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# Producer Attitudes Toward Adjustment of Milk Production in the Kansas City Milkshed

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## INTRODUCTION

It is impossible to consider the fluid milk supply in isolation from its larger setting in the entire dairy industry, from agriculture as a whole, and from the total national economy. Thus, a few of the interrelationships and trends existing in this larger context will be touched on before narrowing the study to the Kansas City milkshed.

Although the relative importance of agriculture in the national economy has declined in the past century, it still plays an important role. People must eat; so agriculture will continue as a vital and imposing force in the nation's economy.

Only a brief glance at the forces at work in our economy is needed to reveal what is perhaps the outstanding fact of our day: technological revolution and the long train of consequences following in its wake. Higher farm productivity permits more people to live in metropolitan centers. Farm productivity that is increasing at a greater rate than population not only permits urbanization, but encourages it and, to a considerable extent, forces it; for only the more productive farmers can expect to attain and maintain a standard of living comparable to that enjoyed by the rest of society. Except for those times when there is general unemployment, the less productive farmer, knowingly or not, has a favorable financial alternative. The lower his income, the higher the attraction of this alternative.

Economic growth, we call progress. Innovations permit progress. Hence, farms are increasing in size and decreasing in number; dairy herds are increasing in size, and the number of herds is decreasing. Farm population continues to decline, and capital required continues to increase. Agriculture, like the rest of the economy, is experiencing a technological revolution. The portion of the population needed to grow food and fiber is declining; and it likely will continue to do so. Conversely, the optimum-sized dairy herd is expanding and it will continue to expand for some time in the future.

In 1954 there were a half million dairy farmers in the nation. Dairy farms comprised 16.5 percent of all commercial farms, but used only 9 percent of all land in farms, and slightly more than 11 percent of harvested cropland. However, they accounted for 15 percent of the value of all farm products sold.[1] Since

[1]United States Bureau of the Census, "Dairy Producers and Dairy Production," *United States Census of Agriculture: 1954.* Special Reports, Vol. III, Part 9, Chap. V (Washington: Government Printing Office, 1956), p. 13.

1944, gross income from dairy products has contributed an average of 15 percent (range: 14 to 16 percent) to total farm income from marketings.[2]

Except for a period of unfavorable milk-feed price relationships in the 1930s the rate of production per cow has increased steadily. (Drouth conditions and relatively low carcass values which, in conjunction with relatively favorable milk prices for that period, discouraged the culling process that would, under more normal conditions, have eliminated low-producing cows.) In part, this higher rate of production has been made possible through improved feeding and breeding. The amount of concentrate fed per cow has increased considerably. Better roughages have also helped. Improved pasture, closer culling, and artificial breeding have all served to increase per-cow productivity. The number of cows kept for milk increased until the mid 1940's when a peak of 27,770,000 was reported on January 1, 1945.[3] Since then, there has been a steady decline in numbers.

Evidence of changes in consumer tastes and preferences can be found in the increased consumption of cheese during the last two decades and the acceptance of margarine as a substitute for butter by a large number of consumers. During the years when cheese consumption was increasing rapidly, revolutionary changes were taking place in methods of processing and marketing. Because of shortages, civilian consumption of butter was held down during the period 1943-46 by a rationing program. Supplies of vegetable oils permitted people to substitute margarine and other spreads for butter. However, consumers did not shift back to butter when it became more available in the postwar period.

It is generally agreed that behavior patterns in the past affect the current consumption of food. Education and knowledge of the nutritive value of some foods tends to make their consumption relatively stable. For these foods, even in periods of falling income, people attempt to maintain previous levels of consumption. This applies to milk as a major source of calcium.

> "No suitable substitute has been found for whole milk as a human food, and skim-milk products are filling a unique place in meeting certain nutritional needs. Therefore both continue to expand. The situation is different with butterfat. Other fats and oils compete directly with it in both cooking and baking and as a spread for bread. Competition has been so keen that the place of butter in the diet has been greatly reduced. Although we are using as much edible fats and oils per capita as before, butterfat accounts for a much smaller fraction of this consumption, and a much smaller proportion of milk is used for making butter".[4]

By 1954, the milk equivalent of all dairy-product sales had increased two and a half times since 1909. Milk sold as whole milk had increased five-fold but sales of cream and butter had decreased to about one-half the quantity sold in 1909.[5]

[2]Anthony S. Rojko, *The Demand and Price Structure for Dairy Products*, United States Department of Agriculture, Technical Bulletin No. 1168 (Washington: Government Printing Office, 1957), p. 25.

[3]*U. S. Census of Agriculture:* 1954, p. 6.

[4]*U.S. Census of Agriculture:* 1954, p. 6.

[5]*United States Census of Agriculture:* 1954, p. 6.

Another change in the dairy industry is the geographic area of concentration. The center of whole-milk sales has moved westward from the northeastern to the north-central parts of the country. Sales of whole milk from the Middle Atlantic geographic division accounted for nearly 40 percent of all whole milk sales in 1909; by 1954, this percentage had dropped to 18. The West-North-Central division increased its proportion from 7.5 to 13 percent, while the rest of the West and South increased its sales from 10.3 to 29.2 percent.[6]

Thus we see many forces at work in the dairy industry. The dominating ones seem to be technology-induced. Hence, milk production records are being set year after year, and yet, simultaneously, the dairy cow population is going down. Total production in 1957 set a new record for the fifth consecutive year. During the same year, dairy-cow numbers declined 2 percent—the twelfth decrease in the last 13 years. Production per cow rose to a new high. The all-state average milk production per cow was 6,162 pounds in 1957—a gain of more than 20 percent in the past ten years.[7] The range was from 2,930 pounds for Louisiana to 8,880 pounds for California.[7] Average per-cow production for the year in Missouri was 4,950; and in Kansas, 5,310.[8]

Dairying is traditionally viewed as a long-run business enterprise. Typically, it does not lend itself to rapid expansion and contraction or to easy entry and withdrawal. The advance of technology will lead to further specialization in an already specialized industry. It will mean greater capital outlays for facilities having practical utility for the dairy enterprise alone. This, in turn, will call for greater specialization of skills on the part of the operator. The net effect will be to make dairying an even longer-run enterprise than it has been traditionally.

Economic progress leads to a ruthless and impersonal re-allocation of human resources. It means lower per-unit costs which are achieved, by and large, through increased scale of production. The larger the farm, the more it demands of its manager. If the farmer does not grow in his managerial skill, he is unable to assemble and direct the new combination of economic factors efficiently.

Is the adoption of technology forced because of a cost-price squeeze or is it encouraged by a favorable cost-price ratio? In any case, it generally increases supply. The early adopter of new methods stands to gain substantially. The late adopter receives lower returns for his efforts. Because the dairy industry faces a fairly inelastic demand curve, adoption of new methods by a relatively few may cause a significant decrease in the price of dairy products. This results in less profit per unit. As cost-price pressures arise, exit is not easy. The dairyman's equipment is specialized and he himself is at least somewhat of a speicalist. He thus has fewer alternatives than most farmers.

Many factors influence the production decisions of dairymen. These factors can be classified as economic, physical, biological, and social. With the exception of social factors, each of these will be discussed, some at length and others only briefly. Because social factors are omitted, two of them will be introduced

[6] *United States Census of Agriculture:* 1954, p. 6.
[7] *The Dairy Situation* (February, 1958), p. 6.
[8] *The Dairy Situation* (April, 1958), p. 16.

only briefly at this point: one, non-monetary and non-physical income; and two, though it may fall in the fringe area of social studies, that unique institutional setting in which farmers operate.

It is a well-known fact that psychic income contributes greatly to real farm income. Thus, farmers' net money incomes are usually substantially less than the average in other sectors of the economy. In the absence of appealing subjective values one might expect the incentive of greater earnings to pull workers out of agriculture until the returns per worker remaining were comparable to returns in other occupations. Though we know that they have a very real bearing, no attempt is made here to evaluate the influence that these amenity incomes have on supply. The non-monetary and non-physical incomes may be made up of such diverse elements as a personal dislike of working for, or with, the public; the desire to rear children in wholesome surroundings; or merely the convenience of the farm as a place to keep the hound dogs.

Thus, this study ignores many of the influences that change only slowly through time and concentrates on those objective economic elements that most immediately and directly affect the dairymen in the area. When possible, cardinal values were assigned to influencing economic factors; when not possible the influence was indicated ordinally.

## PURPOSE OF THE STUDY

This study was guided by two primary objectives: one, to describe and analyze the factors that have influenced fluid milk production trends in the recent past; and two, to anticipate those factors that will affect it in the near future and to estimate the supply response to these factors. Selected for special consideration in the inquiry were the dairymen located in the Greater Kansas City milkshed who sold milk to handlers that were subject to the provision of Federal Order Number 13, July 1, 1956, to June 30, 1957. To furnish the information by which the analysis and estimates could be made, a sample of producers in the Greater Kansas City milkshed were interviewed. (See appendix.)

