</td>
<td>109</td>
<td>145</td>
</tr>
<tr>
<td>Hogs</td>
<td>689</td>
<td>490</td>
<td>716</td>
</tr>
<tr>
<td>Sheep</td>
<td>34</td>
<td>70</td>
<td>41</td>
</tr>
<tr>
<td>Feeds, seeds and supplies</td>
<td>2,148</td>
<td>1,558</td>
<td>2,704</td>
</tr>
<tr>
<td>Total liquid assets</td>
<td>3,560</td>
<td>2,834</td>
<td>4,732</td>
</tr>
<tr>
<td>Cattle, breeding stock</td>
<td>1,205</td>
<td>714</td>
<td>1,267</td>
</tr>
<tr>
<td>Horses</td>
<td>449</td>
<td>521</td>
<td>559</td>
</tr>
<tr>
<td>Tractor</td>
<td>317</td>
<td>310</td>
<td>602</td>
</tr>
<tr>
<td>Crop and livestock equipment</td>
<td>1,167</td>
<td>854</td>
<td>1,526</td>
</tr>
<tr>
<td>Truck and auto (farm share)</td>
<td>187</td>
<td>146</td>
<td>335</td>
</tr>
<tr>
<td>Total working assets</td>
<td>3,325</td>
<td>2,445</td>
<td>4,289</td>
</tr>
<tr>
<td>Farm improvements</td>
<td>4,718</td>
<td>3,266</td>
<td>7,002</td>
</tr>
<tr>
<td>Land</td>
<td>12,826</td>
<td>11,207</td>
<td>18,741</td>
</tr>
<tr>
<td>Total fixed assets</td>
<td>17,544</td>
<td>14,473</td>
<td>25,743</td>
</tr>
<tr>
<td>Total business assets</td>
<td>24,429</td>
<td>19,752</td>
<td>34,764</td>
</tr>
<tr>
<td>Value of dwelling</td>
<td>2,050</td>
<td>1,679</td>
<td>2,825</td>
</tr>
<tr>
<td>Total assets</td>
<td>26,479</td>
<td>21,431</td>
<td>37,589</td>
</tr>
<tr>
<td>Percent business investment in:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid assets</td>
<td>15</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Working assets</td>
<td>14</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Fixed assets</td>
<td>71</td>
<td>74</td>
<td>74</td>
</tr>
</tbody>
</table>

* Liquid assets include feeds, seeds and supplies, marketable livestock, cash, and bills receivable. These are normally liquidated within a period of a year.

* Working assets include horses, breeding stock, machinery and equipment. They are liquidated much more slowly than the liquid assets.

* Fixed assets include land, buildings and permanent improvements. It is practically impossible to cash in on these resources to meet current debts.

* Differences between averages of items on this line have been tested statistically and found to be highly significant.

**FINANCIAL RETURNS**

**INVESTMENTS IN FARM ASSETS**

The capital investments required on these dairy-hog farms are indicated in table 13, according to types of livestock systems.

The value of the land and buildings on the two groups of dairy-hog farms amounted to from $90 to $100 per acre of land, while on the larger and rougher beef-dairy-hog farms the average value was only $83 per acre. Total assets averaged over $26,000 on the more specialized dairy-hog farms, compared to $21,000 on the less specialized ones. It is sig-
significant that 71 to 74 percent of the business investments on these dairy-hog farms were in relatively permanent capital assets on which there is a very slow rate of turnover. This lack of liquidity should be taken into consideration when a farmer decides whether to put savings or borrowed money into the purchase of land and improvements, into machinery or into livestock.

If a man were to start farming in this area by renting a 189-acre farm (the average size of the less specialized dairy farms which were studied), how much capital would he need? It is shown in table 13 that the average investment in working assets in this group of farms amounted to $2,445 at 1935-36 prices. This would include breeding cattle, machinery and equipment, power either in horses or tractor, and the farm share of an automobile. Most of this machinery and equipment would have to be picked up at farm sales to keep within this figure. In addition there would be needed about $2,000 for hogs, poultry and enough feeds and supplies to last until the new crop. If he chose a more intensive dairy business, he would need about an additional $1,500. Of course, he might cut some corners or start on a smaller scale.

RECEIPTS AND EXPENDITURES

What amounts of receipts were obtained and what expenses were involved in operating these farms? Receipts and expenditures are shown in table 14 with the farms grouped according to size and type of livestock system. Livestock or livestock products accounted for approximately 90 percent of the cash income, and over three-fourths of it was furnished by cattle and hogs.

