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Leonard F. Miller

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Dairying as an Economic Enterprise in West Virginia

by L. F. Miller

AGRICULTURAL EXPERIMENT STATION
COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS
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MORGANTOWN

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*Dairying as an Economic Enterprise in West Virginia**

by L. F. Miller

WEST VIRGINIA is considered a dairying frontier, and it is believed that such use of her resources would improve the economic welfare of farmers in the state. However, to date no analysis has been made of the physical and economic factors in the situation to ascertain whether or not this is the direction in which the rural economy of the state should be encouraged to develop, or of the possible limits to this development in terms of more efficient utilization of resources by other enterprises. Consequently, the first section of this study is devoted to an analysis of the proper place of dairying in the state in relation to other farm enterprises. Later, attention is given to the characteristics, profitableness and outlook for fluid milk and butterfat production. Finally, alternative markets are considered, along with management factors essential for successful dairying.

The possibilities for dairying in West Virginia were pointed out as early as 1876, when it was observed, "From what has been said about topography, soil, climate, adaptedness for grass of the state, it will be easily understood that with proper inducements arising from ready transportation and sufficient markets, these products (butter and cheese) should be a source of large revenue to our people."¹ The director of the West Virginia Experiment Station in his first annual report in 1888 stated, "We are fully convinced that the dairy interests of the state must always occupy a prominent position. As these have scarcely received the attention of our farmers, we propose for the first year or two of the station's existence to devote as large a measure of the energies of the station to this business as possible."²

Even with this early interest in dairying, expansion in the number of dairy cows has not been large. In 1890 the number of milk cows in the state was given by the census as 188,492 and in 1940 as 218,769 or an increase of approximately 30,000 in the 50 years. The general lack of interest in farming on the part of many rural people because of non-farm employment, royalty income, and comparatively poor land resources has retarded the development in agriculture in general, including dairying. Factors which more directly influenced the slow development of dairying include poor transportation facilities and the

*A thesis on this subject was presented to the Graduate School of the University of Wisconsin in partial fulfillment of the requirements for the degree of Doctor of Philosophy in June, 1942. However, for the purpose of this non-technical bulletin, it has been modified and condensed considerably. The writer is indebted to Professor P. E. McNall, University of Wisconsin, for helpful suggestions and advice; to Dr. W. W. Armentrout, West Virginia University, for valuable assistance, and to Mr. L. F. Herrmann, formerly assistant in agricultural economics, West Virginia University, who supervised the taking of records used in the butterfat phase of the study.

¹ Maury, M. F., and Fontaine, Wm. M. *Resources of West Virginia*, Wheeling, 1876, p. 79.

² *First Annual Report of the Director of the West Virginia Agricultural Experiment Station, 1888, p. 34.*

fact that the market for dairy products available to many farmers was not particularly profitable. The numbers of other classes of livestock have declined somewhat in the last fifty years. During this same period there has been an increase in hay acreage, while the acreages of corn, wheat, and oats have declined, as has the total acreage harvested. The average size of farms has decreased from 142 acres in 1890 to 90 acres in 1940.

Dairy products now constitute the most important source of cash agricultural income of West Virginia farmers, averaging approximately \$9,300,000 per year for the years 1938, 1939 and 1940 or more than that from apples, potatoes, sheep, and hogs combined. The geographic distribution of dairy production in West Virginia is shown in Figure 1. The northern part of the state with a strip extending southwestward along the Ohio River and the two Eastern Panhandle counties account for a large share of the total.

Fig. 1—Pounds of Milk Sold as Butter, Cream, and Whole Milk by Counties in West Virginia, 1939 *

The Role of Dairying in a Program for Increasing Income

It has been accepted as an economic truism that farmers are inclined to specialize in those products which yield the highest returns from their resources. The history of American agriculture provides many examples of the force of this incentive, but it cannot be taken for

* Source: 1940 Census. Butter was converted to butterfat by multiplying by .8; butterfat was converted to milk by dividing by .042.

granted that the line of production being followed at a given time is necessarily the most profitable.

For one thing, the continuous change in such factors as techniques in production, consumer demands, and transportation facilities produces an inevitable lag between the actual and the most profitable use of resources. Furthermore, in a new agricultural area, experience as to the most profitable enterprises is generally lacking. Even in an old area the most profitable lines of production may not be adopted if the economic development has been such that many of the farmers have relied to a considerable extent on non-farm income or employment instead of the land for their incomes. In other words, farmers with outside interests may be quite slow to adopt the type of farming which will maximize their farm income. With the mining, lumbering, and industrial development in the state this factor has undoubtedly influenced West Virginia agriculture. In any case, the state is faced with such an acute low income problem, (in 1939, approximately three-fourths of the farms in the state had gross incomes of less than \$600) that we may well inquire as to the propriety of the present utilization of resources. Specifically, for the analysis in this section we have asked what place dairying should have in West Virginia in relation to other livestock enterprises if farmers are to make the most efficient use of their resources.

No attempt will be made to obtain a quantitative answer to the question of the place of dairying in the agriculture of West Virginia with its attendant variations for different sections of the state. Rather, the approach will be to discuss the more important physical and economic factors that must be considered in choosing the most profitable enterprises, without attempting to take into account all the exceptions to the general situation that might be found in the state.

Physical Factors: Only 15.9 percent of the state's area has a slope of less than 12 percent, while 65.8 percent has a slope of more than 25 percent. When such factors as fertility, drainage, and texture are considered in addition to slope, only 7.14 percent of the land in the state falls into the three groups of superior, good or average crop land.³

Although the soil and topographic conditions in West Virginia are relatively unfavorable for crop production the climate is generally favorable for crops and livestock. Winter temperatures are milder than those in much of the dairy region of the United States, and the summer temperatures of West Virginia are not so high as to be a limiting factor in any livestock enterprise.

The length of the growing season is important, not only from the standpoint of crops grown, but also because of its effect on the length of the pasture season. In this respect West Virginia compares favorably with a large portion of the corn belt and has an advantage of roughly ten to twenty days over much of the dairy region. Lack of moisture is not often a limiting factor in crop production in West Virginia. The average annual precipitation for most of the state is

³ Pohlman, G. G., *Land Classification in West Virginia Based on Use and Agricultural Value*, W. Va. Agr. Exp. Sta. Bul. 284, 1937, p. 22.

between 40 and 45 inches, with from 12 to 16 inches falling during the three months of June, July, and August. However, the shallow nature of many of the soils in West Virginia enhances the danger from dry periods. Furthermore the favorable climate has not insured good pastures, due primarily to soil acidity and to lack of available phosphorus.

Although it appears that the land resources of the state should be largely utilized by livestock which can take advantage of the large amount of land that should remain in pasture and hay, we must consider other factors to determine the proper place or importance of the sheep, beef, and dairy enterprises. To obtain this we must turn to a consideration of the economic conditions or factors which are involved. It may be that these are such that poultry or perhaps hogs must also receive serious consideration.

Markets: Geographically, West Virginia is well located with respect to the important markets for agricultural products. However, in this analysis we shall be concerned with the local markets, since West Virginia produces less than it consumes of all the principal agricultural products except apples, lamb and mutton, and beef and veal, and the surplus of beef and veal is small.⁴ This fact is felt by some to provide an important basis for deciding which enterprises should be expanded. Although this is a questionable conclusion the point is of some importance in our consideration of the relative advantages of the different farm enterprises for farmers of the state. Its importance lies in the possible effect that transportation costs may have on local prices for products of the different enterprises, depending on whether they are utilized locally or are shipped to terminal markets. This factor of transportation would mean, other things being equal, that the dairy, poultry, hog, and perhaps beef enterprises would have a relative price advantage over sheep because for these products local consumption exceeds production.

However, there are other factors involved. Although the production of beef cattle barely exceeds consumption, the relatively small volume of production of meat animals in this state as compared with that of the corn belt, plus the fact that packing facilities are available nearby in other states, has logically prevented the development of a large scale packing industry. Thus, a large share of the beef still moves out of the state, tending to leave but little relative price advantage for beef over sheep. Furthermore, the advantage of the local market for hog producers is reduced considerably because, in contrast with packer-killing, local slaughter does not utilize the by-products efficiently.

For products of a high specific value which are not highly perishable, such as butter or cheese, the advantage of being close to market is not so important. Although eggs tend to be in this same class, producers who are close to market frequently receive a significant price advantage. It appears, then, that producers of perishable products such

⁴ Based on total 1940 production for West Virginia as released by the Agricultural Marketing Service and the 1939 per-capita consumption as given in Consumption of Agricultural Products, Bureau of Agricultural Economics, March, 1941.

as fluid milk, certain vegetables, and perhaps eggs stand to gain most from the existence of the local markets in the state.

However, in considering the desirability of shifting from the present use of agricultural resources to those which appear to have an advantage from the standpoint of local markets, several factors should be taken into account. In the first place, although a considerable amount of fluid milk moves into the state, the present milksheds are well established and there is not much evidence to support the view that farmers in the state could successfully compete for a large share of this market, at least in many areas.

So far as poultry and hogs are concerned, any large expansion of these enterprises would mean buying considerable quantities of concentrates from the corn belt so that West Virginia farmers would have to receive higher prices to be able to compete successfully with corn belt producers, other things being equal. Hog prices are not enough higher in West Virginia to warrant shipping in the grain, but it is possible that more poultrymen could obtain a sufficient price differential to overcome the disadvantage of higher feed prices and thereby make some expansion of poultry profitable. One possibility for obtaining this price differential is for the poultrymen to adopt those practices which will lead to heavier egg production during the winter months when egg prices in West Virginia are appreciably higher than they are in the corn belt states. During the summer the West Virginia farmer's price advantage is considerably less.⁵ As for truck crops, there appears to be no reason why the local producers should not supply local demand for adapted crops, although some attention would have to be given to marketing practices and facilities if this expansion were to prove profitable.⁶

Summarizing local market possibilities, fluid milk, poultry, and truck crops appear to be the products which might be expanded to take advantage of such markets in West Virginia, although, except for certain truck crops, the possibilities in this respect are not so great as might first be supposed. While the local market factor should not be overlooked in organizing production, the extent of the deficit in adapted products between production and consumption for the state would be a poor criterion for selecting the enterprises most likely to prove profitable.

Roads: In many sections of the United States it would not be necessary to consider this factor in attempting to arrive at some conclusion concerning the place of the different enterprises in the agricultural economy, but in West Virginia such a consideration cannot be omitted. Transportation difficulties retarded the early development of the state and encouraged a pastoral type of agriculture, and there is little ques-

⁵In April (1939 and 1940) the average price received by West Virginia farmers for eggs was only 1.7c per dozen more than the price received by Illinois farmers, but in November the difference was 5.5c. The average price received by farmers for corn in West Virginia for the two years 1939 and 1940 was 74c per bushel, compared with 49c in Illinois. The price received by farmers for hogs for the two years averaged only 30c more per hundredweight in West Virginia than in Illinois. (Calculated from 1940 issues of *Crops and Markets*).

⁶Armentrout, W. W., *Adjusting Agricultural Production and Distribution in the Clarksburg Area to Meet Home Market Demands*, W. Va. Agr. Exp. Sta. Bul. 212, 1926, p. 41.

tion that poor roads are still a real factor in planning West Virginia agriculture since almost one-half the farms are located on unimproved dirt roads. Considerable progress is being made, however, in improving them and if the rate of progress in the last ten years is continued, the influence of poor roads will be greatly reduced in the not-too-distant future.

The influence of poor roads on the type of farming that can be conducted profitably is clear. Perishable products, such as milk, butter, eggs, and truck crops which must be marketed frequently are at a disadvantage compared with beef cattle, hogs, or sheep. However, these unimproved roads are much better during the late spring, summer, and early fall, so that perishable products could be marketed at these times.