## DESCRIPTION OF THE AREA

An important factor influencing or determining farmers' alternative enterprises, and hence, production decisions, is physical environment. Distance from market has a bearing on cost-conscious decision making. The site of a particular farm, within limits, sets the alternatives open to its operator. It limits the enterprises that can be expected to compete successfully with the same enterprises at other sites. Just as physical characteristics of the farm limit the alternatives of the individual farmer, those of an area also limit the enterprises in which farmers compositely may successfully engage to meet inter-regional competition. Hence, physical factors are quite important in a supply response study. Let us

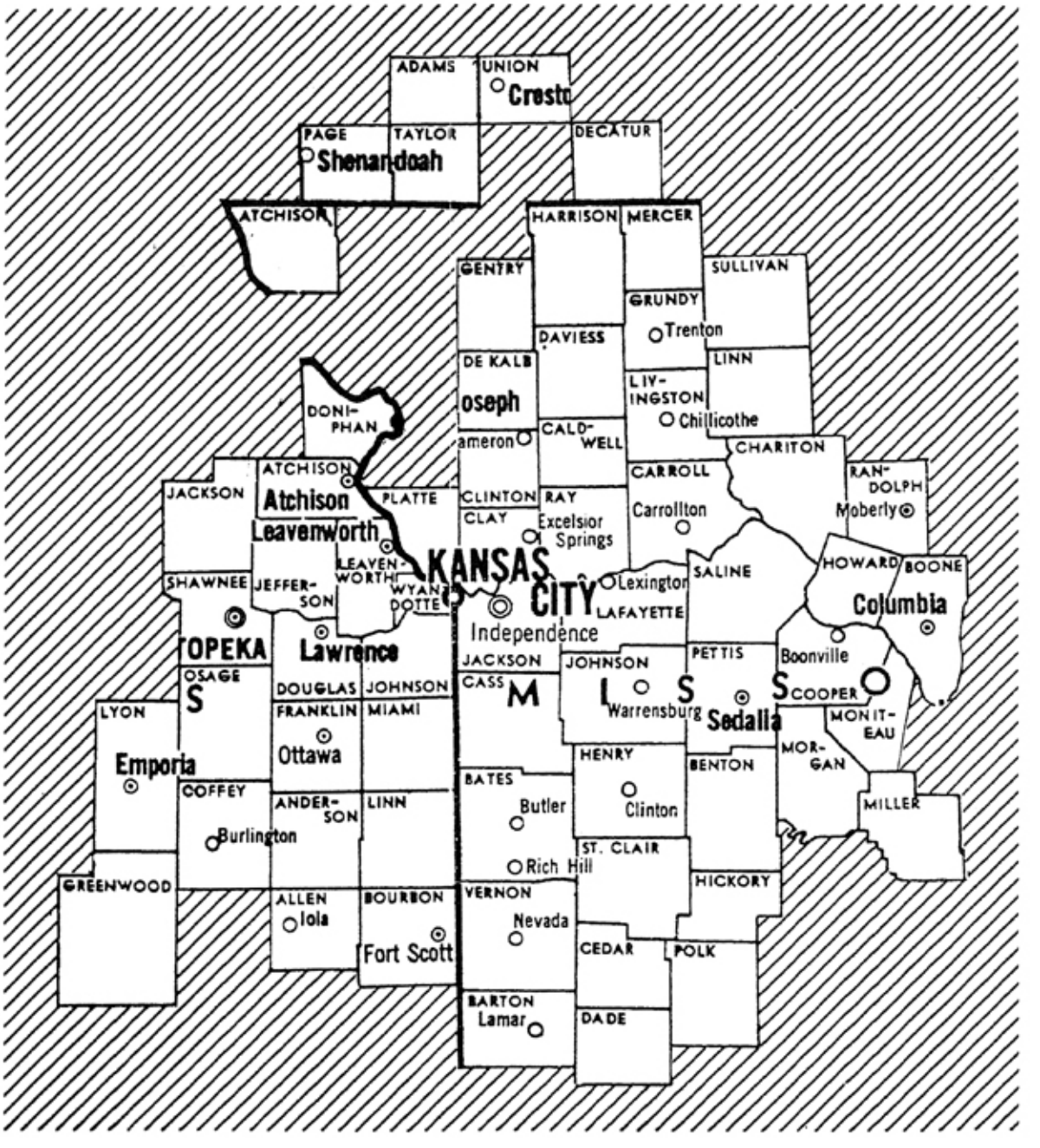


FIGURE 1. THE KANSAS CITY MILKSHED

consider then, some of the physical characteristics of the Greater Kansas City Milkshed.

The milkshed is composed of those counties from which producer milk is received by handlers in the Greater Kansas City Milk Marketing Area. For the period under study, July 1, 1956, to June 30, 1957, this area was composed of five Iowa counties, 19 Kansas counties, and 40 Missouri counties. The northern boundary is about 150 miles from Kansas City. The eastern and southern boundaries are approximately 130 miles away and the western border is about 75 miles from the city (Figure 1).

The area as a whole has relatively fertile and productive soils. Summit silt loam is the predominating type—followed by Shelby silt loam. The southwestern edge of the area is hilly, as is the southeast. Most of the remainder is gently rolling to rolling, although the northeast boundary is perhaps better described as rolling to hilly.

In the southwest portion of the area the normal annual rainfall is 33 inches; in the southeast it averages 42 inches.[9] The figure for northwest Missouri is 32; and in the extreme north end of the area, 38.[10] In the southwest corner of the milkshed, the growing season is 193 days; in the north, 170; and in the southeast, 180.[11]

The average summer temperature (June through August) for the area is 70° to 80°. During the winter (December through February) it ranges between 20° and 30° in the area roughly north of the Missouri and Kansas Rivers, and from 30° to 40° south of the rivers.[12]

Physical characteristics such as these afford a number of crop alternatives. Alfalfa is raised throughout the area although much of the soil requires treatment. Bluegrass predominates, except in the southwest part, where bluestem grasses are found. Most dairymen, however, supplement their permanent pastures with temporary ones, usually small grains and Sudan grass.

Cash-grain farming is concentrated in the river bottoms and south of Kansas City and Atchison. There are a number of orchards and vineyards around St. Joseph and on the Missouri River bluffs east of Kansas City. Another rather heavy concentration of orchards extends northeastward from the Missouri River into Chariton county. For truck farming the main area of concentration is just southeast of Kansas City, though it also may be found in a small section of Vernon County near Nevada, and extending northwest of Kansas City on both sides of the River.

Although cash crops contribute substantially to the total farm income of the area, the major portion comes from livestock enterprises. The hog population is concentrated on the Marshall soils—where the most corn is grown. This is north and west of Kansas City and in the Missouri River counties. Beef production is also concentrated in the Marshall soil area, and, in Missouri, only slightly less so on the summit soils south of Kansas City. Beef cattle are found in fairly large numbers, however, throughout the Iowa-Missouri area. The pattern is somewhat different in Kansas. Here again the beef cattle population is

[9]Kansas Agricultural Experiment Station and Kansas State Planning Board, *Agricultural Resources of Kansas*, Vol. XXI, No. 10 (Manhattan, Kansas: Kansas State College of Agriculture and Applied Science, 1937), p. 86.

[10]Conrad H. Hammer, Walter J. Roth, and O. R. Johnson, *Types of Farming in Missouri*, Research Bulletin 284, 3 rd ed. (Columbia, Missouri: University of Missouri College of Agriculture, Agricultural Experiment Station), p. 41.

[11]*Agricultural Resources of Kansas*, p. 86; and Types of Farming in Missouri, p. 45.

[12]United States Department of Agriculture, "Climate, Temperature, Sunshine and Wind," *Atlas of American Agriculture: Physical Bases Including Land Relief, Climate, Soils, and National Vegetation* (Washington: Government Printing Office, 1936), p. 7.

most dense on the Marshall soils but, in addition, beef cattle are found in large numbers in the southwest section of the area—the bluestem region of Kansas (Lynn and Greenwood counties), and in Osage, Coffey, Franklin, and Bourbon counties. The greatest concentrations of dairy cows are in Johnson, Lafayette, and Pettis counties east of Kansas City, directly south of Kansas City and Atchison, and along the southeast border of the area.

Belonging perhaps as much to the category of economic and social characteristics as physical, but exerting an obvious influence on the milk supply, is the population distribution over the area. The major population concentration is in the cities of Kansas City, Mo., and Kansas City, Kans., and their suburbs. Approximately three-quarters of a million people live here. Topeka, with a population of approximately 84,000 is the second largest city.

## THE REPRESENTATIVE DAIRYMAN

The representative dairyman (in some parts of the study these producers are referred to as Strata I though V), at 45.5 years of age, is farming 325 acres, 141 of which are rented and 184, owned. Ninety-five percent of his gross income is received from farming; and 5 percent from other sources. The most common source of non-farm income is wages earned by his wife; the next most common, from trucking for hire. Of his farm returns, 75 percent is supplied by his dairy project.

**Herd Size and Production Per Cow.** The typical dairyman had a dairy herd of about 27 cows in 1957, having added four to his herd in the past three years (a yearly increase of 5 percent). He planned to have a herd of 35 cows by 1967—a rate of planned expansion equal to only one-half of the expansion rate in the past three years.

At the time of conversion to Grade A milk production, he had a herd of 16.4 cows. The year following, he added 3.4, giving him a herd of 19.8; the succeeding year, 2.8 more were added, for a total of 22.6—a two-year increase of more than 37 percent. These additions were made to increase his net income, to more fully utilize buildings, facilities, and labor, and to build up his herd to the size that his farm would best support. The desire to hasten retirement of debt incurred in making the change-over appears to have had but a negligible influence in spurring the increase. When external financing was used, banks were the most common source of credit; Production Credit Associations ranked second.

An average of 2.5 family members had previously contributed to the dairy enterprise, compared to 2.2 in 1957. The number of hired work days (eight hour day equivalents) averaged 74 per farm at the time of interview, compared to 54 per farm three years earlier. In 1954, 57 percent of the dairy farmers used some hired labor. During the sample year this figure was 66 percent.