Cash operating expenses, which include power and equipment costs, labor hired, livestock and crop expenses and other current expenses, amounted to about one-third of the total cash expenses, or from $4 to $5 per acre. They were slightly larger on the more specialized dairy farms. Cash fixed expenses (taxes, interest, insurance and permanent improvement repairs) accounted for slightly less than one-fifth of the total cash expenses. They averaged $1.96 per acre on the less intensive dairy farms and $2.55 per acre on the more specialized ones, which required more expensive improvements and consequently more interest as well as expense in maintenance. Taxes averaged less than $1 per acre in all groups.

The less specialized dairy-hog farms averaged $1,423 net cash income out of which the family living and payment on debts were paid, while the farms more specialized in dairying averaged $2,075. When figured on a per acre basis, net cash
TABLE 14. RECEIPTS AND EXPENDITURES.
Northeastern Iowa farms average per farm, 1935-36.

<table>
<thead>
<tr>
<th>Dairy-hog farms</th>
<th>Beef-milk-hog farms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over 25 per-</td>
</tr>
<tr>
<td></td>
<td>cent gross in-</td>
</tr>
<tr>
<td></td>
<td>come from</td>
</tr>
<tr>
<td></td>
<td>dairy products</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of farms</th>
<th>27</th>
<th>28</th>
<th>6</th>
</tr>
</thead>
</table>

**RECEIPTS**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hogs sold</strong></td>
<td>$1,686</td>
<td>$1,495</td>
<td>$1,662</td>
</tr>
<tr>
<td><strong>Dairy products sold</strong></td>
<td>1,437</td>
<td>643</td>
<td>554</td>
</tr>
<tr>
<td><strong>Cattle sold</strong></td>
<td>547</td>
<td>589</td>
<td>1,492</td>
</tr>
<tr>
<td><strong>Eggs and poultry sold</strong></td>
<td>455</td>
<td>298</td>
<td>477</td>
</tr>
<tr>
<td><strong>Crops sold</strong></td>
<td>166</td>
<td>141</td>
<td>230</td>
</tr>
<tr>
<td><strong>Miscellaneous receipts</strong></td>
<td>480</td>
<td>574</td>
<td>795</td>
</tr>
</tbody>
</table>

**Total cash receipts**

<table>
<thead>
<tr>
<th>4,751</th>
<th>3,740</th>
<th>5,260</th>
</tr>
</thead>
</table>

**Food and fuel from farm**

<table>
<thead>
<tr>
<th>299</th>
<th>296</th>
<th>389</th>
</tr>
</thead>
</table>

**Net increase in inventories**

<table>
<thead>
<tr>
<th>315</th>
<th>603</th>
<th>541</th>
</tr>
</thead>
</table>

**Total income**

<table>
<thead>
<tr>
<th>5,365</th>
<th>4,639</th>
<th>6,190</th>
</tr>
</thead>
</table>

**EXPENDITURES**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Auto, truck, tractor upkeep</strong></td>
<td>324</td>
<td>262</td>
<td>441</td>
</tr>
<tr>
<td><strong>Livestock expense</strong></td>
<td>55</td>
<td>28</td>
<td>39</td>
</tr>
<tr>
<td><strong>Crop expense</strong></td>
<td>146</td>
<td>108</td>
<td>177</td>
</tr>
<tr>
<td><strong>Labor hired</strong></td>
<td>299</td>
<td>245</td>
<td>599</td>
</tr>
<tr>
<td><strong>Misc operating expense</strong></td>
<td>143</td>
<td>115</td>
<td>161</td>
</tr>
</tbody>
</table>

**Total cash operating expenses**

<table>
<thead>
<tr>
<th>967</th>
<th>758</th>
<th>1,217</th>
</tr>
</thead>
</table>

**Taxes, insurance and upkeep**

<table>
<thead>
<tr>
<th>274</th>
<th>217</th>
<th>355</th>
</tr>
</thead>
</table>

**Interest paid**

<table>
<thead>
<tr>
<th>237</th>
<th>154</th>
<th>200</th>
</tr>
</thead>
</table>

**Total cash fixed expense**

<table>
<thead>
<tr>
<th>511</th>
<th>371</th>
<th>555</th>
</tr>
</thead>
</table>

**Feeds bought**

<table>
<thead>
<tr>
<th>428</th>
<th>336</th>
<th>441</th>
</tr>
</thead>
</table>

**Livestock bought**

<table>
<thead>
<tr>
<th>190</th>
<th>308</th>
<th>216</th>
</tr>
</thead>
</table>

**New capital investments**

<table>
<thead>
<tr>
<th>580</th>
<th>544</th>
<th>784</th>
</tr>
</thead>
</table>