Size of Farm: Approximately 45 percent of the farms in West Virginia are less than 50 acres in area, while 70 percent are less than 100 acres. The farms with small total acreages also have small crop acreages. For example, farms between 70 and 99 acres had, on the average, only 16 acres of cropland and an investment in land and buildings of only \$2373.⁷

A small acreage does not necessarily mean a small farm business, provided the farmer operates it intensively. Unfortunately this is not generally done. In 1940 the average number of livestock per farm in the state was 2.2 cows and heifers for milk, 0.4 cows and heifers for beef, 2.7 other cattle, 1 horse, 1.7 pigs, 4.4 sheep and lambs, and 34 chickens. The acreage of intensive crops grown was small averaging less than 0.5 acres per farm for potatoes, other vegetables for sale, and small fruits combined.

These average numbers of livestock are not so low simply because acreages are small. There were approximately five and one-half animal units dependent on pasture which, at the estimated average carrying capacity of five acres per animal unit,⁸ failed to utilize the 41.2 acres in pasture on the average farm in 1940. This acreage included a small area of wasteland, farmsteads, and the like, but it did not include woodland pasture which averaged 13.7 acres per farm in 1935. Add to this the possibility of increasing the carrying capacity of West Virginia pastures by treatment with lime and phosphate, and it becomes clear that considerably more livestock could be carried than is now the case. Crop yields could be increased materially on the average farm by improving soil fertility so that the winter feed could be provided for the larger number of livestock.

Likewise a small acreage, even if not operated intensively, may give no reason for concern if the farm family is small and the operator is employed off the farm for a large part of the year. Farmers in the state frequently do supplement their farm incomes by working off the farm, but in many cases the amount is small so that the combination of farm and non-farm work still fails to provide full-time employment.

⁷ 1940 Census of agriculture for West Virginia.

⁸ Pierre, W. H., and others, *West Virginia Pastures*, W. Va. Agr. Exp. Sta. Bul. 280, 1937, p. 20.

In addition, West Virginia farm families are large, averaging approximately 5.4 persons in 1940, compared with 4.3 for Iowa, and 5.0 for the United States.

On small farms with a small amount of cropland, a small number of livestock, but with a considerable supply of labor, a major problem is that of organizing the business in such a way that the farmer and his family have full-time employment. Since there is a constant tendency to equalize the returns per hour of labor from different enterprises through competition, farmers with small acreages who are not now fully

employed must adopt those enterprises which have a high capacity for labor if they are to receive maximum returns. An indication of which enterprises these are is given in Figure 2. From this figure it should be clear that a farmer with a very small acreage would logically emphasize truck crops and poultry if he is to obtain full time employment from his land, while a farmer with a somewhat larger acreage would tend toward dairying with correspondingly less emphasis on the more intensive truck and poultry enterprises.

While enterprises which have high labor requirements have the advantage when land is limited in relation to labor, such enterprises may be at a disadvantage on farms with a

Fig. 2—Hours of Labor Utilized in West Virginia in Production of Different Crops and Livestock*

large acreage when labor is limited in relation to land. Farms with large acreages may, if they are well located with respect to markets, find it more profitable to hire labor and turn to those enterprises with a high labor capacity. However, if the farm has no particular advantage with respect to markets, then the operator may well look to those types of enterprises that can be managed by hiring but little labor.

* Source: Herrmann, L. F., R. O. Stelzer, and W. W. Armentrout, *Labor Input on West Virginia Farms*, W. Va. Agr. Exp. Sta. Bul. 286, 1937; and unpublished data obtained in the same study.

In West Virginia this means beef cattle and sheep. While there is no exact size a farm must be before it can be successfully operated as a beef farm, Weitzell, in a study of the Jackson County Soil Conservation Area states that "a medium-sized farming unit of between 200 and 250 acres of pasture with 45 to 55 animal units seemed to be the most efficient."⁹ Even if we consider a unit with a total acreage of 180 acres or more of sufficient size for a beef farm, only 12 percent of the farms in the state would meet this acreage requirement.

From the foregoing discussion it would appear that dairying is an enterprise well qualified to utilize the physical and economic resources of West Virginia, although obviously it is not adapted to all farms. In fact, the dairy enterprise would be seriously threatened, if not eliminated, from farms located at both extremes of the size array. The operators of farms of very small acreage might be expected to replace dairy cows with poultry and truck crops, while those with a large acreage might well shift to sheep or beef cattle.

In reality, this tendency for West Virginia farmers to specialize the type of production by acreage groups in their efforts to maximize income would never go to completion because of the advantage in some degree of diversification to provide for more complete utilization of equipment, labor, and waste products, to reduce risks, or to save transportation costs. Furthermore, the size of farm and the labor supply may definitely indicate that dairying, poultry or truck crops should be the principal enterprise, but poor roads may force the farmer to continue along self-sufficing lines with some extensive enterprise such as beef cattle or sheep as a source of cash income.

Thus far, dairying has been considered as one distinct type of farming utilizing similar resources in the production of one product. But in reality, the form in which the product is sold; i. e. butterfat or fluid milk, makes for considerable difference in the profitability of the dairy enterprise. Fluid milk and butterfat are also produced under quite different conditions. It is essential, therefore, to consider the characteristics of their production in the state and to appraise their comparative returns and future prospects.

Types of Dairying in West Virginia

Fluid Milk Production: From the standpoint of cash farm income, fluid milk sales are considerably more important than the sales of butter and butterfat; for, of the average cash farm income from dairy products for the years 1938, 1939, and 1940 of approximately \$9,300,000, only \$1,600,000 came from the sale of butter and butterfat. A large proportion of the whole milk that leaves West Virginia farms is sold in fluid form to city consumers, although some goes into ice cream. Until 1940, the amount going into cheese and condensed milk was almost negligible.

The West Virginia Agricultural Experiment Station has published two bulletins dealing specifically with dairy enterprises producing fluid

⁹ Weitzell, E. C., *Certain Economic Aspects of Agriculture in the Jackson County Soil Conservation Area*, W. Va. Agr. Exp. Sta. Bul. 291. 1939, p. 38.

milk for city distribution. The first was a study of the costs incurred by 51 farms in the Morgantown and Fairmont market areas in 1934-35.¹⁰ The second was a study of the costs incurred by 36 farms in the Huntington and Charleston market areas in 1935-36.¹¹ In order to present a more complete picture of dairying in the state, a few of the facts found in these two studies are repeated. Later, in the presentation of the characteristics of butterfat production, the two types of dairy production will be contrasted.

The average size of these farms varied from 106.8 acres in the Fairmont area to 325.6 acres in the Charleston area, but even the smaller figure is larger than the average size in 1940 for West Virginia of 90 acres. In the Huntington and Charleston areas it was noted that dairying was carried on by two groups of farms: "(1) small farms located close to the market centers, having limited crop area and buying most of their feed; (2) larger farms, situated at a greater distance from the market centers and more adapted to producing their own feed supplies.¹² In all areas crop land was used principally for hay and corn. The proportion of legume hay was, however, considerably larger in the two southern areas.

The livestock on these farms consisted almost entirely of the dairy herd. The average number of cows kept ranged from 12.3 in the Huntington area to 22.2 in the Charleston area, but the range in the number for any individual farm was from 3.8 to 53.5 cows.

Perhaps a better idea of the extent to which these farms are specialized dairy farms can be obtained from Table 1 of the average gross income from the farms in each area, along with the average gross income from dairy products. The widest range in the percent of income from dairy products on individual farms occurred in the Huntington area, where it varied from 35 to 100 percent.

TABLE 1 — *Percentage of the Gross Farm Income Obtained from the Dairy Enterprise on Farms Selling Fluid Milk in West Virginia**

Area	Number of farms	Year studied	Average gross farm income**	Average income from dairy products	Percentage of total from dairy products
Morgantown	24	1934-35	\$3,203	\$2,908	90.8
Fairmont	27	1934-35	3,200	3,103	97.0
Huntington	16	1935-36	1,877	1,326	70.7
Charleston	26	1935-36	4,557	3,987	87.5

* Adapted from Table 2, W. Va. Agr. Exp. Sta. Bulletins 268 and 281.

** Income figures do not include farm products used in the home.

In all but one area poultry was second in importance as a source of income from livestock, but it did not account for more than 3.4 percent on the average in any area. Income from the sale of crops was most important in the Huntington area, where it amounted to 6.7 percent of the total.

¹⁰ Herrmann, L. F., Stelzer, R. O., and Bowling, G. A. **Milk Production Costs in West Virginia**, W. Va. Agr. Exp. Sta. Bul. 268, 1936, 32 pp.

¹¹ Herrmann, L. F., and Bowling, G. A., **Milk Production Costs in West Virginia: II**, W. Va. Agr. Exp. Sta. Bul. 281, 1937, 27 pp.

¹² *Ibid.*, p. 6.

Since these studies were primarily concerned with the dairy enterprise they did not indicate the size of the total farm investment. A report on 26 dairy farms in the Northern Panhandle for 1937 showed an average total investment of \$12,633, of which 46.4 percent was in land and 32.2 percent in buildings.¹³ These farms were somewhat smaller than those discussed above, having on the average 11.7 cows and 128 acres, but their organizations were quite similar.

The amount of feed and labor used per cow in the four market areas is shown in Table 2. In all cases the milk production has been corrected to a 4 percent fat basis. Thus on a butterfat basis the range between areas in the average production was from 203 pounds per cow in the Fairmont area to 233 pounds in the Morgantown area. This is not a high level of production, considering the rate at which grain was fed. In the Charleston area cows received on the average one pound of grain for each 2.7 pounds of milk while in the Morgantown area, which had the highest average production, cows received one pound of grain for each four pounds of four percent milk.

TABLE 2 — *Average Production Amounts of Feed and Labor Used, and Dairy Investment per Cow on Farms Selling Fluid Milk in West Virginia**

Item	Morgantown	Fairmont	Huntington	Charleston
Average production (lbs 4% milk)	5,823	5,080	5,336	5,734
Concentrates (lbs)	1,463	1,318	1,768	2,128
Hay (lbs)	2,278	2,276	2,228	2,536
Silage (lbs)	4,950	1,513	1,669	1,325
Other roughage (lbs)	209	530	207	39
Pasture days	195	209	218	217
Man labor (hrs)	145	151	174	159
Investment	186	120	166	201

* Adapted from West Virginia Agricultural Experiment Station Bulletins 263 and 281.

The average man labor per cow ranged from 145 hours in the Morgantown area to 174 hours in the Huntington area. The range on individual farms was from 78 to 296 hours per cow. The average investment per cow for dairy buildings, equipment and cows ranged from \$120 in the Fairmont area to \$201 in the Charleston area.

From this brief description of fluid milk production, it is clear that the typical fluid milk farm has a much higher acreage, investment and income than is found on most West Virginia farms. Butterfat is the other important dairy product produced in West Virginia. In fact, from the standpoint of the number of farmers involved, butterfat is more important than fluid milk. According to the 1940 census only 6,548 farmers reported the sale of whole milk, as compared with 14,379 who reported the sale of cream.¹⁴

Butterfat Production: All sections of West Virginia sell some sour cream and butter, but the amount is small in the rather large section

¹³ Weitzell, E. C. *Economic Implications of Soil Conservation in Marshall County, W. Va.* Agr. Exp. Sta. Bul. 293, 1939, p. 14.

¹⁴ The figures are not mutually exclusive, but the duplication is not believed to be important.

running south-west across the state from Morgan County, in the Eastern Panhandle, an area in which agriculture generally is of minor importance. The percentage of the total amount of milk produced that is used for butterfat naturally varies a great deal, depending on the importance of the dairy enterprise in the county in relation to the urban population. This percentage varied from 8 percent in Ohio and Hancock Counties to 97 percent in Wirt County.