With existing labor and facilities, the representative dairyman could add about seven cows to his herd. These additions would increase his profits, he be-

lieves, and he plans to make them as good-quality heifers come into production. This average figure of seven does not present complete information because a few individuals proposed large increases in herd size that raised the average to this magnitude. More than 36 percent said that they could not add any cows. Sixty percent of these gave labor as the limiting factor; 20 percent said limited cooler space prevented further additions; 10 percent gave limited barn facilities as a reason and another 10 percent, limited acreage of land.

Along with the increase in cow numbers per farm, there has been an upward trend in production per cow. This is attributed, in part, to more selective culling, closely followed by better breeding and better feeding. Artificial insemination was given the most credit for the higher quality of replacement stock. Improved pastures furnished the major part of the gains due to better feeding. Next in importance was higher-quality roughage.

The representative dairyman raises his own replacement stock in the belief that this method is more economical and, at the same time, lessens the possibility of his herd contracting disease. He used artificial breeding to improve cow quality, and his breeding program is so planned that slightly over 60 percent of the herd freshens in the fall months.

Even though his cow numbers have increased and plans call for further increases, he still uses cans to handle his milk and does not plan to install a bulk tank because of the cost. He is undecided as to whether or not he would make this installation if such were a requisite for selling grade A milk in the Kansas City Market.

**Other Enterprises.** Next to the dairy enterprise, cash grain crops, largely wheat, contribute most to net farm income. Following next in importance is the hog enterprise, then, beef production. This is not to say that most dairymen have one or all of these other enterprises. The number of dairymen having beef herds has decreased 7 percent in the past three years; at present (1957) only 16 percent engage in this activity. Herds of these dairymen furnish an average of 20 percent of their owners' net farm incomes in 1957, compared to about 29 percent three years earlier.

The number of dairymen owning swine herds decreased 10 percent, between 1954 and 1957, making a total of 33 percent presently engaged in this enterprise. Hog raising furnished an average of about 18 percent to their owners' net farm incomes, compared to 22 percent three years earlier.

Between 1954 and 1957 there was no change in the percentage of dairymen that raised cash-grain crops. Over 60 percent reported some income from this source. There was but a slight decrease in the amount that this enterprise contributed to the net farm income of the cash crop producer—an average of about 23 percent in 1957, compared to 25 percent three years earlier.

The importance of the contribution of other minor enterprises such as sheep and poultry to net farm income is also waning—from a very small fraction to an even smaller one.

Thus, for these farmers, dairying is becoming more important relative to other farm enterprises. The dairyman is becoming more specialized.

The representative dairyman, then, does not have a hog or beef enterprise, nor does he plan to adopt either as long as he is in dairying. With the same investment and labor, he does not believe that he could have made more profit this year in any other farm enterprise. He is in dairying because it yields a steady and stable income, his farm is best adapted to the enterprise, and he knows and enjoys this type of work.

He intends to produce all the hay and silage and most of the grain for his herd. Yet, according to his reports, failure to produce enough feed has little, if any, effect on milk production—totally, or per cow. He does not know with any degree of certainty the production of individual cows, but believes that current production per cow, as well as current herd size, is rather close to the most profitable level.

He does not feed green chop, nor does he think the practice worthwhile for him; moreover, he doubts that it would ever be practical because of the amount of labor, machinery, and equipment required. He has no plans for irrigating pastures because he does not feel that a water supply sufficient for this purpose could be developed at a reasonable cost. His pasture improvement programs are influenced little by milk prices.

**Response to Prices.** Milk prices, according to the producers' statements, do not affect the quantity of concentrates fed; nor does the price of concentrates influence this very much. As prices fluctuate among feed grains and protein supplements, he does but little substituting: rather he adheres to a favorite ration, paying little attention to price. Some dairymen feed each cow the same amount regardless of size or production. Others feed on a production basis: the higher the production, the larger the ration fed and vice versa. By and large, the dairymen under study belong to the latter group. Ordinarily, the volume of concentrates fed per cow is determined by "rule of thumb." Roughly, so many pounds of concentrate are fed per gallon of milk produced.

The average dairyman does not actually endeavor to change production per cow because of a price change in milk; nor does he quickly shift from one enterprise to another in response to price changes. When he enlarges another enterprise, he does not do so at the expense of a reduced dairy herd. This greater farm output is achieved by working longer hours, by using more family and hired labor, and by greater expenditures for capital equipment.

Producers indicated that veal prices had little influence on the length of time that calves were permitted to nurse, nor did they influence the number of replacement heifers kept to any great extent. Milk prices had some influence on these two factors, but very little. In determining herd size, the price of milk gets but scant attention. The price of milk does, however, receive more consideration than the price of dairy cows, beef cattle, hogs, grain or roughage. The prices of

beef cattle and/or hogs were given the least weight in influencing the production decisions of the average dairyman.

A dollar per hundredweight increase in the producer price of Grade A milk would not cause the average dairyman to alter output if the change was to last only six months.[13] Even a long-run price increase of this amount would induce only slight alteration in his production plans. Neither would he increase output with a decrease in the price of milk.

Grade A milk prices would have to drop by about one dollar per hundredweight over a long-run period, from the average price that he has received for the last three years, before he would make a complete withdrawal from dairying. Upon exit, farming would be continued, and beef cattle or hogs, or a combination of the two, would be the substitute enterprise adopted.

The responses indicate that the average—or perhaps, more precisely, the typical—dairyman is relatively impervious to price changes. This is not to say, however, that all producers are insensitive to such changes. There is a certain inertia that must be overcome to alter supply if it is stationary, or to change its direction and velocity if it is increasing or decreasing. For a majority of the dairymen the profit prospects, or the prospects of loss, must be of a fairly large magnitude to overcome the inertia and costs of change to alternative enterprises.

When considering these data it should be kept in mind that they represent the estimates of dairymen now engaged in Grade A milk production. They do not take into account the reactions of farmers not in Grade A dairying but who might be induced to enter this business if prices should become sufficiently attractive. This is especially true of persons now producing manufacturing milk in the Kansas City milkshed. Nor was this study designed to provide information as to the attitudes of these people toward entering the Grade A market.

This typical dairyman watches prices only occasionally in other Grade A markets and prefers to dispose of his milk in a market that employs a base-excess pricing program as opposed to one which offers no seasonal pricing or a take-off pay-back plan. He did not know the percentage of the market's milk used in Class I in the last pay period, but he expects total Class I utilization to increase slightly for the next ten years—a conclusion based on expected population increase.

*Cooperative Membership and Outlook.* Because of the time involved, his relatively small herd, and the cost, he is not nor has he ever been a Dairy Herd Improvement Association member. He is a member of a producers' marketing association, however, and attends the annual meetings if time allows. He believes that the association gets a better price for his milk, that it insures fair tests and weights, and that it guarantees an outlet.

He places only a moderate degree of confidence in outlook statements. As a tool in shaping future plans, both short-and long-run, they are little used.

[13]Throughout the study, all hypothetical price changes in milk are assumed to be in addition to certain or reasonably certain price changes due to seasonal fluctuations in supply.

It is his belief that, during the next ten years, income from dairying will be a little better than that from other farm enterprises but somewhat unfavorable compared to non-farm jobs. He is not satisfied with current Grade A milk prices, nor does he think they are "fair" when compared to the retail price of milk, or the prices of things purchased by farmers. Yet, as a means of bolstering milk prices, he does not favor blocking the entry of new producers into the Grade A market. Milk prices are fair, he believes, when compared to the prices of other farm commodities.

Once started, the average dairyman has never discontinued the dairy enterprise. For 17.5 years he has been continuously engaged in dairying, and his present plans are to remain in this line indefinitely. For 12.5 years he has been producing Grade A milk. Although he indicates that he is selling in the Kansas City Market because it is his only available Grade A outlet, he states that he would not consider changing markets. He was not selling Grade A milk before his entry into this market and, following entry, has sold there continuously.

These producers have increased their dairy herds during the last three years at a rate of 5 percent per annum. This increase came at the expense of reductions in the size of other enterprises or off-farm work; but it was not a proportionate reduction. Over 60 percent of those who have made increases in their herds in the last three years have not reduced the absolute size of any other enterprise. Repeatedly the dairymen commented that they were working harder and longer hours. This factor, along with the fact that their children are older and thus able to contribute more to family labor, accounts for about 60 percent of the reasons given for their being able to increase output. Dairymen do not use the term "economies of scale" but most of them are well acquainted with the idea that they can increase output without a proportionate increase in inputs. For example, many of them had considered this when they stated that they could increase their herds substantially and yet add nothing to clean-up time. Hence, we have a combination of an increase in labor efficiency and more labor applied, both family and hired.

Capital should not be omitted in a consideration of this increased productivity of labor. Talking to producers throughout the area, the authors acquired the rather strong conviction that as a group, dairymen are resigned to the idea that they will, as time passes, have to accept a smaller and smaller per-unit profit for their product and, without increasing per-unit cost appreciably, market more units. The common ground for agreement as to the most direct and quickest means to this end was the application of capital, or stated differently, the absorption of mechanical technology. Next in order of importance were better feeding and better breeding. Little reliance was placed on the hiring of more labor to achieve a more favorable imput-output relationship. "We will either have to get in or get out" was the expression used by the dairymen to convey the widespread resignation to the idea that they will

have to produce more units with existing labor force and accept smaller unit returns.

See Table 1 for a comparison of the different categories of producers and comparisons with the typical producer (Strata I to V).