**Total cash expenditures**

<table>
<thead>
<tr>
<th>2,676</th>
<th>2,317</th>
<th>3,213</th>
</tr>
</thead>
</table>

**Net cash income**

<table>
<thead>
<tr>
<th>2,075</th>
<th>1,423</th>
<th>2,047</th>
</tr>
</thead>
</table>

**Net farm income**

<table>
<thead>
<tr>
<th>2,689</th>
<th>2,322</th>
<th>2,977</th>
</tr>
</thead>
</table>

**Net income above interest payments per acre**

<table>
<thead>
<tr>
<th>14.63</th>
<th>13.10</th>
<th>10.18</th>
</tr>
</thead>
</table>

a Net farm income equals total income minus total expenditures and depreciation on fixed assets and on working assets except cattle.
b Net cash income equals total cash receipts minus total cash expenditures.
c Interest charges were omitted from the expenditures in obtaining this figure.

Income averaged $7.53 and $10.38, respectively, in these two groups.

If we add to net cash income the value of food and fuel from the farm and adjust for changes in values of inventories, we secure the net farm income. This amounted to $2,322 on the less specialized dairy-hog farms, $2,689 on the more specialized ones and $2,977 on the beef-milk-hog farms, or from $9.54 to $13.44 per acre. These amounts compare quite favorably with similar farms in other areas of the state.
Was the income sufficient to pay the current rate of interest on the farmer's own investment and current wage rates for his labor and that of his family? In table 15 is shown the net operating income and management returns. The management return figure is found by deducting from operating income, interest on the capital invested in current assets, rent on land, and wages of operator and family labor. Operators on the larger farms received considerably more for their management than did those on the smaller farms. Farm management studies in many states show that the larger the amount of business done the greater the chances for profits, at least during a normal or fairly profitable year.

**TABLE 15. DISTRIBUTION OF NET OPERATING INCOME BY TYPES OF FARMS.**

Northeastern Iowa farms, average per farm 1935-1936.

<table>
<thead>
<tr>
<th>Dairy-hog farms</th>
<th>Over 25 percent gross income from dairy products</th>
<th>Under 25 percent gross income from dairy products</th>
<th>Beef-dairy-hog farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net operating income&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$3,402</td>
<td>$2,815</td>
<td>$3,841</td>
</tr>
<tr>
<td>Interest on current assets&lt;sup&gt;b&lt;/sup&gt;</td>
<td>405</td>
<td>297</td>
<td>522</td>
</tr>
<tr>
<td>Rent on land&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1,184</td>
<td>965</td>
<td>1,599</td>
</tr>
<tr>
<td>Wages of operator and family&lt;sup&gt;d&lt;/sup&gt;</td>
<td>816</td>
<td>706</td>
<td>696</td>
</tr>
<tr>
<td>Return to management&lt;sup&gt;e&lt;/sup&gt;</td>
<td>997</td>
<td>848</td>
<td>1,024</td>
</tr>
</tbody>
</table>

<sup>a</sup> Net operating income is the total business credit from table 14 minus all cash expenses and charges except cash fixed expenses and depreciation on fixed assets.

<sup>b</sup> Interest on current assets was figured for each year at 6 percent.

<sup>c</sup> Cash rent paid, or estimated cash rental value.

<sup>d</sup> Operator labor was charged at $45 per month, approximately the same rate as hired labor. Family labor was charged at $40 per month.

<sup>e</sup> The difference between the two groups receiving less than 25 percent and those receiving over 25 percent gross income from dairy products is not statistically significant. However, the return to management was found to be significantly greater on the farms over 200 acres than on those under 200 acres.

**FACTORS INFLUENCING FARM PROFITS**

Data in table 16 help to explain why the 12 high-profit dairy-hog farmers made so much more than the 12 low-profit ones. In the first place, the high-profit men had farms which were one-third larger in total acreage and which had 4 percent more land in crops than the low-profit group. Their total capital was larger by two-thirds, and the turnover on capital investment was a fifth greater than was that of the low-profit group. Variation in management returns on the 36 dairy farms are shown in fig. 7.

The high-profit farms not only had larger crop acreages, but they were able to secure higher crop yields and had a
greater proportion of the higher-valued crops.

The high-profit men were more intensive in their livestock enterprises, keeping 0.4 more cows, 3.3 more litters of pigs and 10 more hens per 100 acres of land, having a 23 percent higher butterfat output per cow and 14 percent more pounds of hogs per litter of pigs. They leaned more strongly to hog production, producing 6 pounds hogs to 1 pound butterfat, as compared to a ratio of 4.1 to 1 for the low-profit men. Largely as a result, the high-profit men received 40 percent of their income from hogs, compared to 33 percent in the other group. This optimum combination of livestock enterprise was discussed more thoroughly on pages 698-699.