The areas covered by the study of butterfat production were shown in Figure 1. It is believed that the farms and dairy enterprises studied are representative of the farms selling butterfat in the northern part of the state because of the general similarity of physical and economic conditions in this section of the state. Since small amounts of butterfat are occasionally sold by many farmers it was decided to limit the survey to those farms from which at least \$50 worth of butterfat was sold during the year June 1, 1938, to May 31, 1939. This limited the study to those farms on which the butterfat enterprise was large enough to be of some significance to the farm business, and yet it did not eliminate the small herds of three or four cows, which are of considerable importance as sources of butterfat in West Virginia. The names of farmers who sold this amount of butterfat were obtained principally from cream buyers in the area. The data did not show differences between the areas to be significant enough to warrant presenting a separate analysis for each area. For example, the two areas showed an average difference of only .9 of an animal unit per farm and a difference of only .4 in the average number of cows.

Some conception of the nature of the 131 farms studied which sold over \$50 worth of butterfat during the twelve months ending June 1, 1939, can be obtained from the fact that 86 farms or 65.7 percent, were classified as general farms according to the procedure followed in the 1930 census. Seventeen farms, or 13 percent of the number studied, were classified as self-sufficing, while only twelve, or 9.2 percent, were classified as dairy farms. Other types included seven part-time, four animal specialty (beef), four poultry, and one crop specialty farm. Thus in contrast to farms producing fluid milk, the farms selling butterfat are seldom specialized dairy farms. However, for the purposes of this study, it was thought desirable to separate the general farms into two groups: (1) those on which the dairy income was between 30 and 40 percent of the total, (2) those on which the dairy income was less than 30 percent of the total. The first group of general farms thus approached the specialized dairy type and was included with them, giving 34 so-called dairy farms selling butterfat, instead of 12. The second group comprises the general farms in the following tables. The part-time and self-sufficing farms were sufficiently alike to be grouped together. The number of the other three types was too small to warrant summarizing. Hence the data on land use and livestock kept are presented for only the three groups of farms—dairy, general, and self-sufficing and part time—with the dairy and general having been re-defined for this study.

Table 3 shows that the proportion of the land used for crops varied from 20.8 percent for the general farms, to 26 percent for the dairy farms, the actual acreage being 35.7 and 29.5 acres respectively. The area devoted to woods, pastured and not pastured, was almost equal to the land in crops so that only about three-fourths of the farm area was in crops and permanent pasture. In general, the dairy farms selling butterfat had a considerably smaller acreage than was shown earlier for the farms selling fluid milk.

TABLE 3—*Utilization of Land on Farms Selling Butterfat in West Virginia, 1933-39*

Item	Dairy farms		General farms		Self-sufficing and part-time farms	
	Acres per farm	Percentage of total	Acres per farm	Percentage of total	Acres per farm	Percentage of total
Number of farms	34	—	64	—	24	—
Acres used for crops	29.5	26.0	35.7	20.8	26.7	25.8
Permanent pasture	52.2	46.0	94.6	55.2	46.9	45.3
Woods pastured	17.3	15.3	19.5	11.4	10.5	10.2
Woods not pastured	9.5	8.4	13.6	7.9	13.1	12.6
Other land	4.9	4.3	8.1	4.7	6.4	6.1
Total	113.4	100.0	171.5	100.0	103.6	100.0

From the standpoint of acreage alone, mixed hay was the most important crop grown. Hay crops of all kinds occupied approximately 60 percent of all the land used for crops. Corn was the most important grain crop on these farms, occupying an acreage approximately equal to that of wheat and oats for grain combined. Thus the general pattern of utilizing cropland on farms selling butterfat is similar to that on farms selling fluid milk.

Dairy cattle constituted the most important class of livestock on the three types of farms selling butterfat, being relatively least important on the general farms, where they accounted for 31.5 percent of the animal units (Table 4). Note the small numbers of dairy animals

TABLE 4—*Average Number of Animal Units with Percentage Distribution on Farms Selling Butterfat in West Virginia, 1933-39**

Items	Dairy farms		General farms		Self-sufficing and part-time farms	
	Animal units per farm	Percentage in each group	Animal units per farm	Percentage in each group	Animal units per farm	Percentage in each group
Number of farms	34	—	64	—	24	—
Dairy cows and heifers	7.1	49.8	5.7	31.5	5.1	45.5
Beef cows and heifers	0.6	4.5	1.4	7.4	0.7	6.0
Steers	0.4	2.7	1.5	8.4	0.2	2.0
Other cattle	1.1	7.9	1.4	7.7	0.9	8.0
Working animals	2.1	14.9	2.4	13.3	1.6	14.8
Poultry	1.3	9.0	1.7	9.2	1.1	9.8
Hogs	0.8	5.4	0.9	4.9	0.7	6.8
Sheep	0.8	5.8	3.2	17.6	0.8	7.1
Total	14.2	100.0	18.2	100.0	11.1	100.0

* One animal unit is equal to: one cow, horse, bull, or steer, 2 years old and over, 2 colts or young cattle 1 year old, 4 calves, 7 sheep, 14 lambs, 5 hogs, 10 pigs, 100 hens.

kept on these farms as compared with the farms selling fluid milk. As would be expected, beef cows, heifers, and steers are relatively more important in the general farms. The proportion of the total animal units in working animals, poultry, and hogs was remarkably constant among the three types of farms.

Further indication of the lack of specialization in the dairy enterprise on farms selling butterfat in contrast to that found on fluid milk farms is shown by the proportion of total cash receipts from different sources. Butterfat sales were the most important single source of cash receipts on all three groups of farms selling butterfat, although they constituted only 19.2 percent of the total on general farms, compared with 35.3 percent on the self-sufficing and part-time farms, and 33.3 percent on the dairy farms. Eggs were the next most important source of cash income, and all livestock products accounted for 53.6 percent of the total on dairy farms, 42.2 percent on general, and 49.2 percent on the self-sufficing and part-time farms. The sale of livestock made up most of the remaining receipts, although no one class of livestock accounted for a large portion of these receipts. Dairy cattle and calves were the most important source on dairy farms, while beef cattle were the most important on the general farms. Crop sales were an unimportant source of receipts on all types of farms.

The investment in land accounted for 40 percent of the total investment on dairy farms and for 47 percent on general farms. Livestock constituted approximately 14 percent and buildings, excluding the dwellings, 13 percent of total investment for each of the three groups of farms. Machinery represented approximately six percent of the total. General farms with their larger acreages and numbers of livestock had the greatest total investment, \$6650, compared with \$4073 for self-sufficing and part-time farms and with \$5386 for dairy farms. The latter figure is only 43 percent of the investment reported previously for farms selling fluid milk.

Most of the butterfat sold in West Virginia is produced by small herds. On the 124 farms for which satisfactory data were obtained concerning the dairy enterprise, only ten herds contained more than eight cows, while sixty-six consisted of five cows or less. The average size of the herds was approximately five and one-half cows. The production of many of the herds is low. Twenty herds averaged less than 150 pounds of butterfat per cow, while 23 averaged more than 250 pounds. The average for all herds was 200 pounds of butterfat per cow. This is not far below the production on the farms selling fluid milk.

To present the amount of feed, labor and investment utilized in producing butterfat in West Virginia, the herds were divided into three groups based on the average amount of butterfat produced per cow. The low-producing group contained 38 herds producing less than 170 pounds of butterfat per cow. The medium-producing group contained 49 herds producing between 170 and 230 pounds of butterfat per cow. The high-producing group contained 37 herds producing 230 pounds and more of butterfat per cow.

The amounts of roughage and concentrates fed per cow and per pound of butterfat are shown in Table 5. Unfortunately, corn stover was the most important source of roughage from the standpoint of pounds fed, although it is probable that a considerable portion of the amount fed was not actually consumed. In this connection it is interesting to note that in the farms selling fluid milk the largest amount of stover fed in any area was 530 pounds per cow, the least was 39 pounds.

The total pounds of roughage fed per cow increased from 5,528 pounds for the low-producing cows to 6,655 for the high-producing cows, averaging 5,796 for all three groups. This large amount of roughage per cow should be considered in relation to the quality fed and the days on pasture. The concentrates fed per cow likewise increased with increased production, going from 548 pounds per cow for the low-producing cows to 949 pounds for the high-producing ones. These data on feed consumption show that butterfat was produced on a considerably wider ratio of concentrates to roughage than was fluid milk.

TABLE 5 — *Average Amount of Feed Consumed Per Cow on Farms Selling Butterfat in West Virginia by levels of Butterfat Production, 1938-39*

Item	Type of herd			
	Low Producing	Medium Producing	High Producing	All Herds
Number of farms	38	49	37	124
Number of cows	236	285	169	690
Butterfat per cow	147	200	274	200
Pounds roughage				
Corn stover	2433	2447	2440	2440
Mixed hay	1523	1726	2042	1735
Legume hay	1034	1043	1141	1082
Other roughage	488	281	1032	539*
Days on pasture	171	169	169	170
Total pounds roughage	5528	5497	6655	5796
Pounds concentrates				
Corn	264	314	373	312
Other grains	101	94	83	94
Protein feed (20% and less)	104	73	230	123
Protein feed (over 20%)	79	138	263	149
Total pounds concentrates	548	619	949	678
Total digestible nutrients **	3095	3057	4000	3305

* This consisted of 47 percent oat hay, 29 percent straw, 18 percent wheat hay, and 15 percent silage when converted to a dry-roughage basis.

** Pasture is not included.

Only 28 of the 124 farmers interviewed indicated that they attempted to feed grain according to production. In fact, only four stated they weighed the milk produced. On the other hand 58 of the 124 followed the usually recommended practice of feeding grain to dry cows.

The average amount of labor used per cow in producing butterfat was 229 hours. Of this amount 88 hours were spent in milking, 74 in caring for the cows and barn and 67 in the care of milk and equipment (Table 6). The amount of labor used was quite uniform throughout the year, averaging 100 hours per cow while on pasture and 129 hours during the winter. The extra time required for the care of the cows and barns in the winter was partially offset by the reduction in the time required for milking, since most of the cows freshened in the spring.

TABLE 6.—*Hours of Labor Utilized Per Cow on Farms Selling Butterfat in West Virginia, by Levels of Butterfat Production, 1938-39*

Item	Type of herd			
	Low Producing	Medium Producing	High Producing	All Herds
Milking	90	83	92	88
Care of cows and barns	66	75	82	74
Care of equipment	57	66	84	67
Total	213	224	258	229

The amount of labor used per cow as shown by this study was considerably greater than that found in the studies of herds selling fluid milk. This is not what one would ordinarily expect, since extra care is usually expended in the care of cows, barns, and equipment in herds selling fluid milk. A study, in Iowa, of herds selling butterfat showed that only 131 hours of labor were used per cow on the average.¹⁵ However, in both the herds selling fluid milk and in the Iowa study, the average herd was almost three times larger than the herds selling butterfat in West Virginia. That this fact is of considerable importance in explaining the large amount of labor used per cow in West Virginia herds selling butterfat is substantiated by the following tabulation:

<i>Size of herd selling butterfat</i>	<i>Hours labor per cow per year</i>
Less than 4.5	301
4.5 — 6.49	236
6.5 and over	186

Larger herds are more efficient in the use of labor, since the time required to perform certain tasks does not increase in direct proportion to the number of cows kept. In this connection it should be noted that the average size of the herds in the high-producing group was 4.5 cows compared with 6.2 cows for the herds in the low group. This fact undoubtedly accounts in part for the larger amount of labor used per cow in the high group in the care of cows, milk and equipment.

The average investment per cow was \$43 with those in the low-producing herds averaging \$40 and those in the high-producing herds averaging \$49. In view of the wide difference in amount of butterfat produced by these two groups there is little doubt that the poor producers were overvalued in relation to the high producers. The investment per cow for bulls was \$6 in the low-producing herds compared with \$10 in the high-producing herds. For all herds the average investment per cow was \$19 for dairy buildings and \$6 for equipment. The total investment, excluding bulls, averaged \$98 for all herds. In comparison, a simple average for the four areas producing fluid milk showed an investment per cow of \$168.