**Bulk Handling.** Ninety-four percent of the dairymen in strata I to V used cans to handle their milk. Five percent used bulk tanks and slightly over 1 percent used bulk tanks and pipelines. Twenty-five percent planned to install bulk tanks, and 69 percent did not plan to do so; 6 percent already had them.

Those who planned to install one were doing so for purposes of labor saving and because they believed that it soon would be required for selling in the Grade A market. The reason given next most frequently was that installation would insure a future outlet. Cost was the reason most frequently offered for not planning to install one; this was followed by smallness of herd size, and the intention to quit milking soon. Of those who did not have a bulk tank, 53 percent said that they would not install one even if it were required for selling in the Kansas City market, 42 percent said they would install one, and 5 percent were undecided. As would be expected it was the dairymen in the small-producer stratum that were the most reluctant: 63 percent said that they would not make such an installation. The reasons given for refusal were, in order of importance, (the first reason being very dominant) costs, impracticability (in terms of financial returns) with present and projected herd size, availability of alternative Grade A outlets, and intention to quit milking cows.

At the time of conversion to bulk, the average herd size was 29.4. During the first year after conversion this average increased to 36 cows, and at the end of two years it had reached 37.5, a gain of 23 percent for the first year and 28 percent for the 2 years.

## LARGE QUANTITY PRODUCERS

In theKansas City milkshed there were only 11 producers who had milk receipts of 700,000 pounds or greater during the sample year. (In some parts of the study there producers are referred to as stratum VI). Because of their large production in relation to the other producers, they were sampled 100 percent. Seven were from Missouri and four were from Kansas. The majority were quite close to Kansas City; four from Jackson County, Mo.; one from Johnson County, Mo.; and two from Johnson County, Kans.

The average large producer was 44 years old, had been in dairying 17.5 years, had produced Grade A milk 12.8 years, and had been producing fluid milk for the Kansas City market 11.6 years. He farmed more acres than the average dairyman, almost 1,000 acres, compared to 325 for the average dairyman; yet, he obtained exactly the same average percentage (95) of his gross income from farming. Dairying accounted for a larger share (86 percent) of his net farm income than it did for the other producers (75 percent).

TABLE 1--A COMPARISON, BY CATEGORY, OF PRODUCER CHARACTERISTICS

| | | Current Producers | | New | Past | All |
|---|---|---|---|---|---|---|
| | | Strata I to V | Stratum VI | Producers | Producers | Producers |
| Number of producers in the sample | | 80 | 11 | 10 | 20 | 121 |
| Number of producers in the population | | 2,349 | 11 | 247 | 402 | 3,009 |
| Percentage of all producers | | 78.07 | 0.37 | 8.21 | 13.36 | 100 |
| Sampling fraction | | .0341 | 1.00 | .0405 | .0498 | |
| Expansion factor | | 29.360 | 1.00 | 24.7005 | 20.1005 | |
| Percentage of total producer receipts | (sample) | 89.09 | 2.04 | 5.94 | 2.92 | 99.99 |
| | (actual) | 86.78 | 2.07 | | | 100 |
| Yearly producer receipts | (sample) | 405,850. | 9,295 | 27,070 | 13,324 | 455,538 |
| (1,000 lbs.) | (actual) | 399,906 | 9,295 | | | 460,834 |
| Mean yearly receipts | (sample) | 172,790 | 844,986 | 109,595 | 33,143 | 151,391 |
| (lbs.) | (actual) | 170,245 | 844,986 | | | 153,152 |
| Herd size (mean) | | 26.7 | 104.4 | 24.1 | 22.6 | 26.2 |
| Yearly production per cow | (adjusted)* | 6,631 | 8,147 | 5,866 | 6,117 | 6,572 |
| (lbs.) | (unadjusted)** | 6,479 | 8,097 | 5,648 | 5,885 | 6,372 |
| Producer's age (mean) | | 45.5 | 44 | 37.8 | 51.8 | 45.7 |
| Years in dairying and | | 17.5 | 17.5 | 6.9 | 21 | 17.1 |
| number of exits during this time (mean) | | .20 | .45 | .2 | .15 | .19 |
| Years in Grade A production and | | 12.5 | 12.8 | 2.2 | 9.4 | 11.2 |
| number of exits during this time (mean) | | .15 | .09 | .1 | .1 | .14 |
| Years in Kansas City market and | | 12.1 | 11.6 | 1.3 | 8.7 | 10.7 |
| number of exits during this time (mean) | | .04 | 0 | 0 | .05 | .04 |
| Percentage of gross income from farming (mean) | | 94.9 | 95 | 92.5 | 88 | 93.8 |
| Percentage of gross income from dairying (mean) | | 75.3 | 86.4 | 74 | 69 | 74.4 |
| Acres farmed (mean) | | 325 | 952 | 226 | 285 | 314 |
| Acres owned (mean) | | 184 | 612 | 130 | 142 | 175 |

* Figures adjusted for producer milk consumed at home.

** Figures unadjusted for producer milk consumed at home.

NOTE: When not specifically indicated otherwise, the figures in thie table are sample estimates.

**Herd Size and Production Per Cow.** These dairymen comprised only 0.36 percent of the market producers but sold slightly over 2 percent of the market's total producer milk. Their mean yearly output differed significantly from that of the other producers, including those of Stratum V who had the next largest yearly production. The large quantity producers not only had large herds; relatively high-producing cows composed these herds. It was estimated that the average yearly output per cow of these producers, when corrected for milk consumed at home, was 8,147 pounds (uncorrected for home consumption, 8,097; Appendix Section II). In this respect they were surpassed only by the producers from Stratum V. The differences between average production per cow in Stratum VI and that of the remainder of the current-producer category was very significant. It was also very significant when compared to the new-and past-producer categories.

For the large quantity producers, there was a significant negative correlation between herd size and average production per cow, indicating that as a farm gets larger, it is more demanding of its management. The number of cows in their herds ranged from 65 to 150 and the average per-cow yearly production ranged, by herd, from 5,223 to 12,150 pounds. The smallest herd had the largest average production per cow and the largest herd had the smallest. A more complete discussion of correlations will be presented later.

Large quantity producers freshened a greater percentage of their cows in the fall than other producers—70 percent compared to 60 percent. To assure himself of better-quality animals and to guard against introduction of disease, the large producer planned to rear an average of 98 percent of all replacement stock. More of these men than of other producers had their own herd bulls. In contrast to other producers who attributed increased per-cow productivity to more selective culling—followed closely in importance by better breeding and better feeding—the large producers gave credit to better breeding as the most important contributing factor. This was followed by better feed (improved pastures receiving the most credit for this type of gain) and then close culling.

These dairymen could add an average of 11 cows to their herds with existing facilities and labor; five, however, could add none. The most important barrier to expansion was labor, followed by limited barn, milking parlor, and land facilities. Those that could add planned to do so; their herds were in a transition stage and will be enlarged as replacement heifers come into production. By far the main deterrent to herd contraction was the investment in buildings and equipment.

Only one of these producers had decreased his dairy-cow numbers during the last three years. Having cut his herd size from 150 to 115 in the last three years, he had the second highest producing herd, on an individual animal basis, in the large-producer group. In adition to managing his dairy enterprise, this producer had expanded his hog enterprise and entered beef cattle production. He

gave labor troubles (cost and quality) as the main motive for contracting his dairy enterprise. Dairying contributed only 60 percent to his net farm income, whereas three years ago it contributed 90.

**D.H.I.A. Membership.** A large percentage of these dairymen were Dairy Herd Improvement Association members—73 percent, compared to only 14 percent of the other dairymen. The eight large producers who were D.H.I.A. members belonged to the organization because, they said, they couldn't afford not to belong. The three who were not members said that they didn't want to be bothered with it. These had an average per-cow yearly production of 6,936 pounds—1,200 pounds less than the average of all the large producers, and over 1,750 pounds less than the average of the large producers when the three were excluded from the group. In either case, the difference was significant. We might conclude, then, that the three large producers who were not members of the Association were paying a rather high price for foregoing services that the Association provided.

**Other Enterprises.** With these dairymen as with the other producers, dairying is becoming more important both relatively and absolutely. Three years before the interview income from dairying contributed an average of 82 percent to the net farm income of these large quantity producers; at time of interview it furnished 86. The average size of herd then was 80 cows; at time of interview it was 104 and plans were to increase this to 108 in 1958 and to 111 by 1962. (One producer with a herd of 150 cows planned to retire by 1962; he was not included for that year's average.) By 1967, when another producer plans to have retired from dairying, the projected average herd size for the remaining nine will be 116 cows.

The percentage of large quantity producers who had other enterprises was practically the same as that of the other producers; however, the percentage that these other projects contributed to net farm income was somewhat different. For example, hog production contributed an average of 25 percent to net farm incomes of the six large producers who raised hogs (this is the same percentage figure and the same number of producers as it was three years before the interviews), compared to 18 percent for the other current producers who had such an enterprise. The figures for cash grain were 15 percent for large producers and 25 percent for the other producers. The importance of beef cattle was the same in both groups (20 percent). For the large producers the number who had such an enterprise and the percentage that it contributed to net farm income had not changed in the preceding three years.

The relative contribution of cash grain crops to the farm incomes of large producers diminished from 22 percent to 15 percent during the three years prior to interview. The corresponding figures for the other producers were 25 and 23 percent. Thus cash grain crops were relatively more important to the main body of producers than to the large producers, and hogs less so. For the large pro-

ducers, then, only cash grain crops experienced a diminution in relative importance. Livestock enterprises increased in absolute, though not relative, importance.