The high-profit farmers were also more efficient and more economical in their use of labor and power. Even with their more intensive livestock systems, they tended more crop-acres per man and had $2.50 less operating expenses per $100 gross income.

Part of the variation in management returns between farms is related to differences in the size of farm. Another part depends on the balance or proportion between enterprises, while still a third type of influence is found in the efficiency with which each enterprise is conducted. Further, it is noteworthy that management return or profit does not necessarily vary at a constant rate, either with size of enterprise or degree of efficiency. The relationship is more
TABLE 16. MANAGEMENT ANALYSIS: A COMPARISON OF THE LOW AND HIGH-PROFIT DAIRY-HOG FARMS.

<table>
<thead>
<tr>
<th></th>
<th>12 high-profit farms</th>
<th>12 medium-profit farms</th>
<th>12 low-profit farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return to management</td>
<td>$2,034</td>
<td>$785</td>
<td>$63</td>
</tr>
<tr>
<td>Volume of business</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size of farm, acres</td>
<td>213</td>
<td>204</td>
<td>159</td>
</tr>
<tr>
<td>Percent land in crops</td>
<td>69</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>Total capital managed</td>
<td>$29,986</td>
<td>$25,098</td>
<td>$17,927</td>
</tr>
<tr>
<td>Gross income</td>
<td>6,447</td>
<td>4,911</td>
<td>3,166</td>
</tr>
<tr>
<td>Gross income per $100 invested</td>
<td>21.50</td>
<td>19.35</td>
<td>17.66</td>
</tr>
<tr>
<td>Cropping efficiency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn yields, bu.</td>
<td>47</td>
<td>41</td>
<td>35</td>
</tr>
<tr>
<td>Oats yields, bu.</td>
<td>41</td>
<td>34</td>
<td>33</td>
</tr>
<tr>
<td>Gross value crops per crop-acre</td>
<td>$22</td>
<td>$19</td>
<td>$19</td>
</tr>
<tr>
<td>Livestock efficiency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock returns per $100 fed</td>
<td>$179</td>
<td>$157</td>
<td>$152</td>
</tr>
<tr>
<td>Pounds butterfat per cow</td>
<td>260</td>
<td>216</td>
<td>212</td>
</tr>
<tr>
<td>Pounds hogs per litter</td>
<td>1,542</td>
<td>1,352</td>
<td>1,356</td>
</tr>
<tr>
<td>Labor efficiency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Months man-labor</td>
<td>27</td>
<td>27</td>
<td>22</td>
</tr>
<tr>
<td>Crop-acres per man:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On horse farms</td>
<td>(4) 72</td>
<td>(4) 70</td>
<td>(6) 54</td>
</tr>
<tr>
<td>On tractor farms</td>
<td>(8) 71</td>
<td>(8) 60</td>
<td>(8) 69</td>
</tr>
</tbody>
</table>

likely to be described by a curve than by a straight line, as is brought out clearly in fig. 8.

As the size of any individual enterprise expands (other important influences on profits being taken into account) management returns generally rise more and more slowly. Thus, as shown in fig. 8, an increase in corn from 20 to 30 acres on the farms studied, brought about $300 increase in profits. But the farther the corn acreage rose the smaller became the effect of an added acre, so that an increase from 60 to 70 acres per farm raised profits only $175. The same tendency occurred with acreage in pasture, with number of milk cows kept and with the amount of beef produced.13

With variation in the amount of hogs produced, management returns increased more rapidly as hog production rose from 6,000 or 7,000 to 10,000 pounds per farm than it did above that point. For the most part, however, the relationship is described by a straight line within the limits of fig. 8. There was some evidence of a downturn in the curve of profits when hog production became quite large, but the number of farms in this study was too small to show conclusively just where the downturn occurs.