Comparative Returns from the Production of Fluid Milk and Butterfat: Several points must be considered in comparing the returns from the dairy enterprise reported in the studies of fluid milk production with the study of butterfat production. The fact that they were made in

¹⁵ Buck, R. K., Hopkins, J. A., and Malone, C. C. *An Economic Study of the Dairy Enterprise in Northeastern Iowa*, Iowa Exp. Sta. Bul. 278, 1940, p. 867.

different years is not a serious obstacle to comparison, since there were no important price fluctuations either in product or in costs during the years 1934-35, 1935-36, and 1938-39. The procedures in calculating costs and returns, while not identical, were sufficiently similar to yield comparable results, provided the problem of different values having been placed on labor is avoided by making the comparison in terms of returns to labor.¹⁶

The returns for labor per cow for farms selling fluid milk and butterfat have been summarized in Tables 7 and 8 respectively. It will be noted that in all but one area, the returns per cow were much higher for fluid milk producers than for butterfat producers. A simple average for the four market areas showed \$29.64 as the returns per cow for labor, compared with \$11.14 for butterfat producers. However, 24 of the 124 farms selling butterfat received a higher return per cow for labor than the average of the herds selling fluid milk. Since the hours of labor utilized per cow were much higher for the butterfat producers, in this particular study as explained previously, the comparison is even less favorable when made on the basis of the returns per hour of labor, being 19 cents¹⁷ for the fluid milk producer, compared with five cents for the producer of butterfat. The costs were much lower for the butterfat producers, but this fact could not compensate for the small returns. The fact that the returns for labor from butterfat production are frequently low should not be interpreted to mean that the farmers should eliminate the dairy enterprise. Some return was

¹⁶ The procedure in calculating the costs and returns per cow for farmers selling butterfat was as follows: Feed raised on the farm was valued as nearly as possible at the price it could be sold for at the farm, except grains, which were charged at a fixed price for all farms. This price was the average for the year covered by the study as given by the West Virginia Agricultural Marketing Service. Purchased feeds were charged at the cost at the farm. Pasture was charged at the prevailing local rates for rented pasture.

Depreciation of cows was obtained by subtracting the ending inventory, sales and losses from the beginning inventory, purchases and value of heifers freshening. In cases where the ending inventory was larger, the increase was credited as appreciation. "Depreciation and repairs of buildings" used for the dairy enterprise was charged at four percent of their value in the beginning inventory. "Depreciation and repairs on equipment" was figured at 10 percent of beginning inventory. Interest at the rate of five percent was charged on the average investment in cows, buildings, and equipment. "Other costs" include taxes which were charged at five-tenths percent of the average investment, bedding, veterinary expenses, and supplies. Bull costs included feed, labor and shelter charged at the rates given by the farmers, plus a 5 percent interest charge and a 5 percent depreciation charge on the beginning inventory value of the animal. On herds where services were hired, rates were charged at prices given by the farmers.

Skim milk was credited at the rate of 35 cents per 100 pounds. This was based on the average price in West Virginia for the year of the study of 69 cents a bushel for corn and \$60 a ton for tankage, assuming that 100 pounds of skim milk was equal in value to 7.3 pounds of tankage and 10.9 pounds of corn. (See Morrison, F. B., *Feeds and Feeding*, 20th Edition, 1937, p. 873). On the average three tons of manure were recovered from each cow, which was credited at \$1.50 per ton, giving a uniform credit of \$4.50 per cow. This is not, of course, a realistic procedure, but it was the only recourse in view of the data. Calves were valued at prices given by farmers for calves two or three days old. Whole milk fed was credited at \$1.50 per hundredweight, while that used in the house was credited at \$2. Butter used in the home was valued at the prices given by the farmers. To compare the procedure used for farms selling fluid milk see pages 8 and 9 of West Virginia Agricultural Experiment Station Bulletin 268, and pages 7 and 8 of Bulletin 281.

¹⁷ Based on a simple average of the average hours of labor per cow (157 hours) for the four areas.

TABLE 7—*Costs and Returns Per Cow on Farms Selling Fluid Milk in West Virginia by Market Areas**

Item	Morgantown	Fairmont	Huntington	Charleston
Number of farms	24	27	16	20
Year studied	1934-35	1934-35	1935-36	1935-36
Costs per cow				
Feed and pasture	\$ 74.80	\$ 67.94	\$ 60.53	\$ 75.54
Depreciation **	9.73	6.97	1.51	1.62
Bull costs	2.57	2.00	3.74	2.95
Supplies and equipment	1.24	.97	5.27	4.40
Interest **	9.65	6.29	2.13	2.49
Building charge **	—	—	12.49	13.49
Other costs	2.40	2.16	4.42	5.15
Total (except labor)	109.39	86.33	90.09	105.64
Returns per cow				
Milk	118.63	80.48	102.31	143.23
Manure	11.72	10.10	11.91	13.70
Calves	.98	1.12	1.53	1.70
Other returns	.59	.58	.80	1.63
Total	131.92	92.28	116.55	160.26
Returns for labor	31.53	5.95	26.46	54.62

* Adapted from Tables 7, 8, 9, and 10 in West Virginia Agricultural Experiment Station Bulletin 268, and Tables 7, 8, 9, and 10 in Bulletin 281.

** Procedure in calculating costs was identical in both bulletins so that final results are entirely comparable, although the presentations were different. In Huntington and Charleston markets depreciation and interest is for cows only, the building costs being shown separately.

obtained from the feed and labor utilized which otherwise might not have been used at all or perhaps utilized in some other enterprise which would have returned even less for the feed and labor. The farm operator should decide whether or not to keep a certain enterprise

TABLE 8—*Costs and Returns Per Cow on Farms Selling Butterfat in West Virginia, by Levels of Butterfat Production, 1938-39*

Item	Type of herd			
	Low Producing	Medium Producing	High Producing	All Herds
Number of farms	38	49	37	124
Number of cows	236	286	168	690
Butterfat per cow	147	200	274	290
Cost per cow				
Feed (roughage)	\$ 31.14	\$ 33.09	\$ 44.12	\$ 25.12
Feed (concentrates)	7.70	8.80	13.65	9.61
Interest on investment	4.95	4.51	5.68	4.95
Depreciation and repairs on buildings	2.20	1.65	2.35	2.01
Depreciation and repairs on equipment	.70	.67	.82	.59
Depreciation on cows	1.35	1.16	.69	1.11
Bull costs	2.02	1.59	2.25	1.89
Other costs	1.03	1.02	1.31	1.11
Total costs (except labor)	51.14	52.49	70.87	56.39
Returns per cow				
Butterfat sold	17.87	25.91	37.35	25.96
Home used	9.83	12.39	18.85	13.51
Skim milk	6.93	9.73	13.13	9.60
Manure	4.50	4.50	4.50	4.50
Calves	2.34	2.59	2.92	2.53
Whole milk fed	10.81	11.02	12.80	11.28
Total credits	52.28	67.14	89.55	67.53
Returns for labor	+1.14	+14.65	+18.68	+11.14

on his farm on the basis of the profitability of alternative uses for the feed and labor rather than on the basis of the returns from the one enterprise alone.

A comparison of returns from the entire farms for these two groups of producers cannot be made, since the studies of fluid milk production did not obtain data on the receipts and expenses of the farm business, as was done in the study of butterfat production. However, unpublished data of the West Virginia Agricultural Experiment Station show that dairy farms which obtained the highest proportion of the dairy receipts from fluid milk had the highest farm income (Table 9).

TABLE 9 — *Proportion of Dairy Receipts from Fluid Milk and From Cream and Butter on Dairy Farms in Different Income Groups in West Virginia, 1935-39**

Farm Income	Number of Record years	Percentage of dairy receipts from:	
		Fluid milk	Cream and Butter
Less than \$101	105	60	40
101-700	223	74	26
701-1300	100	84	16
More than 1300	98	89	11

* Data summarized by E. C. Weitzell, formerly assistant agricultural economist, West Virginia Agricultural Experiment Station.

Another approach to the comparative profitableness of the two types of production is to compare the returns for 100 pounds of milk when sold at the average prices in West Virginia¹⁸ for the two products. The results of the comparison is shown in Table 10.

TABLE 10 — *Comparison of Returns for 100 Pounds of Milk Sold to Plants and Dealers at Wholesale in West Virginia Compared with the Returns Had the Cream in the 100 Pounds of Milk Been Sold as Butterfat, by Years, 1931-40**

Year	Returns for 100 lbs. milk	Returns for butterfat in 100 lbs. milk **	Gross difference in favor of selling milk
1931	\$2.20	\$1.05	\$1.15
1932	1.80	.80	1.00
1933	1.65	.80	.85
1934	1.80	.92	.88
1935	1.80	1.05	.75
1936	2.00	1.26	.74
1937	2.20	1.30	.90
1938	2.10	1.01	1.09
1939	2.05	.97	1.08
1940	2.15	1.05	1.10

* Price for milk and butterfat from Farm Production, Disposition and Income from Milk: 1924-40, 35-39, and 40-41, U. S. D. A. Agricultural Marketing Service, May, 1941.

** Calculated by multiplying the average annual price for butterfat by 4.2, the average test for milk in West Virginia during these years.

¹⁸ In 1940, the average price in West Virginia for butterfat was 25 cents per pound, as compared with 27 cents in Ohio, 29 cents in Pennsylvania, 29 cents in Iowa, and 23 cents for the United States. Since West Virginia farmers do not produce even enough butter to supply the needs of their own state, factors other than the proximity to market must be responsible for this situation. One such factor may be the quality of the product sold. That farm handling of cream is not what it should be to produce the highest quality butter is indicated by the fact that even during the summer 103 out of the 124 farmers interviewed in the study of butterfat production marketed their cream only once a week. Even though most of the farmers follow such practices as cooling freshly-separated cream before mixing it with the old, such infrequent market-

In many states the price for milk sold to plants and dealers would not be valid for our purposes, since it would include milk going to condenseries and cheese plants, but as was explained previously, that is not the case in West Virginia. However, two important adjustments must be made in the data for the gross differences in favor of selling whole milk before we can arrive at an approximate net figure. First, if butterfat is sold, there remains the value of approximately 85 pounds of skim milk from the 100 pounds of whole milk. If the value for skim milk that was calculated for the study of butterfat production is used, the 85 pounds would be worth 30 cents. Since this value depends on the price of corn and tankage it would not be the same for each year, but it is satisfactory for this approximation.

Secondly, extra costs are involved in producing market milk. A recent study specifically designed to measure the extra costs of producing milk for a fluid versus an evaporated market showed that meeting the extra sanitary regulations for fluid milk production cost 24 cents per 100 pounds of milk.¹⁹ It will be shown in another section that the cost of producing milk for a condensery is slightly less than the cost of producing butterfat, so that the figure given above appears satisfactory for our purpose, although it may vary from one year to another as does the value of skim milk. There is also the cost of transporting the milk to the plants and dealers. Assuming this to average 25 cents per hundredweight, we have a total deduction of 79 cents which should be subtracted from the gross figure before returns can be compared.²⁰ But even this deduction leaves a margin in favor of the producer of fluid milk in all but two years, and in five of the ten years the margin was a substantial one. Thus, all the evidence points to the same general conclusion; namely, that butterfat production is not as profitable as fluid milk production. In line with these data it is interesting to note that the amount of milk being utilized in the production of butter and butterfat in West Virginia has trended downward since 1928. On the other hand, the volume utilized as fluid milk has increased somewhat.