Another difference arising between the main body of producers (Strata I through V) and those in Stratum VI was the amount of labor hired. The nine large producers who hired labor used an average of 938 eight hour days per year. For the main body of producers, 27 (34 percent) hired no labor; those who did hired an average of 112 eight-hour day equivalents. Yet it should be noted that three years before the interviews the producers of Strata I through V hired a total of 4,075 eight-hour day equivalents, whereas during the interview year they hired 5,913. Thus, the amount of labor they were hiring was on the increase. The corresponding figures for the large producers, however, are 8,445 and 8,010, showing a small decrease.

We conclude then, that the large quantity producer in the last three years had increased physical output per unit of labor employed. Mechanization was given credit for this increased productivity by a majority of the producers. In this respect it appears that the large producers have made greater strides toward increased efficiency than the main body of producers.

**Exits from and Re-entry into Dairying.** Another difference between these producers and producers in other groups and categories was the number of exits made from dairying. Five (over 45 percent) large producers after once entering, withdrew from dairying and then re-entered. Each gave a different reason for withdrawal. In one instance the degrading of a barn was the explanation given; one dairyman left the farm for military service; another withdrew when his sons left the farm; a dispersal sale held in order to buy a farm accounted for yet another departure; and personal preference was the reason given for one withdrawal.

Three gave a common reason for reentry; they could make a better living at dairying than at other farm enterprises. Another re-entered after completing his military service. The other returned because he felt that the price of feeder cattle became so high that he was afraid to buy; any fed cattle price change, he felt, would be downward and the probability of losing money would be greater than that of making money.

**Outlook.** Seventy-three percent of the large producers favored some kind of a barrier to entry into the Grade A market, whereas only 36 percent of the other producers favored such a scheme. Generally the restriction proposed amounted to setting up a waiting list and allowing entry when the supply of fluid milk became short as indicated by Class I utilization. However, 45 percent of the large producers said they would like to see the government stop supporting dairy products; for the other producers, the percentage figure was only 24. Ten percent of the large producers thought that the government's role in dairying should be that of stabilizing dairy product prices (28 percent of the other producers gave this answer), and 45 percent indicated that the government should support dairy products, compared to 49 percent for the main body of producers.

The main differences between the two groups of producers—large (Stratum VI) and those in Strata I through V—have been enumerated. We can see that in many respects they are quite different. Analysis of their responses gives further support to the hypothesis that size is the correlator of other attributes. The sensitivity of these producers to price changes is discussed in a later section.

**Bulk Handling.** Tweny-seven percent of these producers used cans to handle their milk, 18 percent used bulk tanks, and 55 percent used bulk tanks and pipe lines; whereas 94 percent of the other producers used cans. Of the large producers who had bulk tanks or bulk tanks with pipe lines, 18 percent said that they could not afford the losses in weight and butterfat that accompanied handling milk in cans, and 36 percent gave labor cost as the primary motive. Time saving, ease of handling, and added assurance of a continued outlet for their milk were other reasons mentioned. Some said that since bulk tanks eventually were likely to become a requirement for selling in the Grade A market, they installed them while there was still a premium for bulk-tank milk.

Only one of the three large producers who did not have bulk tanks planned to install one. He planned to do so as soon as he gained access to a bulk-tank route. The other two had no such plans. Even if bulk tanks were a requisite for selling milk in the Kansas City market, they would not make the installations. One would not do so became of age (he plans to retire within five years) and the other, because he planned to sell his farm (he lived on the outskirts of Kansas City where, he said, taxes prohibited farming).

At the time of conversion to bulk milk production this group of large producers had an average herd of 80 dairy cows. The year following, they increased this 25 percent and in the two years following conversion, they added cows to bring the average herd size to 108 cows, 35 percent increase in two years. Most of the increase in cow numbers was brought about as a result of the wish to use farm and facilities to capacity. Two of the producers said that the desire to hasten the retirement of debt incurred in making the conversion had a great bearing on their decisions; one said this had very little bearing and two indicated that it had no influence at all. For the other producers the gains were not quite as spectacular—at least absolutely. At the time of conversion to bulk the average herd size of the group was 29.4. After 2 years this had been increased to 37.5 a gain of 28 percent for the 2 years.

## NEW PRODUCERS

Because the average new producer (See Appendix for definition) closely resembled the representative dairyman (Strata I through V), the discussion will be concerned chiefly with those aspects in which the two differ. Generally, the new producer was considerably younger. The average age of producers in this category was 38 compared to 46 for the representative producer. He also farmed fewer acres (226 compared to 325), and was less likely to own his own farm (70

percent compared to 86 percent). These producers had been in dairying for an average of seven years, whereas the average dairyman had been engaged in this activity for 17 years. Only 20 percent of the new producers had been in any type of dairying for more than 10 years. Few of them had sold Grade A milk before entering the Kansas City market. Most of them previously had produced manufacturing milk.

**Herd Size.** For the new producers who then had such a project, the average size of dairy herd three years previous to the interview was a little less than 14 cows. At the time of interview they had an average of 24 cows (compared to the average dairyman with a herd of 27) and planned for 32 the next year. By 1962, when 10 percent planned to have withdrawn from dairying, the average herd size of those still in dairying is projected to be 43. Their plans called for no further change in size by 1967. This makes their planned herd ten years from the interview slightly over 16 percent larger than that planned by the average dairyman (43 cows compared to 37).

The new producer, like the average dairyman, raised slightly less than 90 percent of his replacement stock. Eighty percent of the new producers, however, raised all of their replacements; 10 percent purchased all of them; and 10 percent bought one-fourth.

The average per-cow production of new producers was 5,658 pounds annually, compared with 6,479 for producers in Strata I through V, 8,097 for large producers (Strata VI); and 5,885 for past producers.[14] We might logically expect this. Entry into Grade A production is almost certain to be accompanied by rapid build-up in cow numbers. This entails, for most producers, adding poorer quality animals than those already in their herds. Also, most of the new producers had not been in dairying long enough to breed selectively for higher rates of production.

**Other Enterprises.** Forty percent of the new producers were not in dairying three years prior to the interview. Those who were, received an average of 52 percent of their net farm income from this enterprise—compared with 74 percent when interviewed. This was the same as the percentage received by the average dairyman. Three years previously, hog enterprises had contributed an average of 33 percent to net farm receipts of the 60 percent who engaged in this activity. At the time of the interview this enterprise accounted for 25 percent of the net farm income of those who had retained it. Forty percent of the new producers got an average of 64 percent of their net farm receipts from beef production three years previously; when interviewed none had this enterprise. Cash grain contributed a little over 22 percent to net farm income of the 80 percent who raised these crops three years previous to the interview and about the same percentage to the 70 percent of new producers still engaged in this activity at the time of interview.

To the new producer dairying is becoming more important in its contribution to farm income. The number of other enterprises is decreasing, and their

[14]Unadjusted for producer milk consumed at home. The respective adjusted averages are 5,866; 6,631; 8,147; and 6,117 (See Appendix Section II for method of computation).

relative importance in the total farm picture for those who still retain them also is diminishing.

**Outlook.** In reply to the question as to whether they would stay in dairying if they were sure that over the next five years Grade A milk prices would be unfavorable, 70 percent of the new producers indicated that they would remain, whereas 41 percent of the dairymen in Strata I to V gave this answer. When asked if they would remain in dairying if they were denied privileges of the Grade A market and were forced to sell at manufacturing milk price levels, 50 percent of the new producers indicated their willingness to remain; 36 percent of the dairymen in Strata I through V said they would do so; but only 18 percent of the large producers (Stratum VI) replied affirmatively.

New producers, supplying an estimated 5.9 percent of the market's producer milk, and representing 8.2 percent of all producers, were in dairying because they liked the work, it furnished them a stable and steady income, it yielded a better income than other enterprises, and their farms were best adapted to this enterprise. They seemed more determined to remain in dairying than any other category under study.

**Bulk Handling.** Ten percent of the new producers used bulk tanks to handle their milk, and 90 percent used cans. Of the producers in Strata I through V, 94 percent used cans, 5 percent used bulk tanks; and 1 percent, bulk tanks and pipe lines. One-third of the new producers who did not have bulk tanks planned to install them to save labor and to provide for a more certain outlet. Two-thirds did not plan such an installation, principally because of the cost. Other reasons given, in order of importance, were their status as renter rather than owner, their age, and their small herd. When asked if they would install a bulk tank if it should be required for selling in the Kansas City market, about 45 percent replied that they would not, giving these reasons (in order of importance): the cost; availability of an alternative Grade A market; and smallness of herd size. In this respect, as in most others, new producers were quite similar to the producers in Strata I through V.

## PAST PRODUCERS

### General Description.

Twenty past producers (see Appendix for definition) were selected randomly from the population of 402. Forty-five percent came from Missouri and 55 percent from Kansas. The actual distribution of the past producers in the parent population was 0.25 percent from Iowa, 49.25 percent from Missouri, and 50.5 percent from Kansas. They represented 13.36 percent of all producers in the Kansas City market during the sample year, but they produced only an estimated 2.9 percent of its total producer milk.

These past producers were selected for study, not because of their relative contribution to production, but because they represented a group which had

made a negative supply response. Most farmers who remain in dairying are quite rigid in their production adjustments but this does not mean that no adjustment will be made. Current producers may discontinue operations or new producers may enter the field.