Management returns vary also with the yield per acre of

---

13 See table B-1 for data on correlations of the factors mentioned with management returns.
land or per head of livestock. Generally, however, the higher yields are obtained at higher costs so that net returns de-
cline after a certain yield is reached. Among the farms studied, there was some indication that the highest returns were reached with corn yields of between 55 and 60 bushels, though the number of farms with yields above this level was small. A similar influence on returns is found in variation in the amount of feed per 100 pounds of hogs produced. As feeding became less efficient, profits fell more and more rapidly. On the other hand, increases in the butterfat output per cow are accompanied by a rising curve of profits within the limits of fig. 8. We would hardly expect this rise to continue indefinitely, but the point of maximum net returns is evidently higher than 275 pounds output per cow. The relationship between butterfat output per cow and returns from the dairy enterprise has been discussed elsewhere.14

One of the strongest influences on management returns is found in the amount of labor employed on the farm. Maximum returns occurred where from 16 to 18 months of labor were used per farm. This amounts to full-time employment for the farmer himself, plus 3 or 4 months of family labor and a small amount of hired labor in the busy seasons. On the typical Iowa farm it is difficult to keep a hired man occupied efficiently throughout the year, and if more than one man is hired efficiency of the labor declines still further.

What kind of farm is likely to yield the greatest profit in the area studied? From the graphs in fig. 8, we might conclude that for farms with the type of organization discussed, the most profitable farm would contain a minimum of 60 acres of corn. (The available data, however, do not tell us what would be the maximum, and this would probably vary with the type of land and the topography as well as with the ability of the farmer.) We would also expect the most profitable farm to contain a minimum of 70 acres of pasture, to keep about 15 milk cows, produce not less than 30,000 pounds of hogs (about 20 litters) and produce about 10,000 pounds of cattle per year. It might be concluded further that the most profitable farm would produce a yield of 55 to 60 bushels of corn per acre, not less than 275 pounds of butterfat output per cow (though again we cannot say on the basis of these data what would be the maximum) and would produce the hogs mentioned above with a minimum of feed per hundred pounds of gain.

For maximum profit, an effort should be made to keep down the cost elements while obtaining optimum production. As stated above, the highest returns on these farms (which averaged about 195 acres per farm) were made when 16 to 18 months of labor were used. But if corn acreage were

---

increased to 60 (about one-third more than the average), and if hog production were also expanded materially, an increase in labor about the 16 to 18-months figure would also be implied.

In interpreting these data, we must remember that a farm is made up of many different, specific factors of production; that it generally produces several marketable products and also feed crops which are consumed on the farm. Further, the successful operation of each division of the business depends on the skillful selection of those grades or types of materials, equipment, labor and so on that can be obtained at a minimum of cost per dollar of product. Next, these factors of production must be combined by satisfactory and sometimes rather involved techniques. The technique itself must be varied from time to time to conform to the price situation and at any given time must be varied appropriately to fit the conditions of each different farm. More important in its effect on returns than any of these, however, is the variation in aptitudes and abilities between different farmers. And for this most important influence there is, as yet, no satisfactory method of measurement.  

The 10 influences on management returns indicated in fig. 8 should be considered simply as some of the more obvious and important ones. Farm returns are affected by so many different things that no single one can be expected to account for any large percentage of the difference found between farms. These 10, taken together, explain slightly over half of the variation in the 55 farms. To explain a larger proportion, we would need to study a greater number of farms and use even more elaborate methods of analysis.

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15 See appendix C for a discussion of certain problems involved in the interpretation of such data.
APPENDIX A—SUPPLEMENTARY TABLES

PRODUCTION AND DISPOSITION OF FEED CROPS

TABLE A-1. ACREAGE AND DISTRIBUTION OF CORN, SMALL GRAIN AND HAY CROP.
Northeastern Iowa farms, average per farm, 1935-36

<table>
<thead>
<tr>
<th>CORN, TOTAL ACRES</th>
<th>PERCENT: HUSKED</th>
<th>ENSILED</th>
<th>SHOCKED</th>
<th>HOGGED DOWN</th>
<th>SMALL GRAIN, TOTAL ACRES</th>
<th>PERCENT IN:</th>
<th>OATS</th>
<th>BARLEY</th>
<th>SOYBEANS FOR GRAIN</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>46.0%</td>
<td>61%</td>
<td>24%</td>
<td>3%</td>
<td>48.0%</td>
<td>68%</td>
<td>13%</td>
<td>11%</td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>41.1%</td>
<td>57%</td>
<td>20%</td>
<td>5%</td>
<td>45.1%</td>
<td>75%</td>
<td>11%</td>
<td>5%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>51.4%</td>
<td>62%</td>
<td>25%</td>
<td>4%</td>
<td>62.0%</td>
<td>77%</td>
<td>12%</td>
<td>7%</td>
<td>3%</td>
<td>3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HAY, TOTAL ACRES</th>
<th>PERCENT IN:</th>
<th>ALFALFA</th>
<th>RED CLOVER</th>
<th>SOYBEANS</th>
<th>MIXED HAY</th>
<th>OTHER (INCLUDING TIMOTHY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.7%</td>
<td>29.0%</td>
<td>38%</td>
<td>25%</td>
<td>25%</td>
<td>14%</td>
<td>14%</td>
</tr>
</tbody>
</table>

a Including the farms for which records were obtained both for 1935 and 1936.