Although the production of fluid milk appears profitable, its expansion is limited by the size of the urban population, which increased only from approximately 492,000 in 1930 to 534,000 in 1940.²¹ According to a survey of milk consumption in cities in the United States, the weekly per capita consumption of whole and evaporated milk in Charleston, West Virginia, was 2.26 quarts, in Clarksburg, 2.44 quarts and in Wheeling 2.33 quarts while the average for the 59 cities surveyed was

ing is certain to lead to deterioration in quality. On the other hand, it is probable that West Virginia farmers take as good care of their cream as do farmers in many other states. The other factor which may be quite important is the lack of effective competition among the sour cream buying companies—there are no cooperatives. There is of course no way of knowing to what extent lack of quality or of effective competition may be responsible for the low prices West Virginia farmers receive for their sour cream. It should be noted, however, that the price in West Virginia of 25 cents compares favorably with 25 cents in Virginia, 24 cents in Kentucky, and 26 cents in Maryland. Data from *Farm Production, Disposition, and Income from Milk*, op. cit., 1924-40, p. 94.

¹⁹ *The Extra Cost of Producing Milk for Fluid vs. Evaporated Markets*, National Dairy Products Corporation, 1940, p. 13.

²⁰ Actually there is another extra cost of indeterminate amount in producing fluid milk—the necessity for maintaining an adequate supply for local sales requirements throughout the year.

²¹ **1940 Population Census.** Cities of less than 2500 are not classified as urban.

2.44 quarts.²² The proportion of evaporated milk in the totals was 26, 19, and 18 percent respectively, in the three West Virginia cities compared with 16 percent for all cities. Doubtless the consumption of whole milk is considerably lower in many comparatively small mining and industrial centers which are somewhat remote and isolated from agricultural sections. However, in view of the fact that the consumers are accustomed to the use of evaporated milk and that the delivered price of whole milk is likely to remain relatively high, expanding the use of fluid milk in these areas is likely to be a slow process. But even if there were a considerable increase in city consumption, either through an increase in size or through a change in the rate of consumption, it would probably be supplied by a comparatively few farmers with relatively large herds. The usual investment for fluid milk production is too large for many West Virginia farmers to consider shifting to it even if there were a market.

On the other hand, no large investment is required to produce butterfat, and a good dairyman finds its production profitable, but there is little indication that the average farmer considers it sufficiently profitable to expand its production. Incomes on most West Virginia farms cannot be greatly increased unless the volume of business is enlarged. In general this means increasing the production of hay and pasture on present acreage, which would require significant expenditures for lime and fertilizer. There is little evidence that the usual returns from butterfat production will encourage farmers to make these expenditures.

Thus, although dairying appears to be a logical enterprise for many West Virginia farmers to adopt and expand in order to increase their incomes, in reality the typical farmer in the state is not likely to become a dairyman if only the fluid milk or butterfat markets are available. Recently a condensery market has been established in West Virginia which may point the way toward a solution of this problem of finding a more profitable market than butterfat for the average West Virginia farmer.

The Alternative of Selling to a Condensery: The United Dairy Company has been purchasing some milk in West Virginia for condensery purposes by sending trucks into the state from the plant at Waterford, Ohio, for two years prior to the opening of their collecting station at Lambertton, West Virginia, in May 1940. The Carnation Milk Company opened its condensery at Clarksburg, West Virginia in August, 1940. The approximate sections of the state from which these companies now obtain milk are shown in Figure 3. If the actual truck routes in the areas were drawn in on the map, it would be evident that not all farmers have an opportunity to sell milk to a condensery, either because the roads are not satisfactory, or because volume produced in the neighborhood is not sufficient to warrant the establishment of a route.

In checking the list of farmers selling butterfat who were interviewed originally for the study of butterfat production with

²² A survey of Milk Consumption in 59 Cities in the United States, Consumers Council Division, Agricultural Adjustment Administration, U. S. D. A. Publication No. 2, 1936, p. 24-25.

the list of one-year patrons of the Carnation Milk Company, fourteen identical names were found. These fourteen farmers were revisited in the fall of 1941 to obtain data concerning the effect on certain cost items of changing from selling sour cream to selling to a condensery, along with information which would give some indication of the probable effects, if any, that selling to a condensery would have on the dairy enterprise and general organization of the farms concerned.

* Courtesy of West Virginia offices of Carnation Milk Company and United Dairy Company in fall of 1941.

²⁴Based on the average price in West Virginia for the period in question of \$1c a bushel for corn and \$60 a ton for tankage and assuming that 100 lbs. of skim milk was equal in value to 7.3 pounds of tankage plus 10.9 pounds of corn. Morrison, F. B., op. cit. p. 573.

be available from each 100 pounds of whole milk, hence, the credit of 32 cents.

This comparison showed that the returns from butterfat plus skim milk from 100 pounds of 4 percent milk were more than the net returns (hauling deducted) from the same amount of milk sold to a condensery for only the three months of December, January, and February. A simple average for the twelve months shows that the returns from selling to a condensery exceeded the returns from butterfat and skim milk by five cents per one hundred pounds of four percent milk. However, this margin of advantage derived from selling to a condensery might well be larger in practice for two reasons. First, this comparison assumes that a farmer would be able to market four pounds of butterfat after separating one hundred pounds of four percent milk. Actually, because of inefficient separating facilities found on many West Virginia farms selling butterfat, the losses in separation and subsequent handling would prevent a farmer from receiving the value of four pounds of butterfat. Secondly, the credit of 32 cents for skim milk from each one hundred pounds of 4 percent milk will not be realized unless it is fed efficiently. This value for skim milk was based on the assumption that only enough was fed to balance the ration and as Morrison points out, "any additional amounts of skim milk or buttermilk that may be used beyond the amounts needed to balance the rations for pigs will, of course, be worth much less than the portion that is actually needed as a protein supplement."²⁵ At any rate, farmers interviewed believed there was a definite advantage in selling to a condensery, for all but one of the fourteen thought that he was making from one-fourth to one-half more money by selling to a condensery. The one individual was selling to the condensery because of the saving in labor.

The annual time required for the care of milk and equipment was reduced on the average from 57 hours per cow to 25 hours by selling to a condensery since separating and washing the separator are eliminated. Removing the separator reduced the average investment in dairy equipment from \$6.69 per cow to \$1.93. On the other hand, since strainers requiring a new cotton disc must be used for each milking, the cost of supplies increased for 17 to 95 cents per cow per year.

The farmers incurred only small costs in preparation for selling milk to a condensery. All had to buy one or more milk cans and in most cases a strainer, but these purchases average only \$11.70 per herd or \$1.72 per cow. Only one farmer had spent any money in improving his barn and he had doubled the size of his herd.

Since the farmers had been selling to a condensery for only one year, they would not have had the time to effect all the changes that they might wish to make. For this reason they were asked if they planned to make changes in the dairy and other enterprises as a result of selling milk to a condensery instead of butterfat.

Admittedly, it is not possible to isolate completely those changes or planned changes which are due to a shift in one factor affecting the business if at the same time other influences are at work which may have

²⁵ Morrison, F. B., op. cit., p. 372.

affected the business. In this particular case a general increase in farm prices was occurring at the same time that the farmers were shifting from selling butterfat to selling to a condensery. However, it is believed that the planned changes were in this case largely the result of a shift in the method of marketing, because it is a type of influence in which the farmers were able to and did measure at a given time the comparative profitableness of both systems. This lends credence to the definite statements of the farmers that their planned changes in the dairy and other enterprises were due to the greater profits obtained from selling to a condensery. Furthermore, the fact that the planned changes were centered in the dairy enterprise although the price increase extended to products other than dairy gives additional support to the belief that the changes were largely the result of greater relative profits from the dairy enterprise because of an improved market outlet.

The most important and far-reaching change planned by these farmers is a definite increase in the number of cows kept. While there has already been some increase, the plans of these farmers call for an average increase in the size of their herds of approximately three cows within the next two or three years. There were only four who had neither increased nor planned to increase the size of their herds. On about half the farms the addition of extra cows will not call for any important changes in the other enterprises. On the remaining farms, however, the expansion of the dairy enterprise calls for either the curtailment or elimination of certain enterprises, particularly sheep, although in one case the hog enterprise and in another the beef enterprise were affected. Approximately half the farmers planned to improve the quality of their roughage by growing more legumes. This is important for it indicates that some of the extra cash will be spent on lime and fertilizer to produce more and better roughage. Perhaps in some cases the vicious circle of low incomes resulting in decreased production and still lower incomes through inability to maintain soil resources will be broken.

Other changes besides that of herd increase are planned for the dairy enterprise. There is evidence of a greater interest in breeding higher producing cows as is shown by the fact that five are planning to use Jersey instead of Hereford bulls. In order to receive an income throughout a greater part of the year, eight of the farmers are planning to have some of their cows freshen in the fall.

Thus it appears that many farmers with small acreages and little capital now have a market which is sufficiently profitable to induce them to keep more cows and to initiate certain improvements in the management of their herds. The future of dairying and of agriculture in general will depend in no small degree on the extent to which such improved markets can be made available to other farmers in the state.

However, an improved market, essential as it is, is no substitute for efficient production. As would be supposed, many improvements must be effected in this respect in West Virginia if dairying is to return a satisfactory income to the farmers of the state. It seems im-

portant therefore to determine the important factors, aside from the market, influencing the profits of the dairy enterprise and of the entire farm business. Emphasis in the analysis will be on data from farms selling butterfat, since they more nearly represent the typical West Virginia farm, although most conclusions are equally applicable to farms selling fluid milk.

Other Factors Influencing the Success of the Dairy Enterprise in West Virginia

Production per Cow: The importance of this factor is shown clearly in Table 11. In the study of butterfat production, the 29 herds in which the average production was less than 160 pounds of fat per cow returned only \$12.41 over the cost of the feeds fed for each cow kept, while the 27 herds which averaged over 240 pounds per cow returned \$35.79 over feed costs per cow. It should be noted that the feeding of 1157 pounds more of the total digestible nutrients accompanied this increase in production from the low to the high group.

TABLE 11 — *Relation of Butterfat Production Per Cow and Other Factors to Returns Over Feed Costs on Farms Selling Butterfat in West Virginia, 1938-39*

Butterfat production		Number of herds	Months on pasture	T. D. N. except pasture	Nutritive ratio of winter ration 1:	Percent freshened Mar.-Aug.	Returns over feed per cow*
Range	Average						
0-155.9	143	29	5.6	2974	10.0	81.3	12.41
160-199.9	179	33	5.6	3216	9.7	80.0	19.20
200-239.9	219	35	5.8	3198**	10.1	83.1	28.86
240-over	291	27	5.6	4131	9.4	76.9	35.79

* Returns include all credits to the dairy enterprise. The price received for the product was approximately the same in each group.

** Would be 3298 if adjusted for difference in time on pasture at the average rate fed during the winter.

The influence of the level of production on the cost per unit produced is shown in the fact that in 1938-39 the cost of producing a pound of butterfat in West Virginia for 38 herds averaging only 147 pounds per cow was 25 cents, compared with 18 cents for the 49 herds which averaged 200 pounds per cow.²⁶ These figures cover all costs except labor which amounted to 1.45 hours per pound of butterfat in the low producing group compared with 1.12 hours in the group averaging 200 pounds of butterfat per cow.

It is imperative that production per cow in West Virginia be increased if real improvement in net returns is to be effected. In 1940 the average production for the state was only 145 pounds per cow, compared with 183 for the United States and 210 for Pennsylvania.²⁷ Only seven southern states had a lower average production per cow.

This low production is partially the result of poor feed. With low quality roughage a cow either fails to produce as much as she profitably could, unless she is a low producer, or the roughage must be supplemented by concentrates which the West Virginia farmer fre-

²⁶ The value of the skim milk, calves, and manure was allowed as credits in figuring these costs.

²⁷ *Farm Production, Disposition, and Income from Milk, 1940-41*, op. cit., p. 6.

quently has to buy. Dairying in West Virginia would progress much faster if the hay and pasture fed were improved in quality. On the other hand, it is essential to keep cows with an inherent ability to convert feed into milk efficiently. An indication of the quality of cows found on many farms can be obtained from a consideration of the breeding program followed on the farms included in the study of butterfat production.