The average past producer at the time of market withdrawal was 52 years old. He farmed 285 acres—143 were rented and 142 owned. His average herd was composed of 22.6 cows, near the average size of the herds in the stratum that contained the modal group of current producers, but four less than the average of the producers in Starata I thorugh V. It was also somewhat smaller than that of the new producers. Eighty-eight percent of his gross yearly income came from farming; 69 percent, from dairying. He had been in dairying for 21 years and had been selling Grade A milk in the Kansas City market for 8.7 years. Production for the market had been continuous since entry.

Eighty-five percent of the past producers were still farming, however large or small the scale and whatever their stage of retirement or semi-retirement. However, only half of them were full-time farmers depending altogether on their farm output for a livelihood; one-fourth were retired or semi-retired; the other fourth had full time non-farm jobs, although some of these still lived on the farm and managed side-line enterprises.

Of all the market withdrawals, 25 percent still had a dairy enterprise. Three-fifths of these sold Grade A on other markets, and two-fifths, manufacturing milk. These producers will be more fully discussed later as current non-market producers.

Thirty-five percent of all past producers stated that they could not make an acceptable level of living dairying. As a group, they were the youngest of the past producers and, compared to the average dairyman, had not been milking long.

Ten percent withdrew when sons left the farm. Age and/or poor health accounted for 20 percent of the exits and better non-farm alternatives, 5 percent. Twenty-five percent of the producers were dropped by their handlers, and 5 percent transferred to other markets. Part of the incentive inducing change to other markets was the belief that they would not require bulk tanks as soon as Kansas City. The availability of social security benefits made it possible for several of the older dairymen to withdraw from dairying, and to partially retire from farming.

Those who withdrew from the Kansas City market because they were dropped by their handlers had relatively small herds (average, 23.4 cows) and were rather old (average, 59 years). Two-fifths of these producers retired, or partially retired, after the incident. One of the past producers who withdrew from the market because of age and/or poor health was only 37 years old. The remainder were over 64.

For a comparison of past producers with new and current ones, see Table 1.

## Past Producers Grouped According to Occupational Status

*Group I—Full-time farmers who had a dairy enterprise.* Twenty percent of all the sample market withdrawals were in this group. Three-fourths of these were selling Grade A milk on another market; and one-fourth, manufacturing milk. Over half of those selling Grade A to other markets were dropped by their Kansas City handlers.

*Group II—Full-time, non-farm workers who had a dairy enterprise.* Only one past producer (5 percent of the sample) was in this category. He had a full-time, non-farm job, yet had retained his dairy herd. This dairyman was employed full time at his present job before he made his market withdrawal. By far the larger portion of his disposable income came from his non-farm job, and he doubted the wisdom of maintaining a small herd and producing for a low-return market.

*Group III—Full-time farmers with no dairy enterprise.* They comprised 30 percent of all the market withdrawals. Their predominating farm enterprises were beef and grain.

Two-thirds of the producers in this group dropped dairying because it did not, they said, yield an acceptable level of income. This complaint seemed to be based on low returns to their labor. They said that their present enterprises yielded at least as good an income and required much less labor.

One producer in this group quit milking because of poor health. As an alternative, he adopted beef and cash-grain crops because, in his opinion less work was involved and the income was greater. Two-thirds of the producers in this group stated that they would not return to dairying if they could make a living any other way.

One-third withdrew because their sons left the farm. They said they would re-enter dairying if their boys returned; otherwise they would not.

*Group IV—Past producers who had withdrawn completely from farming and who had full-time, non-farm employment.* This group represented 15 percent of the total exits. All gave as their motive for market withdrawal the inability to make a living with a dairy enterprise.

*Group V—Full-time, non-farm workers having a non-dairy farm enterprise.* There was only one producer (5 percent of the sample) in this group. He had sold most of his farm land, but had retained 40 acres on which his home was located. He operated a small beef cattle enterprise. Before he withdrew from dairying he was working full time at his present non-farm job. He has no disposition whatever to re-enter dairying. This farmer had the highest-producing herd in the past producer sample—an average per-cow production of 9,642 pounds of milk per year. This past producer was marginal in an opportunity-cost sense as opposed to the marginal producers who could not make an acceptable level of living by dairying. He could make a good living in the dairy business but thought he could do even better at his non-farm job.

TABLE 2--PAST PRODUCERS CHARACTERIZED AS A WHOLE AND BY GROUP

n = 20; f = 0.04975; g = 20.1005; N = 402

| Attributes of Past Producers at the Time of Market Withdrawal | | All Past Producers in the Sample | Group I | Group II | Group III | Group IV | Group V | Group VI |
|---|---|---|---|---|---|---|---|---|
| | | n = 20 | n = 4 | n = 1 | n = 6 | n = 3 | n = 1 | n = 5 |
| Producer's age | Range | 32-78 | 45-50 | | 32-59 | 35-48 | | 64-78 |
| | Mean | 51.75 | 47.00 | 58.00 | 42.33 | 43.00 | 56.00 | 70.00 |
| Herd size | Range | 12-43 | 14-43 | | 14-38 | 20-30 | | 12-19 |
| | Mean | 22.6 | 27.2 | 22.0 | 24.8 | 24.00 | 20.0 | 16.0 |
| Acres farmed | Range | 80-880 | 160-880 | | 156-550 | 100-160 | | 95-360 |
| | Mean | 285 | 465 | 80 | 392 | 136.66 | 110 | 178 |
| Acres owned | Range | 0-560 | 80-560 | | 0-510 | | | 95-360 |
| | Mean | 142 | 220 | 80 | 158 | 6 | 40 | 178 |
| Acres rented | Range | 0-550 | 80-420 | | 0-550 | 100-160 | | |
| | Mean | 143 | 245 | 0 | 234 | 136.66 | 70 | 0 |
| Percentage of gross income from farming | Range | 35-100 | 50-100 | | 100 | 35-100 | | 90-100 |
| | Mean | 88 | 80 | 50 | 100 | 66.66 | 100 | 98 |
| Percentage of gross income from dairying | Range | 30-100 | 30-60 | | 30-100 | 35-100 | | 30-100 |
| | Mean | 69 | 40 | 35 | 65.8 | 66.66 | 100 | 74 |
| Years in dairying | Range | 2-60 | 10-30 | | 2-28 | 6-20 | | 14-60 |
| | Mean | 21 | 20.25 | 35 | 10.16 | 13 | 10 | 38.6 |
| Years producing grade A milk | Range | 2-26 | 5-25 | | 2-6 | 2-6 | | 7-26 |
| | Mean | 9.4 | 13.75 | 15 | 4.16 | 4.66 | 10 | 13.8 |
| Years producing for the Kansas City Market | Range | 2-26 | 5-19 | | 2-6 | 2-6 | | 7-26 |
| | Mean | 8.7 | 10 | 15 | 4.16 | 4.66 | 10 | 13.8 |
| Percentage that owned no land | | 25 | 0 | | 10 | 100 | 0 | 0 |
| Percentage that rented no land | | 40 | 0 | | 10 | 0 | 0 | 100 |

*Group VI—Past producers now retired or semi-retired.* All lived on farms which they owned. Their average age was 70, the youngest being 64. Two retired after they were dropped by a handler and three, because of old age or old age and poor health. Sixty percent (three) of the group said that social security benefits made it possible for them to retire or to partially retire. These producers represented one-fourth of the total market exits; because of their age, reentry is highly unlikely.

## Reasons for Exit from the Market.

Reason I in Table 3 shows information concerning producers who left dairying because it did not yield them an acceptable level of income.

Note that their herds were small and that their average production per cow was the smallest of any group or sub-group in the study. Yet dairying furnished two-thirds of their gross income. Thus, it is not hard to ascertain why they were so disgruntled with their dairy enterprise: it would be difficult to realize any profit on such low-producing herds.

There are some individuals in every line of endeavor who, because of their personal make-up, are ill-adapted to it. In this particular case they are the ones who make up the top rungs of the dairy industry's cost ladder. Once induced to shift out of this line, both the individual and society are benefited.

The main reason that handlers dropped some of their producers was that the producers were located far from the plant and had small herds. Given the distance from the market, larger pick-ups per stop reduce unit costs. For this reason, handlers prefer large producers. There also may be another reason. It may be that large producers furnish, on the average, a higher quality product than do smaller ones. The time involved to effect sanitary measures is subject to economies of scale. All dairymen are concerned about a market for their milk. This concern manifests itself in large measure through the quality of milk sold. Because of the absolute loss that a large producer would incur if he lost his Grade A outlet, his concern may be greater than that of the small dairyman.