TABLE A-2. DISPOSITION OF GRAINS BY TYPE OF LIVESTOCK SYSTEM.
Northeastern Iowa farms, average per farm 1935-36.

<table>
<thead>
<tr>
<th>CORN—TOTAL BU. FED:</th>
<th>PERCENT FED TO:</th>
<th>HOGS</th>
<th>MILK COWS</th>
<th>OTHER CATTLE</th>
<th>HORSES</th>
<th>POULTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>70%</td>
<td>12%</td>
<td>4%</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,752</td>
<td>68%</td>
<td>8%</td>
<td>5%</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,604</td>
<td>8%</td>
<td>5%</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2,218</td>
<td>4%</td>
<td>4%</td>
<td>9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OATS—TOTAL BU. FED:</th>
<th>PERCENT FED TO:</th>
<th>HOGS</th>
<th>MILK COWS</th>
<th>OTHER CATTLE</th>
<th>HORSES</th>
<th>POULTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>26%</td>
<td>31%</td>
<td>7%</td>
<td>24%</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,062</td>
<td>35%</td>
<td>14%</td>
<td>16%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,014</td>
<td>6%</td>
<td>16%</td>
<td>15%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NUMBER OF FARMS</th>
<th>OVER 25 PERCENT GROSS INCOME FROM MILK</th>
<th>UNDER 25 PERCENT GROSS INCOME FROM MILK</th>
<th>BEEF DAILY-HOG FARMS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>27</td>
<td>28</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OATS—TOTAL BU. FED:</th>
<th>PERCENT FED TO:</th>
<th>HOGS</th>
<th>MILK COWS</th>
<th>OTHER CATTLE</th>
<th>HORSES</th>
<th>POULTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>26%</td>
<td>31%</td>
<td>7%</td>
<td>24%</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,062</td>
<td>35%</td>
<td>14%</td>
<td>16%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,014</td>
<td>6%</td>
<td>16%</td>
<td>15%</td>
</tr>
</tbody>
</table>
### TABLE A-3. DISPOSITION OF PRINCIPAL ROUGHAGE CROPS.
Northeastern Iowa farms, average per farm, 1935-36.

<table>
<thead>
<tr>
<th></th>
<th>Dairy-hog farms</th>
<th>Beef-dairy-hog farms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over 25 percent gross income from dairy products</td>
<td>Under 25 percent gross income from dairy products</td>
</tr>
<tr>
<td>Corn silage, total tons fed</td>
<td>73</td>
<td>46</td>
</tr>
<tr>
<td>Percent fed to:</td>
<td>Milk cows</td>
<td>74</td>
</tr>
<tr>
<td>Other cattle</td>
<td>26</td>
<td>35</td>
</tr>
<tr>
<td>Legume hay, total tons fed</td>
<td>45</td>
<td>34</td>
</tr>
<tr>
<td>Percent fed to:</td>
<td>Milk cows</td>
<td>57</td>
</tr>
<tr>
<td>Other cattle</td>
<td>29</td>
<td>31</td>
</tr>
<tr>
<td>Horses</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>Sheep</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Non-legume hay, total tons fed</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Percent fed to:</td>
<td>Milk cows</td>
<td>32</td>
</tr>
<tr>
<td>Other cattle</td>
<td>21</td>
<td>30</td>
</tr>
<tr>
<td>Horses</td>
<td>45</td>
<td>41</td>
</tr>
<tr>
<td>Sheep</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Pasture, total value</td>
<td>$223</td>
<td>$207</td>
</tr>
<tr>
<td>Percent fed to:</td>
<td>Cattle</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Hogs</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Horses</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Sheep</td>
<td>2</td>
</tr>
</tbody>
</table>

### TABLE A-4. A COMPARISON OF FARMS OF FIVE STATES IN CONTRIBUTION OF THE DAIRY AND HOG ENTERPRISES TO TOTAL CASH RECEIPTS.