In these herds the Jersey ranked far ahead of other dairy breeds from the standpoint of numbers on the farms studied. Some Jersey cows were found on 103 farms, although only 33 of these kept Jerseys exclusively. There were three Guernsey herds and one Holstein herd. The most common practice was to keep Jerseys along with some other dairy or beef breed, or both. Such a mixture of breeds is not likely to lead to the establishment of herds of the high productive ability essential to profitable dairying.

Perhaps a better insight into the present breeding program can be gained from a tabulation of the bulls being used (Table 12). The data in this table reveal that 95 of the 141 bulls being used were of beef breeding, while only 46 or 32.6 percent belonged to the dairy breeds. That a number of the farmers surveyed realized that such crossing of beef and dairy breeds would not produce high-producing cows is evidenced by the fact that they were purchasing rather than raising their replacement stock. Although the relative merits of purchasing versus raising replacements cannot be settled here, the situation in West Virginia is such that high quality dairy stock for sale is relatively scarce; consequently, it is doubtful if the farmers who buy replacement stock always obtain well-bred dairy animals, although they may obtain animals superior to those that could be raised under their present breeding program.

TABLE 12 — *Type and Ownership of Bulls Used in Herds on Farms Selling Butterfat in West Virginia, 1938-39*

Breed	Purebred			Not purebred		
	Bull owned	Services hired	Total	Bull owned	Services hired	Total
Hereford	12	35	47	6	9	15
Jersey	7	15	22	4	6	10
Guernsey	6	5	11	—	3	3
Angus	3	6	9	1	3	4
Shorthorn	2	5	7	1	2	3
Mixed	—	—	—	4	6	10
Total	30	66	96	16	29	45

The natural question regarding such a breeding program is, "Why do the farmers follow it?" While several factors may be involved, the principal reason is that they want a better calf for veal purposes. Eighty-seven of the 124 farmers interviewed stated that they vealed their surplus calves after they had nursed for from six to eight weeks. It is true that Jersey calves are at a disadvantage in veal production, but this is primarily due to the fact that they are small at birth and must therefore receive more milk before they reach the desired market weight of 150 to 175 pounds, rather than to the fact that they are

not of beef breeding.²⁸ Veal calves with some beef breeding may sell for a cent or two per pound, but this amounts to very little when the calves are sold at such light weights.²⁹ While Jersey calves do have the disadvantage of small size at birth, Holstein calves are larger at birth than those of any of the beef breeds.

There is no doubt that these farmers are obtaining the advantage of both a little better selling price per pound and a little heavier birth weight by producing cross-bred calves. But it is doubtful if the gain of a few extra dollars on a veal calf compensates the farmer for foregoing a program which would establish and maintain a herd of high-producing dairy cows.

From this evidence on the nature of the existing breeding program, it seems clear that just as much attention must be directed to this phase of dairy management as to improving the quality of forage if dairy-ing is to return a satisfactory income to West Virginia farmers.

Time of freshening: Spring freshening was an almost universal practice on the farms selling butterfat. Twenty-one percent of the cows calved in March, 30 percent in April, and 18 percent in May, making 69 percent for the three months of March, April, and May. Inasmuch as this practice is contrary to the general recommendations in many dairy states, it seemed desirable to make an analysis of the relative profitability of the different freshening seasons in West Virginia.

At least three important factors must be considered in discussing this problem. These are (1) the difference in the average price received for the annual production of cows which freshen at different seasons, (2) the difference in the annual production that may be expected from cows which freshen at different seasons, and (3) the difference in the annual feed cost for cows which freshen at different seasons. Other factors which would be important to consider in relation to time of freshening on certain farms, such as the labor supply, the maintenance of uniform production throughout the year, or the obtaining of a high production during base months, are not considered. The following results are, therefore, more directly applicable to producers of butterfat or milk for a condensery rather than fluid milk.

Prices for many dairy products are seasonally low during the spring and summer months, so that farmers whose cows freshen at this time have a maximum amount of milk or butterfat for sale when prices are normally lowest. However, since good cows may be expected to produce for 10 or 11 months, some of the product would be sold when prices are higher. This raises the question of what would be the average yearly price of the same amount of product produced by cows freshening at different seasons. Butterfat, which has a typical seasonal price movement, was the product used in calculating these yearly prices. The average was 24.5 cents for January freshening, 24.3 cents for April,

²⁸ Henderson, H. O., Larson, C. W., and Putney, F. S., **Dairy Cattle Feeding and Management**, third edition, 1938, p. 277.

²⁹ A local butcher indicated that he would pay 1 to 2 cents more per pound for a veal calf of a beef-Jersey cross than for one of only Jersey breeding. He also stated that the calves of the larger dairy breeds would not be subject to such a price discount.

24.6 cents for July, and 25 cents for October freshening.³⁰

These data bring out the significant fact that the average price for the yearly production is about the same, regardless of when the cow freshens since a high-producing cow normally produces through most of the year. It should be remembered that the price disadvantage of spring freshening would be considerably more if the cows lacked persistence to continue production during the fall and winter seasons of higher prices. This appeared to be the case on many of the farms selling butterfat.

While it may be possible to feed and manage a herd of dairy cows so that their average production for the year would be approximately the same regardless of when the cows freshened, it is generally agreed that under actual farm conditions cows which freshen in the spring usually do not produce as much as those which freshen in the fall or winter. In attempting to prove this point by the use of actual production figures of cows freshening at different seasons, the question always arises as to whether the cows being compared are of the same inherent ability.

Data compiled from Iowa cow testing association records by Professor Cannon³¹ showed that cows which freshened in November produced the most, with October and December a close second, while cows freshening in June produced the least, with May and July not much better. The milk production for those cows freshening in June was only 86 percent of that for those freshening in November.³²

However, the climatic and feed conditions in Iowa are not com-

TABLE 13--*Nine-Year Average Milk and Butterfat Production of Cows Freshening in Different Seasons in West Virginia**

Season cow freshened	No. Records	Average yearly milk production per cow	Percentage the yearly production each season is of highest season (winter)		Av. yearly butterfat production per cow	Percentage the yearly production each season is of highest season (winter)
			Actual	4% FCM**		
Dec.-Feb.	1090	7267	100.0	100.0	316	100.0
Mar.-May	901	6810	93.7	95.2	304	96.2
June-Aug.	758	6781	93.3	93.1	294	93.0
Sept.-Nov.	1133	6960	95.8	96.6	307	97.2

* 1929-1939 inclusive, except for 1933 and 1934 as summarized from DHIA records.

** Pounds of 4% milk = (actual pounds of milk $\times$.4) + (pounds of fat $\times$ 15).

³⁰ In calculating these average prices, it was assumed that the cows which freshened at the different seasons produced the same amount of product. The proportion of the total amount produced during the year that could be sold in each month was calculated by multiplying the percent of the yearly total production normally produced in each month by the annual production. These percentages were calculated from the data given in Eckles' **Dairy Cattle and Milk Production**, 3d ed., p. 349. The amount that could be sold in each month was then multiplied by the ten-year (1931-40) average monthly price for these products. (The butterfat price was that received by West Virginia farmers.) This would give the yearly gross income for the cow from the sale of butterfat and when divided by the amount produced would give the average price received.

³¹ Cannon, C. "Seasonal Effect on Yield of Dairy Cows," **Journal of Dairy Science**, vol. 16, January, 1933.

³² A tabulation of 12 month DHIA records selected at random from data reported from Wisconsin for the year 1939-40 showed the following butterfat averages for cows freshening in different seasons: fall, 342; winter, 334; spring, 314; and summer, 310 pounds per cow. (Tabulation prepared by the Washington office).

pletely comparable with those found in West Virginia, so the average yearly production of milk and butterfat for cows freshening at different seasons was calculated from West Virginia Dairy Herd Improvement Association records as shown in Table 13.

These data differ in two important respects from the Iowa data; (1) the difference in production between different seasons is not so large and (2) the season of highest production appears to be somewhat later in West Virginia, since winter instead of fall shows the highest production. But in the case of both Iowa and West Virginia data, the cows freshening in the spring or summer are at a disadvantage with regard to the total yearly production.³³

Another argument for spring freshening is that the cows would be producing most when feed costs are lowest because of the cheap feed obtained from pasture. For example, a six-year average cost per cow of roughage and concentrates by months tabulated from West Virginia Dairy Herd Improvement Association records for 1933-38 showed that in June the average cost per cow for all feed was \$4.34 while in January it was \$7.94.³⁴ In view of this large decrease in feed costs on pasture, it is not surprising that successful dairymen insist on having a plentiful supply of good pasture during a large share of the year. But good pasture is a great asset to a dairyman regardless of when his cows freshen, since he must feed them the year around, and in this analysis we are primarily interested in the total feed costs for the year in relation to the time the cows freshened. A nine-year average of the DHIA records of the total yearly feed cost for cows freshening at the different seasons showed the following: winter, \$81.00; spring, \$80.92; summer, \$79.49; and fall, \$80.54. Apparently the total feed cost for the year was not materially influenced by the time the cows in DHIA herds freshened.³⁵

Using data on actual feed costs for cows freshening in different seasons reflects both the differences due to the total amount of milk produced and the proportion that is produced on grass. For this reason differences in the yearly feed bill in relation to the time of freshening were checked by calculating the amount of grain a cow should be fed for a year, assuming she produced the same amount of milk but freshened at different months.³⁶

³³ Except for the June-August period, the disadvantage appears more serious with respect to milk production than to the amount of butterfat produced. In the Iowa study the percentage changes shown in Table 14 for milk and butterfat were closer together.

³⁴ The data by months are not entirely comparable because the feed costs include the feed fed to dry cows. However, this is not a serious limitation of the data because the percentage of dry cows does not vary greatly between months, the range being from 10.4 percent in May to 15.6 percent in December. The average percentage for the 6 months October to March inclusive was 12.8, while for the 6 months April to September, inclusive, it was 11.3.

³⁵ This does not agree with an earlier study using DHIA records from a number of states by McDowell, J. C., *The Influence of Season of Freshening on Production and Income from Dairy Cows*. U. S. D. A. Bul. 1071, 1922. He found that while the roughage costs per cow were practically constant regardless of the season of freshening, the cost of grain per cow was as follows: fall, \$28.45, winter, \$25.51, spring, \$19.22, and summer, \$22.48.

³⁶ The grain feeding tables for cows not on pasture and for cows on pasture found in Morrison, op. cit., p. 1032-33 were used in these calculations with interpolations between the point of least grain fed per day and the point where no grain was fed. It was assumed that the amount of milk produced each month after freshening followed the curve mentioned earlier and that the cows were on pasture five months.

Although we are interested here in the total yearly feed bill as influenced by the time of freshening, the amount of roughage fed for the year was not considered because it would not vary appreciably within the same roughage group with the time the cow freshened. Hence, the difference in cost of grain consumed represents the essential difference in the yearly feed bill for cows freshening in different months. These calculations are shown in Table 14.

TABLE 14—*Effect of Quality of Pasture, Amount of Roughage Fed, and Time of Freshening on the Amount of Grain Which Should be Fed to a Dairy Cow*

Kinds, quality, and amount of roughage fed	POUNDS OF GRAIN RECOMMENDED PER YEAR WHEN COWS FRESHEN IN:*			
	January	April	July	October
Good pasture and 2 lbs. good hay per 100 lbs live weight	1747	1756	1854	1839
Excellent pasture but 1½ lbs. good hay per 100 lbs. live weight or feeding poor hay	1931	1769	2016	2222

* The following amounts were added to the amount required for milk production alone so that the cows would be in the desired flesh when they freshened: 300 lbs. if dry on 1½ lb. hay ration, 230 lbs. if dry on 2 lbs. hay ration, 160 lbs. if dry on good pasture, and 70 lbs. if dry on excellent pasture.