TABLE 3--PAST PRODUCERS CHARACTERIZED ACCORDING TO THE REASON GIVEN FOR MARKET WITHDRAWAL

| Producer Characteristics | | Reason I* | Reason II** | Reason III† | Reason IV†† | Reason V‡ | Reason VI‡‡ | All Reasons |
|---|---|---|---|---|---|---|---|---|
| Number and percentage of past producers | Number | 7 | 5 | 4 | 2 | 1 | 1 | 20 |
| | Percentage | 35 | 25 | 20 | 10 | 5 | 5 | 100 |
| Age | Range | 32-50 | 45-73 | 37-78 | 52-59 | | | 32-78 |
| | Mean | 40.7 | 58.6 | 61.25 | 55.5 | 56 | 45 | 51.75 |
| Herd Size | Range | 8-37 | 12-43 | 17-20 | 24-38 | | | 14-43 |
| | Mean | 21.9 | 23.4 | 18.3 | 31 | 20 | 27 | 22.6 |
| Production per cow Lbs. per year | Range | 3508-5314 | 4819-8412 | 2314-7072 | 8813-8938 | | | 2314-9642 |
| | Mean | 4294 | 6381 | 4316 | 8862 | 6574 | 9642 | 5885 |
| Years in dairying | Range | 2-20 | 20-47 | 14-60 | 4-28 | | | 2-60 |
| | Mean | 9 | 35.6 | 28.75 | 16 | 10 | 21 | 21 |
| Years producing Grade A milk | Range | 2-6 | 7-25 | 5-26 | | | | 2-26 |
| | Mean | 4.4 | 15.2 | 14.5 | 4 | 10 | 5 | 9.4 |
| Years production for the K. C. Market | Range | 2-6 | 7-19 | 5-26 | | | | 2-26 |
| | Mean | 4.4 | 15.2 | 14.5 | 4 | 10 | 5 | 8.7 |
| Percentage of gross income from farming | Range | 35-100 | 50-100 | 90-100 | | | | 35-100 |
| | Mean | 78.6 | 84 | 97.5 | 100 | 100 | 100 | 88 |
| Percentage of gross income from dairying | Range | 35-100 | 30-75 | 30-100 | 50-90 | | | 30-100 |
| | Mean | 66.4 | 46 | 73.75 | 70 | 100 | 30 | 69 |
| Acres farmed | Range | 100-550 | 80-500 | 95-420 | 395-510 | | | 80-880 |
| | Mean | 208 | 284 | 198 | 452.5 | 110 | 880 | 285 |
| Acres owned | Range | 0-156 | 80-360 | 95-180 | 160-510 | | | 0-560 |
| | Mean | 33.7 | 168 | 123 | 335 | 40 | 560 | 142 |
| Acres rented | Range | 0-550 | 0-420 | 0-300 | 0-235 | | | 0-550 |
| | Mean | 194.3 | 116 | 75 | 117.5 | 70 | 320 | 143 |
| Per cent that owned no land | | 71.42 | 0 | 0 | 0 | 0 | 0 | 25 |
| Per cent that rented no land | | 14.28 | 60 | 75 | 50 | 0 | 0 | 40 |

*Reason I: Dairying did not yield an acceptable level of income.
**Reason II: Dropped by handler.
†Reason III: Age and/or poor health.
††Reason IV: Son left farm.
‡Reason V: Favorable price differential at another market.
‡‡Reason VI: Better non-farm alternative.

NOTE: Production figures were secured from the Market Administrator's Office for that part of the year that milk was sold in the Kansas City market, then adjusted to a yearly basis by applying a weighted multiplier (Table 21). The figures are not adjusted for producer milk consumed at home.

## PRODUCERS WHO REDUCED THEIR HERDS IN PREVIOUS THREE YEARS

In the previous three years, about 14 percent (11) of the main body of producers (Strata I through V) had reduced their herd size by an average of 34 percent. The reasons given for reduction were, in order of importance, better opportunities in other farm enterprises, disease in the herd, attempt to increase net income, changing breeds (going to registered stock of different breed or culling yellowhammers), more attractive opportunities in non-farm work, and labor troubles. It is immediately evident that these causes were not mutually exclusive. All reductions were, in the final analysis, attempts to increase net income. None of these producers planned for a very large herd. Two of them plan to withdraw from dairying by 1967. The largest herd projected for that time is 50 cows. Average herd then, according to the projection, will be a little less than 30 cows, compared to slightly over 20 at time of at time of interview.

One producer from Stratum VI, because of labor troubles, had reduced his herd in the last three years from 150 to 115—a decrease of about 25 percent—and planned a further decrease to a 100-cow herd, a level he planned to maintain.

Producers who had decreased their herds within the previous three years had higher production per cow than the average for their stratum. For example, in Stratum I, the average per-cow production was 4,650 pounds of milk per year, compared with 5,397 pounds for all the producers who reduced their herd size and 5,804 pounds when producers who had disease in their herds were omitted. In Stratum II, the average production was 6,121 pounds, compared with 6,809 for those who decreased their herds, and 7,609 when those producers with diseased herds were not counted. For Stratum III, the respective figures are 7,737 and 8,417; and for Stratum VI, 8,147 and 10,335.

With a probability coefficient set to equal 0.05, the difference between the average production figures in the strata and the corresponding sub-strata is in none of these cases significant. However, it would seem that differences of these magnitudes in all four strata cannot be dismissed as meaningless. It well may be that these producers have been rather successful in at least partially attaining their objective.

## ATTITUDES TOWARD PRODUCTION ADJUSTMENT IN RESPONSE TO CHANGES IN THE PRICE OF MILK

### Methodology

To arrive at some definite figures which would indicate production response to price changes in milk, elasticity (the percentage change in quantity divided by the percentage change in price) was calculated for each stratum, each category, and for the market. The base price of milk from which the hypothetical price changes were made was the simple average of the weighted annual gross average

values that producers had received for their milk, at average butterfat tests, over the previous three years. This value was calculated to be $4.25 per hundredweight. To avoid hopeless complication, this average figure was used instead of the averages of the prices received at any period in time; for example, in May, September, etc., of the last three years. With a base price of $4.25 a hundredweight, a price change of 20 cents is equal to 4.70 percent; a change of 10 cents, to 2.35 percent; and a change of five cents, 1.17 percent.

Because it was believed that the dairyman thinks more in terms of varying cow numbers than in varying pounds of milk when he considers altering output, the question used to obtain information by which elasticities could be established was phrased in terms of herd size. Then, since the size of each producer's herd was known and his average production per cow had been calculated, if the dairyman said that he would alter his cow numbers by 20 percent, this figure could be converted into a production change in pounds of milk. This was done for each individual, and the results were totaled to obtain the stratum, the category, and the market response.

Although this question concerning alteration of herd size was of primary importance in determining production adjustment in response to price change, another question dealing with percent change in output was also of considerable consequence. It asked the producer to indicate the means by which he would bring about this change in output. He was asked how a 50 cents per hundredweight increase (above the average gross price that he had received for the last three years) in the price of milk would affect his output if he expected this price increase to last (a) less than six months and (b) permanently. Given the following choices, he was to select the one most nearly representing his probable reaction: (a) none, (b) some (5-10 percent), (c) moderately (10-20 percent), (d) significantly (more than 25 percent). The midpoint of the answer given to this question was used to calculate output increases; for example, if the producer said that output would be expanded "some," his production, as determined, earlier would be expanded by 7.5 percent. For a 50-cent price increase, there were no replies indicating a significant change, either short or long-run, so this open-ended (25 percent and greater) answer did not have to be contended with. Answers given to this question contributed about a third to long-run output increases. These increases were about equally divided between better feeding and higher quality animals. When the reply to this question indicated that production changes would be effected by herd enlargement, the percentage figure expressing the amount of change was ignored and this information was obtained from the answer given to the question previously referred to regarding change in herd size. It was because of the belief that farmers tend to think more in terms of varying cow numbers than in varying pounds of milk when they consider altering output that this method was employed in selecting the data to calculate the elasticities.

Since it is the volume of milk marketed that is germane in a supply response study rather than the quantity produced, the production figures used did not include milk consumed in the home. This injects some bias into the study, for as herd size increases, a larger percentage of the total produced will be marketed, and the converse holds as cow numbers are reduced; but the bias is a negligible one.

## Calculated Production Adjustments

According to the producers' replies, a long-run price increase of 50 cents (11.76 percent) would increase the output of the market participants by 5.95 percent, resulting in a supply response to price, or an elasticity of 0.5 (Table 4). Two-thirds of the response came from planned herd additions and one-third from anticipated improvements in feeding and herd quality, each of these contributing approximately the same weight.

The producers in Stratum II seem to have shown the greatest response to this hypothetical price increase. The elasticity figure for these dairymen was 0.99, while dairymen from Stratum V, with an elasticity of zero, were the least responsive. However, because there are only three sample individuals in Stratum V, we cannot place a great deal of confidence in this figure.

For current producers, exclusive of Stratum VI, the elasticity was calculated to be 0.54. Over two-thirds of the response came from projected additions to herds and less than one-third, from better feeding and quality. The producers in Stratum VI indicated an elasticity of only 0.19, all the response being attributable to anticipated improvement in feeding and cow quality. The new producers said that, under these circumstances, they would increase output by a little less than 5 percent, giving them an elasticity of 0.47.

Thirty-one percent of the producers in Stratum I responded positively to the long-run, 50¢ price increase, and 5 percent negatively; from Stratum III, 25 percent positively, and 6 percent negatively. Producers in other Strata (with exception of some new producers) said they would increase production in response to the price increase.

The large producers indicated less planned response to this long-run price increase than did the small producers.

A short-run price increase of 50 cents computed from the answers of the producers gave a projected output increase for the market of only 1.5 percent. This would be an elasticity of 0.13. Slightly over half of the response was due to planned additions to herds; most of the remainder came from better feeding Any lesser short-run price increase would have no effect on output, according to producers' replies. The producers in Stratum II showed the most response (an elasticity of 0.24) and those in Strata III and V indicated none.