<table>
<thead>
<tr>
<th>Location of farms</th>
<th>Year</th>
<th>Type of farm</th>
<th>Number of farms included</th>
<th>Percent cash receipts from dairy products</th>
<th>Percent cash receipts from hogs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast Iowa</td>
<td>1935-36</td>
<td>Dairy</td>
<td>27</td>
<td>30.2</td>
<td>35.5</td>
</tr>
<tr>
<td>Central and East Ohio</td>
<td>1935</td>
<td>Dairy</td>
<td>23</td>
<td>47.7</td>
<td>(b)</td>
</tr>
<tr>
<td>Southeast Michigan</td>
<td>1935</td>
<td>Dairy</td>
<td>56</td>
<td>50.4</td>
<td>(b)</td>
</tr>
<tr>
<td>Iowa, state total</td>
<td>1935</td>
<td>All types</td>
<td>152</td>
<td>28.3</td>
<td>20.3</td>
</tr>
<tr>
<td>Michigan, state total</td>
<td>1935</td>
<td>All types</td>
<td>781</td>
<td>9.1</td>
<td>30.7</td>
</tr>
<tr>
<td>Wisconsin, state total</td>
<td>1935</td>
<td>All types</td>
<td>933</td>
<td>29.7</td>
<td>7.5</td>
</tr>
</tbody>
</table>

aData from annual reports published by the various states on farm records kept in cooperation with the Agricultural Experiment Stations for the years indicated.

bData not available.
<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn (acres)</td>
<td>Æ</td>
<td>.26</td>
<td>.23</td>
<td>.17</td>
<td>.52</td>
<td>.15</td>
<td>.41</td>
<td>.56</td>
<td>.19</td>
<td>.67</td>
<td>.52</td>
</tr>
<tr>
<td>Pasture exc. alf. &amp; sw. clo. (acres)</td>
<td>.26</td>
<td>.23</td>
<td>Æ</td>
<td>.24</td>
<td>.06</td>
<td>.06</td>
<td>.24</td>
<td>.36</td>
<td>.21</td>
<td>.08</td>
<td>.51</td>
</tr>
<tr>
<td>Alf. and sw. clo. (acres)</td>
<td>.04</td>
<td>.26</td>
<td>.50</td>
<td>.50</td>
<td>.45</td>
<td>.45</td>
<td>.45</td>
<td>.60</td>
<td>.05</td>
<td>.37</td>
<td>.43</td>
</tr>
<tr>
<td>Corn per acre (bu.)</td>
<td>.50</td>
<td>.50</td>
<td>.35</td>
<td>.35</td>
<td>.24</td>
<td>.24</td>
<td>.24</td>
<td>.61</td>
<td>.18</td>
<td>.67</td>
<td>.40</td>
</tr>
<tr>
<td>Milk cows (no.)</td>
<td>.06</td>
<td>.06</td>
<td>.35</td>
<td>.35</td>
<td>.24</td>
<td>.24</td>
<td>.24</td>
<td>.61</td>
<td>.18</td>
<td>.67</td>
<td>.40</td>
</tr>
<tr>
<td>Milkfat output per cow (lb.)</td>
<td>.52</td>
<td>.24</td>
<td>.24</td>
<td>.24</td>
<td>.24</td>
<td>.24</td>
<td>.24</td>
<td>.61</td>
<td>.18</td>
<td>.67</td>
<td>.40</td>
</tr>
<tr>
<td>Beef produced (cwt.)</td>
<td>.15</td>
<td>.06</td>
<td>.06</td>
<td>.06</td>
<td>.06</td>
<td>.06</td>
<td>.06</td>
<td>.18</td>
<td>.05</td>
<td>.31</td>
<td>.37</td>
</tr>
<tr>
<td>Hogs produced (900 lbs.)</td>
<td>.41</td>
<td>.36</td>
<td>.36</td>
<td>.36</td>
<td>.36</td>
<td>.36</td>
<td>.36</td>
<td>.18</td>
<td>.05</td>
<td>.31</td>
<td>.37</td>
</tr>
<tr>
<td>Butterfat output per cow (lb.)</td>
<td>.41</td>
<td>.36</td>
<td>.36</td>
<td>.36</td>
<td>.36</td>
<td>.36</td>
<td>.36</td>
<td>.18</td>
<td>.05</td>
<td>.31</td>
<td>.37</td>
</tr>
<tr>
<td>Concp. per 100 lb. hog produced</td>
<td>.56</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.18</td>
<td>.05</td>
<td>.31</td>
<td>.37</td>
</tr>
<tr>
<td>Months labor</td>
<td>.56</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.18</td>
<td>.05</td>
<td>.31</td>
<td>.37</td>
</tr>
<tr>
<td>Management return</td>
<td>.56</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.21</td>
<td>.18</td>
<td>.05</td>
<td>.31</td>
<td>.37</td>
</tr>
</tbody>
</table>

Multiple correlation:
- Linear correlation: $R_{X:CD} = .85$, $\sigma_{X:CD}^2 = 455$
- Curvilinear correlation: $\Gamma_{X:CD} = .88$, $\sigma_{X:CD}^2 = 568$
The regression curves shown in fig. 8 should be considered as relatively simple and early approximations of the effects of the factors listed on management returns. To show separate regression curves, plotted on a single plane, implies that the relationship of one factor to the dependent variable can be treated without regard to the simultaneous values of the other factors concerned. Obviously this is too simple an assumption to be realistic.