The lower half of Table 14 illustrates the important point that the best freshening month from the standpoint of low feed costs is influenced by the quality of pasture and the quality and amount of dry roughage on the farm. Thus if a farmer had excellent pasture but was rather short on roughage or if it were of poor quality, 453 pounds more grain would be required to get the same yearly production if the cow freshened in October instead of April. At \$26 per ton this amounts to \$5.89 and in case the cost of grain were higher, the difference would naturally be even more significant. If the cows were not the persistent producers assumed here, the difference in the yearly concentrate requirement would be greater with cows freshening at different seasons.

In summary, the price received for the dairy products produced and the cost of the feeds fed are factors influencing the most profitable time to have dairy cows freshen, but at any given time these factors tend to work in opposite directions. Furthermore, they are not as important as might first be supposed, because regardless of when the cows freshen, part of their annual production normally will be sold when prices are seasonally high and part when they are seasonally low, unless the cows lack persistence in production. The same is largely true of the cost of feeds fed, although contrary to West Virginia data, McDowell's study³⁷ showed that spring freshening resulted in a lower total feed bill for the year.

The lower annual production of cows freshening in the spring or summer tends to reduce the profitableness of these seasons as freshening periods. However, the available data indicate that this is not as important in West Virginia as in Iowa. The amount and quality of roughage available is probably the most important factor in determining the extent to which farmers not selling fluid milk can profitably change

³⁷ McDowell, J. C., op. cit.

to earlier freshening. If the roughage is of such poor quality that considerable grain must be fed to prevent a serious decline in milk flow then it is not likely that winter freshening could be recommended. However, it would appear that in most, if not all, cases it would be desirable to have the cows freshen early enough to allow the veal calves to be sold by the beginning of the pasture season. This is often not done at present, but it would permit all the product to be sold during the months of high and economical milk production on grass.

Size of herds: Dairy enterprises as small as many of those in West Virginia are at a disadvantage in several respects. The increase in the number of hours of labor used per cow in small herds has already been indicated. An intangible factor undoubtedly involved in certain cases is the lack of interest in a small enterprise. The incentive to follow the best practices is lacking, since the total to be gained is comparatively small if only a few cows are kept.

Farmers with small herds are also at a disadvantage in the efficient utilization of buildings or keeping a bull (Table 15). In the survey of herds selling butterfat the annual cost of buildings, which included interest, depreciation, repairs and taxes, for the herds which averaged less than 4.5 cows was \$6.47 per cow, compared with \$3.86 for those herds of more than 6.5 cows. Bull costs averaged \$5.04 for the small herds but only \$1.43 for the large herds. That farmers generally appreciated this high expense of keeping a bull is shown by the fact that only eight

TABLE 15 — *Relation of Size of Herd to Cost Per Cow for Buildings and Bull Charges on Farms Selling Butterfat in West Virginia, 1933-39*

Size of herd	Number of herds	Average number of cows	Building cost per cow	Bull cost per cow	
				If bull is kept *	If services are hired *
0 - 4.49	37	3.6	6.47	5.04	1.19
4.5-6.49	49	5.2	4.67	2.86	1.02
6.5- over	38	8.0	3.86	1.43	.95

* In the first group, 8 herds kept a bull. In the other size groups, the numbers were 16 in the second and 21 in the third size group.

out of the thirty-seven small herds kept a bull. The difficulty with hiring services is that bulls of good quality frequently are not to be found or are not for hire. Rather than to rely on whatever is available, small herd owners might well pool their resources and purchase one good bull for common use provided care is exercised to prevent the possible spread of diseases. Such a practice would tend to curb undue expense and still maintain quality.

General improvements along the lines indicated in this section would greatly enhance the profits from the average dairy enterprise, regardless of the type of product. However, a profitable dairy enterprise is no guarantee of a satisfactory return from the entire farm, although there is clearly a reciprocal relationship between the two. For this reason some attention will be devoted to a consideration of the factors influencing the success of the farm unit.

Factors Influencing the Success of Dairy Farms in West Virginia

The farms included in the study of these factors represent the smaller, more diversified farms with a dairy enterprise containing on the average approximately 5.5 cows,³⁸ rather than the larger, more specialized farms producing fluid milk. At the time the data were collected in the summer of 1939 all were selling butterfat, although at present many have shifted to selling milk to a condensery. Seven of the 98 farms studied³⁹ had operator's earnings⁴⁰ above \$600, while two earned between \$1200 and \$1400. Fifty-nine farms, or 60 percent, had earnings between zero and \$400, while 16 showed a loss, though only two were below a minus \$400. When the farms were separated according to the farm-type classification used in the 1930 census, only 12 were dairy farms, while the other 86 were general.

The first step in ascertaining the factors that influence the incomes of these farms was to compare various items for the most and least profitable farms (Table 16).

TABLE 16—*Comparison of Various Items for Most and Least Profitable Farms
Selling Butterfat in West Virginia, 1938-39*

Item	Operators' earnings more than \$400	Operators' earnings less than \$100
Number of farms	23	26
Total acres per farm	129.96	160.00
Crop acres per farm	33.40	33.50
Animal units per farm	15.60	12.60
Gross receipts per farm	1034.00	595.00
Gross expenses per farm	618.00	754.00
Crop Index	116.00	96.00
Acres pasture per animal unit grazed	4.50	6.80
Gross income from livestock per animal unit	62.00	40.00
Returns per \$100 feed fed	148.00	104.00
Expenses per animal unit	40.09	60.00
Years for gross income to equal investment *	6.60	11.00
Investment in land and build- ings per animal unit *	236.00	317.00
Value land per acre*	14.00	15.00
Operators' earnings	640.00	126.00

* Based on 17 farms in high group and 22 in low group which were owner-operated.

This comparison shows that the two groups had an equal number of acres in crops, although the least profitable farms had the larger total acreages. With respect to the other two size factors shown, number

³⁸ See the first farm types in Tables 3 and 4 for more information concerning the organization of these farms.

³⁹ The 24 self-sufficing and part-time farms were not included in the study of these factors. They were, in general, smaller farms with respect to acreage, animal units, and sales, and it was felt that their inclusion would introduce undue heterogeneity into the data. The other farms are not completely homogeneous, but preliminary tabulation indicated that they were sufficiently similar to be grouped for the purpose of this study.

⁴⁰ In calculating operator's earnings all expenses including depreciation, interest on investment, and the value of unpaid family labor are deducted from total receipts including, in addition to sales, increase in inventory, food used in the home, and 10 percent of the value of the dwelling as rent.

of animal units and gross sales, both were larger on the most profitable farms. Soils were more productive on the most profitable farms, or crops were better cared for, as indicated by the higher crop index. The pastures on the most profitable farms also appear more productive, since only 4.5 acres of pasture were used for each animal unit grazed, compared with 6.8 acres in the least profitable group.⁴¹ The gross income from livestock for each animal unit was approximately 50 percent higher on farms in the most profitable group. This gross income figure included sales, changes in inventories and value of livestock products used in the home except eggs, which had been lumped with other perquisites. Thus the more profitable farms had the advantage of both more livestock and higher returns for each unit kept. The livestock on the most profitable group of farms returned \$44 more for each \$100 of feed fed than did those in the least profitable group.

The fact that total expenses average \$136 less on the most profitable farms is significant; however, it is not so much in keeping total expenditures small that the most profitable farms excel as in obtaining much higher gross receipts. Farms in the most profitable group were operated more intensively, as is indicated by the fact that on these farms, only 6.6 years were required for gross income to equal investment, while on farms in the least profitable group 11 years were required. Also the investment in land and buildings averaged \$317 per animal unit for the least profitable group, compared with \$236 for the high profit farms, although the land was valued at approximately the same price per acre in each group. A special tabulation showing the proportion of the land in different uses and the proportion of the total animal units in each class of livestock showed no important differences between the two groups.

Although this simple tabulation has brought to light certain marked differences between the high and low income farms, it is well to inquire further into the relationship of these factors to income. To do this tables have been prepared showing the relationship of certain of these factors to operators' earnings on all 98 farms. However, to analyze more carefully the nature of the relationships, other causal factors have also been tabulated and are shown in each table.

Size: Size of business is important from the standpoint of the opportunity it affords to earn a higher income. Profit per unit produced is only one part of the equation for a successful farm business. Equally important is the production of sufficient numbers of units for sale to lead to a satisfactory total income for the farm. It is axiomatic that a large business also means larger losses if poorly managed. The number of animal units appears to be a good measure of size for these farms, since approximately 90 percent of the receipts came from livestock. The relation of number of animal units to operators' earnings is shown in Table 17. The 29 farms with only 7.4 animal units had average

⁴¹ Undergrazing probably is involved also, but its extent could not be determined from the data available.

TABLE 17 — *Relation of Number of Animal Units Per Farm and Associated Factors to Operators' Earnings on Farms Selling Butterfat in West Virginia, 1938-39*

Animal units		No. of farms	Total acres	Crop acres	Gross income	Gross live stock income per animal unit	Crop index	Total ex- penses	Oper- ators' earn- ings
Range	Average								
0- 9.9	7.4	29	94.8	21.0	\$428	\$63	106	\$395	\$163
10-16.9	13.1	40	122.2	33.8	634	54	94	583	219
17-over	23.1	29	235.9	47.4	1139	45	104	874	348
All farms	14.4	98	151.8	34.1	747	51	100	613	240

operators' earnings of \$163 per farm, compared with \$348 for those with an average of 23.1 animal units. As would be expected, this large increase in animal units was accompanied by a large increase in the average gross receipts, total expenses, total acres, and crop acres per farm. However, the increase in acreage was not proportional to the increase in animal units, for the smallest farms kept one animal unit for each three crop acres, while the larger farms kept one animal unit for each two acres of crops. The fact that Table 17 shows an average increase of only \$185 in operators' earnings with a three-fold increase in animal units suggests that other factors may have more effect on the operators' earnings than size. Further evidence of this fact will be noted later.

Productivity: Low crop yields, low milk or egg production, or slow gain in the live weight of meat animals are seldom associated with a successful farm business. The importance of crop productivity is indicated in Table 18. The 30 farms with an average crop index of 70 earned on the average only \$132 compared with \$327 for the 31 farms with an average crop index of 146. Greater productivity of the pasture, as indicated by the use of smaller acreage to maintain an animal unit without any reduction in the livestock returns per animal unit, also was associated with higher crop yields. The most profitable group of farms had on the average 12.5 fewer acres in crops than did the least profitable group. However, not all the changes in income can be attributed to changes in the crop index, because of the concomitant variation in livestock returns per animal unit.

Since practically all the crops, as well as pasture, are marketed through livestock, it is apparent that productivity of livestock is of great importance in determining the success of these farms. The gross

TABLE 18 — *Relation of Crop Index and Associated Factors to Operators' Earnings on Farms Selling Butterfat in West Virginia, 1938-39*

Crop index*		No. of farms	Crop acres	Ani- mal units	Gross live- stock income per animal unit	Total ex- penses	Acres pasture per animal unit grazed	Oper- ators' earn- ings
Range	Average							
0- 84.9	70	30	38.8	13.3	\$44	\$542	6.2	\$132
85-119.9	100	37	36.8	15.3	52	632	5.6	254
120-over	146	31	26.3	14.3	57	660	5.0	327
All farms	100	98	34.1	14.4	51	613	5.6	240

* Average yields for West Virginia, 1923-1932, equal 100.