Thus, suppose that of two farms otherwise identical one has 50 acres of corn and the second only 40. How much should we expect management returns to differ between them on this account? The curve of regression of management returns on corn acreage would tell us that the first farm might be expected to have management returns about $250 greater than the second.

This relationship, however, could be expected only as long as the other factors remained constant. The trouble is that if the first farm has 10 acres more corn than the second, other factors are not likely to be equal. There is a good chance that there will be more hogs to consume the corn—although there is also an opportunity to sell the entire production from the added acreage. If more corn is raised, more labor is likely to be employed also—or else the labor already available must be spread more thinly over the rest of the farm. In this latter case, the change in labor intensity in itself may be an important difference between the two farms.

Consequently, we must raise the question of functional relationships among the independent variables as well as between the independents on the one hand and the dependent on the other. A first approximation to these inter-relationships is shown by the simple correlation coefficients between independent variables in appendix B. Substituting these correlation coefficients in simple regression equations, we find that (considering the relationship between corn acreage and hog production alone) an increase of 10 acres of corn may be expected to be accompanied by an increase of 3,300 pounds of hog production. Likewise, if we considered the relationship between corn and labor alone, the 10-acre increase in corn would be accompanied by employment of an additional 2.9 months of labor.

Suppose that we next turn to the effects which these related increases in hog production and in months of labor may be expected to have on the management returns. The regression curves of management returns on hog production and
months of labor in fig. 8 inform us that the 3,300 pounds increase (from, say, 15,000 pounds to 18,300 pounds) in hogs is likely to be accompanied by an increase of about $120 in management returns. At the same time the related increase in labor (say from 20 months to 22.9 months) will probably be accompanied by a decline of about $230 in management return. If the hog production and labor hired were the only independent variables affected by the 10-acre increase in corn as between the two farms, then we would expect the net change in management returns to be:

\[ \$250 + \$120 - \$230 = \$140. \]

As was said above, however, this represents only a first approximation. It is likely that the relationships among independent variables are more accurately described by curves rather than by straight lines, which introduces a further great complexity in arriving at any correct solution.\(^a\)

Further, it should be observed that there is not necessarily a unique solution to the problem. It was suggested above that the farmer has an alternative in disposition of his corn. He may either raise more hogs to consume it, or he may sell part or all of it. Or he may feed the extra corn to additional dairy cows or to fattening steers rather than to hogs. There are likewise alternatives regarding labor. Instead of hiring additional labor, the farmer may elect to spread more thinly the labor already available on the farm.

A combination of the budgeting method with the statistical method will probably yield a more satisfactory solution for each specific case than would either of these two methods applied alone. Suppose that a farmer who is raising 40 acres of corn questions how his management return would be likely to change if he raised 10 acres more corn. How should he be answered?

First, the farmer should indicate how he intends to dispose of the extra corn produced, whether by sale, by feeding to hogs, to cattle, etc. Next, it is necessary to know how many pounds of additional hogs could be produced from the extra corn (and incidentally how much extra labor, if any, need be hired to take care of the extra hogs). It is necessary to know also whether the farmer will hire additional labor to tend the extra corn, etc., or will take less intensive care of the greater acreage. A list of further questions might also be added. Next, it becomes possible to sub-

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stitute the changes involved or elected in all of the independent variables in the respective regression curves, and finally, to observe the resulting net change in the management return.

Two points of caution must still be observed. First, the regression curves, such as those shown in fig. 8, are necessarily based on data from a number of different farms, operated by men of varying ability. The relationships of the independents to the dependent variable might be somewhat different if the variations in acreages, etc., occurred in a group of farms operated by farmers all of whom had equal ability, from what they would be if similar variations were to occur on a single farm operated by an individual and unchanged farmer. Second, since each regression curve in turn is based on the assumption that the other factors remain unchanged, it is not altogether certain that the sum of changes in management returns (as portrayed by the series of regression curves representing independent variables elected in the budgeting process) will exactly add up to the net change that would occur if it were possible to conduct an experiment in which the independent factors in question were changed on a given farm with prices and other "outside" influences held constant.