TABLE 19 -- *Relation of Gross Income From Livestock per Animal Unit and Other Factors to Operators' Earnings on Farms Selling Butterfat in West Virginia, 1938-39*

Gross livestock income per animal unit		No. of farms	Animal units	Crop acres	Crop index	Total expenses	Percentage of total animal units				Operators' earnings
Range	Average						Dairy cattle	Beef cattle	Sheep	Poultry	
\$ 0-44.9	34.91	35	18.1	43.1	93	\$671	36.1	20.8	22.1	8.7	\$ 98
45-64.9	52.96	35	13.2	30.0	101	585	49.8	13.4	14.2	11.0	241
65-over	80.07	28	11.1	27.9	115	576	53.0	10.6	8.3	14.6	419
All farms	50.35	98	14.1	34.1	100	613	44.3	16.0	16.4	10.8	240

livestock income per animal unit appeared to be the best indication of livestock productivity in this study. Table 19 shows that high operators' earnings were closely associated with higher gross livestock income per animal unit. The farmers who obtained the higher gross livestock income per animal unit were placing somewhat more emphasis on the dairy and poultry enterprises and less on beef and sheep. The farms with the highest gross income per animal unit had 53.0 percent of the total animal units in dairy cattle and 14.6 percent in poultry, contrasted with 36.1 and 8.7 respectively in these two classes of livestock on the farms with the lowest gross income per animal unit.

In view of the weakness of simple relationships with such complex data, it was considered desirable to cross-classify the farms according to the crop index and the livestock income per animal unit (Table 20). This table shows the importance of both these factors, for better-than-average production of one factor without change in the other resulted in increased income. The 33 farms which were above average for both factors had an average operators' earnings of \$393, compared with \$124 for the 28 farms which were below average for both factors. The livestock returns per animal unit appears to be somewhat more important than the crop index; this might be expected, since the crops are largely marketed through livestock. However, the crop index does not show the possible effect on income of increasing the kind and amount of nutrients produced per acre, particularly through the production of more legumes and the earlier cutting of hay. It is believed that this is an important factor, provided high-quality livestock are available to take advantage of better roughage.

Referring back to Table 19 it will be noted that the group of farms with the highest operators' earnings had on the average 11.1 animal

TABLE 20 -- *Relation of Crop Index and Gross Livestock Income per Animal Unit to Operators' Earnings on Farms Selling Butterfat in West Virginia, 1938-39*

Crop index	LESS THAN \$50 LIVESTOCK INCOME PER ANIMAL UNIT		MORE THAN \$50 LIVESTOCK INCOME PER ANIMAL UNIT	
	Operators' earnings	Number of farms	Operators' earnings	Number of farms
Less than 100	124	28	238	18
More than 100	152	19	393	33

TABLE 21—*Relation of Number of Animal Units and Gross Income per Animal Unit to Operators' Earnings on Farms Selling Butterfat in West Virginia, 1938-39*

Gross income per animal unit	Less than 13 animal units		More than 13 animal units	
	Operators' earnings	Number of farms	Operators' earnings	Number of farms
Less than \$50	\$ 52	15	\$174	32
More than \$50	273	34	470	17

units, contrasted with 18.1 for the group with the lowest income. This indicates that over a considerable range in size, practices implied in a high gross income per animal unit, such as better feeding, breeding, and marketing are more important than mere size. However, Table 21 indicates that both size and livestock income per animal unit are important, for when either factor is above average, the income is higher even though the other factor remains essentially the same. Size is particularly important when the gross livestock income per animal unit is above average, as is indicated by an increase in average operators' earnings from \$273 for the farms of less than 13 animal units to \$470 for those farms with more than average number of animal units. In contrast with the average earnings of \$470 for those farms above average for both factors is the average of only \$52 for those below average for both factors.

Feeding Efficiency: The efficiency with which the livestock convert feed into saleable products is particularly important on these farms because practically all the crops grown are fed. As an indication of this efficiency the gross livestock returns per \$100 of feed fed was calculated. The general relation of this factor to operators' earnings is shown in Table 22. The operators' earnings for the 33 farms with the lowest feeding efficiency were only \$68, compared with \$375 for the farms with the highest efficiency. A high gross livestock income per animal unit was closely associated with a high feeding efficiency.

The farms with the lowest efficiency had a somewhat larger acreage, but in general there was not a great deal of difference between the acreages, numbers of animal units, or crop indices for the three groups of farms with different feeding efficiencies. The principal difference between the groups was in the associated factor of gross livestock returns

TABLE 22—*Relation of Livestock Returns per \$100 of Feed Fed and Associated Factors to Operators' Earnings on Farms Selling Butterfat in West Virginia, 1938-39*

Returns for \$100 feed fed		No. of farms	Crop acres	Total acres	Animal units	Crop index	Gross live- stock income per animal unit	Total ex- penses	Opera- tors' earn- ings
Range	Average								
\$ 0 -112.4	\$87	33	37.2	165.8	14.1	100	\$42	\$613	\$68
112.5-150.4	131	32	34.4	145.7	14.2	95	49	535	280
150.5-over	196	33	30.6	143.7	14.9	107	62	639	375
All farms	132	98	34.1	151.8	14.4	100	51	613	240

per animal unit and in the total farm expenses. The influences of factors other than feeding efficiency on income is indicated by the fact that the operators' earnings on the 33 farms which received \$196 for each \$100 of feed fed averaged but \$375 (Table 22). On the other hand, operators' earnings averaged \$640 on the 23 most profitable farms (Table 16) yet they received only \$148 for each \$100 of feed fed.

Capital Turnover: Every farmer with money invested in his business is incurring either a direct or an indirect interest cost. Thus a farmer with a large investment must have a proportionately large production of units for sale if he is to avoid an excessive interest cost on each unit produced. The importance of this factor is shown in Table 23 for seventy-three owner-operated farms. On those farms where the annual gross income was large enough to equal the total investment in

TABLE 23—*Relation of Rate of Capital Turnover and Associated Factors to Operators' Earnings on Farms Selling Butterfat in West Virginia, 1938-39*

Years for income to equal investment		No. of farms	Animal units	Crop acres	Crop index	Acres pasture per animal unit grazed	Gross live-stock income per animal unit	Total expenses	Investment in land and bldgs. per animal unit	Operators' earnings
Range	Average									
0- 6.9	5.4	19	11.3	21.2	113	4.7	\$65	\$541	\$185	\$411
7-10.9	8.7	36	15.7	37.7	101	5.6	48	674	254	221
11.0-over	15.2	18	11.7	30.8	101	5.5	43	506	358	4
All farms	8.9	73	13.6	31.7	103	5.3	50	597	261	217

less than seven years the operators' earnings averaged \$411. On the other hand, if the gross income was so small in relation to the investment used that it took eleven years or more before they were equal, the average income was only \$4.

The farmers who obtained a high gross income in relation to investment had high crop yields and better livestock which they marketed to advantage, as is indicated by a high gross income from livestock per animal unit. They also kept practically as much livestock with a considerably smaller total investment, having only \$185 invested in land and buildings for each animal unit compared with \$358 for the least profitable group of farms.

Combination of Favorable Factors: It should be clear from the preceding discussion that being superior with respect to only one factor affecting the success of the farm business does not insure high earnings. Successful farm management cannot be simplified to that extent. As further evidence of this fact the earnings of farms that were above or below average for the three factors of size, crop productivity, and livestock productivity were calculated. In reality these farms were probably superior in other respects also because of the intercorrelation of factors. For example, a higher feeding efficiency is associated with a high gross livestock income per animal unit.

Only ten farms of the 98 had over 13 animal units, a crop index of over 100, and a gross livestock income per animal unit of over \$50. The

average operators' earnings of these 10 farms was \$623. Thirteen farms, on the other hand, were below average for these factors, and their average operators' earnings were only \$82. There were 47 farms above average in two of these three factors, and 28 above average for only one of the three. The average operators' earnings of these two groups were \$248 and \$165 respectively.

Summary

It was the primary purpose of this study to appraise critically the merits and place of dairying in West Virginia agriculture, to analyze the possibilities for the different types of dairying, and finally to determine the factors influencing the success of the dairy enterprise and the dairy farm.

Physical factors impose rather definite limits on the type of enterprise adapted to West Virginia. The rough topography indicates that pasture and hay should constitute the principal uses of the cleared land, which means that dairy, beef cattle, or sheep must be the principal types of livestock if physical resources are to be most effectively utilized. The fact that for many common agricultural products consumption in the state exceeds production at first appears to be a factor of considerable importance in determining the most profitable enterprises. Closer examination shows, however, that only adapted truck crops, poultry to a lesser extent, and perhaps fluid milk appear to merit more attention on this account.

Poor roads have had an important effect on agricultural development, and they still limit the alternatives of some farmers, although the situation is steadily improving. While beef, sheep, and dairy cattle appear equally adapted from the standpoint of utilizing physical resources, the fact that most farms are small, puts beef and sheep at a considerable disadvantage, since they do not afford the same opportunity to utilize labor as do dairy cattle. Poultry and truck crops are particularly adapted to the smaller acreages because of their high labor requirements. The poultry enterprise is handicapped, however, by the fact that concentrates are not produced locally in any large amount.

Thus it appears that dairying is well qualified to utilize both the physical and economic resources of West Virginia, although obviously it is not adapted to all farms. Some large farms may find beef and sheep more profitable, whereas the smallest ones probably should depend primarily on truck crops and poultry. Farms located on poor roads must continue to be largely self-sufficing until such roads are improved. It is believed that allocation of the agricultural resources of West Virginia along these lines, if properly supported by the general adoption of improved practices, would lead to a definite rise in the level of incomes in the state.

In general, farms selling fluid milk have a much larger acreage and investment than the average farm in the state; butterfat production, on the other hand, appears to be much better adapted to the typical conditions in West Virginia. Comparison of the two types of dairying shows, however, that the returns from butterfat production are much less al-

though good dairymen find its production profitable. In fact, the returns from butterfat production have been such that it has been slowly declining.

In spite of the fact that dairying is well adapted to general conditions in the state, the probability of any large expansion of the field appears small unless a more profitable market than butterfat becomes accessible to the smaller farmers with little capital. The fact that the fluid milk market is of limited extent and of doubtful suitability to the average West Virginia farmer, and that the returns from butterfat production under present conditions are often low, point to this conclusion. A condensery was established in the state in 1940, and a survey of farmers who have shifted from butterfat production to selling to a condensery indicates that markets of this general type may be the answer to the problem. The farmers interviewed agreed that net dairy income definitely was higher when selling to a condensery. They incurred little expense in making the change, and many were planning to make such important improvements as growing more legume roughage, breeding higher producing cows, and increasing the size of their herds. In November, 1942 another market of this general type became available to West Virginia farmers with the establishment of a milk-drying plant at Sistersville.

But a good market, essential as it is, does not automatically mean a profitable dairy enterprise. This will depend on the farmer's ability to make two fundamental changes: First, an improvement in the quality of feed grown, including both pasture and hay; and secondly, adoption of a breeding program designed to produce high quality dairy cows that will efficiently convert this feed into milk. Cows of this type are seldom produced by the common practice of crossing dairy and beef breeds. Evidence of the importance of higher production to a profitable dairy enterprise was given by the fact that in the study of butterfat production the 27 herds which averaged more than 240 pounds of fat per cow returned approximately \$23 more per cow over feed costs than did the 29 herds which averaged less than 160 pounds of fat per cow. It was demonstrated that small herds are inefficient in the use of labor and fixed investments. A special study of the most profitable freshening season in West Virginia indicated that in many herds, freshening earlier in the spring than is now the case would prove profitable.

A study of the factors affecting operators' earnings on the farms selling butterfat indicates that in many cases small acreage is not the factor making for low income. Size may well become the limiting factor, but over a considerable range in size, practices implied in a high gross livestock income per animal unit, such as better feeding, breeding and marketing, more productive crops and pasture, and a more intensive business are more important than mere size. Ten of the 98 farms studied had over 13 animal units, a crop index of over 100, and a gross livestock income per animal unit of over \$50. The average operators' earnings of these 10 farms was \$623. Thirteen farms, on the other hand, were below average for these factors, and their average operators' earnings were only \$82.