A temporary price decrease of 50 cents, answers indicated, would induce the market participants to reduce supply by 1.34 percent. The reduction would come

TABLE 4--SUPPLY RESPONSE TO PRICE CHANGES*

| | Current Producers | | | | New Producers | | All Producers | |
|---|---|---|---|---|---|---|---|---|
| | Stratum I to V | | Stratum VI | | | | | |
| | Change in Output (%) | Point Elasticity | Change in Output (%) | Point Elasticity | Change in Output (%) | Point Elasticity | Change in Output (%) | Point Elasticity |
| Short-run price increase of** | | | | | | | | |
| $.05 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| .10 | | | | | | | | |
| .20 | | | | | | | | |
| .50 | 1.52 | 0.13 | 1.59 | 0.11 | 2.07 | 0.18 | 1.51 | 0.13 |
| Long-run price increase of | | | | | | | | |
| $.05 | 0.14 | 0.12 | | | | | 0.13 | 0.11 |
| .10 | 0.21 | 0.09 | | | | | 0.19 | 0.08 |
| .20 | 0.73 | 0.15 | | | 2.67 | 0.57 | 0.81 | 0.71 |
| .50 | 6.30 | 0.54 | 2.28 | 0.19 | 4.74 | 0.47 | 5.95 | 0.51 |
| Short-run price decrease of | | | | | | | | |
| $.05 | | | | | | | | |
| .10 | | | | | | | | |
| .20 | 0.11 | 0.02 | | | | | 0.10 | 0.02 |
| .50 | 1.50 | 0.13 | | | | | 1.34 | 0.11 |
| Long-run price decrease of | | | | | | | | |
| $.05 | | | | | | | | |
| .10 | 0.10 | 0.04 | | | -0.96 | -0.41 | 0.03 | 0.01 |
| .20 | 2.00 | 0.43 | | | 1.44 | -0.31 | 1.70 | 0.36 |
| .50 | 23.30 | 1.98 | -25.02 | -2.13 | -7.27 | 0.62 | 23.23 | 1.98 |

* Unless a minus sign precedes the figure, all elasticities are positive; that is, price and output changes are in the same direction.

** From the base price.

wholly from four producers in Stratum II, giving an elasticity of 0.33 for this Stratum and 0.11 for the market.

A temporary price decrease of 20 cents would give a market elasticity of 0.02. This response is attributable to one producer in Stratum II. There was no response from any other stratum or category of producers. Any lesser temporary price decrease has a zero elasticity.

According to producers' replies, a long-run Grade A milk price decrease of 50 cents a hundredweight would result in a percentage change in production equal to 23.23, giving a market elasticity of 1.98. Forty-two percent of the producers in Stratum I indicated that they would decrease output, whereas 11 percent replied that they would increase production, giving these dairymen an elasticity of 2.49. For Stratum II, 57 percent indicated that they would decrease production and 11 percent said that they would increase it. This resulted in a net decrease in output of 31.62 percent and an elasticity of 2.71.

For Stratum III, 19 percent indicated a decreased output and the same percentage an increased one, for a net decrease in production equal to 4.01 percent, giving an elasticity of 0.34. Forty percent of the dairymen in Stratum IV indicated that they would increase their output, given this price reduction. The projected increase in production amounted to a change for the stratum of 10.67 percent, giving a negative elasticity of 0.90. Two-thirds of the producers from Stratum V gave responses indicating a decreased output. The percentage change was 60.29; the elasticity, 5.13. For these first five strata, the planned decrease in supply was equal to 23.3 percent (an elasticity of 1.98). The producers in Stratum VI indicated a net decrease of 25.02 percent for an elasticity of 2.13. Fifty-five percent of these dairymen indicated a reduced output; 18 percent, an increased one; and 27 percent, no change.

New producers' responses revealed a net decrease in output of 7.3 percent (an elasticity of 0.62). Forty percent of the sample individuals in this category indicated a change. Three-fourths reported plans for decreased production; one-fourth, for increased output.

In summary, the producers from Stratum III exhibited the least response to the long-run price decrease of 50 cents; the elasticity, according to their replies, was 0.34. The next least response was from new producers, with an elasticity equal to 0.62.

A long-run price decrease of 20 cents will reduce total producer milk for the market by 1.7 percent (an elasticity of 0.36) and a decrease of ten cents, will reduce milk 0.03 percent (an elasticity of 0.01), if producers react as they indicated they would.

### Perverse Elasticities

Some perverse elasticities appear with a long-run, 20-cent price reduction. The producers in Strata I, III, and IV and the new producers, indicated (at this level) a supply response in the opposite direction to the price change, giving

them the following elasticities: -0.13, -0.14, -0.38, and -0.31. With a long-run price decrease of 10 cents only the new producers and with a long-run price decrease of 50 cents only Stratum IV dairymen exhibited net output changes in a direction opposite to the price change.

It is a common argument that a farmer's demand for income is inelastic. Thus, the argument runs, a decrease in the price of a farm commodity results in a greater supply produced. This is supposed to be especially applicable to commodities that furnish the bulk of the income on a majority of the farms where they are produced. The foregoing paragraphs furnish some support to this hypothesis through a small price range. It is only weak support, though, because for the market as a whole the price changes and supply changes were always in the same direction.

To account for the negative elasticities, the following possibilities are offered. It may be that the managerial abilities of these producers are such that they can reduce costs to a point that will permit them to retain an acceptable standard of living even in the face of price drops of this magnitude. And, should they be able only to maintain present costs, smaller per unit profit may be tolerated if operations can be expanded to a large enough scale. Nor can we ignore another factor which undoubtedly plays a part in this kind of response: many of these men have specialized in dairying to the extent that their alternatives may be rather limited.

The new producer may have two particularly strong motives for an inverse supply response to negative price changes: one, he may be anxious to prove himself a success; and two, the new fixed investment may be saddled with a large debt. His response shows that he believes he can at least cover variable cost at a reduced price of 20 cents a hundredweight, and that an increased output will give him more revenue to apply to fixed costs. It will be noted, too, that with a long-run price decrease of 50 cents, the anticipated percentage supply decrease for new producers still is less than that of the other producers. A good part of this reluctance to withdraw, wholly or partially, from dairying can be explained by the newly acquired investment. This hypothesis is substantiated by answers given when the producers were asked what were the main problems incurred in reducing herd size. Fifty percent stated that investment in buildings and equipment or the debt on the new building was the most serious problem and another 40 percent gave these reasons as the next most serious problem.

## Influence of Price Differences, Grade A vs Manufacturing

The following data tabulated from other questions in the schedule support the general validity of the calculated elasticities. Even if the premium for Grade A were no more than 25 cents, 30 percent of the producers said they would continue in the Grade A market. Fifty percent would continue Grade A production with a price spread of 50 cents and two-thirds would do so for a premium of a dollar. The producers from Stratum IV were the most willing to produce

TABLE 5--AMOUNT THAT GRADE A MILK PRICES WOULD HAVE TO FALL PER HUNDREDWEIGHT TO CAUSE A COMPLETE WITHDRAWAL FROM DAIRYING*

| | Less Than $.25 | $.25-.50 | $.50-.75 | $.75-1.00 | $1.00-1.25 | $1.25-1.50 | More Than $1.50 |
|---|---|---|---|---|---|---|---|
| | (Percentage of Producer Replies) | | | | | | |
| Small producers (Stratum I) | 5 | 5 | 16 | 11 | 36 | 11 | 16 |
| Average producers (Stratum II) | 0 | 0 | 14 | 37 | 27 | 14 | 8 |
| Large producers (Stratum VI) | 0 | 0 | 18 | 37 | 0 | 18 | 27 |
| New producers | 0 | 0 | 0 | 50 | 20 | 10 | 20 |
| All producers** | 1 | 1 | 12 | 29 | 31 | 17 | 9 |

* Percentage figures are calculated to the closest whole number.

** Excludes past producers; percentages weighted.

for a small premium, 60 percent saying that the margin needed to be only 25 cents per hundredweight. About 55 percent of the producers in Stratum VI said that a price spread of 75 cents would be incentive enough to produce Grade A milk, and over 90 percent would continue production for the Grade A market with a margin of one dollar.

## Other Considerations Related to Supply Response

According to their replies, a permanent price decrease of $1.25 to $1.50 a hundredweight from the average price that they had been receiving for the last three years would cause over 90 percent of the producers to withdraw completely from dairying. About three-fourths would withdraw, given a $1.00 to $1.25 drop, but only 14 percent would discontinue production altogether in the event of a 50 to 75 cent drop (Table 5).

Ninety percent of the producers said that they did not actually endeavor to alter production per cow because of a price change in milk (Table 6). More affirmative replies (21 percent) were given by the small producers than by other groups, but the difference was not significant (chi-square test).

TABLE 6--PERCENTAGES OF PRODUCERS REPLYING YES OR NO TO THE QUESTION AS TO WHETHER OR NOT THEY ACTUALLY ATTEMPT TO ALTER PRODUCTION PER COW IN RESPONSE TO PRICE CHANGES IN MILK*

| | Yes | No | Total |
|---|---|---|---|
| Small producers (Stratum I) | 21 | 79 | 100 |
| Average producers (Stratum II) | 8 | 92 | 100 |
| Large producers (Stratum VI) | 9 | 91 | 100 |
| New producers | 10 | 90 | 100 |
| All producers** | 9 | 91 | 100 |

* Percentages given to the closest whole number.

** Past producers excluded; percentages weighted.

Most of the producers indicated milk prices had little influence on the amount of concentrate fed (Table 7). More producers were influenced by concentrate prices. The smallest producers were influenced more than other groups by concentrate prices in determining the amount to be fed (Table 8). A higher rate of concentrate feeding is made profitable by an increase in the price of milk relative to that of grain. The relationship between feed prices and milk prices varies from time to time. Therefore we would expect those producers who are striving for maximum net incomes to vary their concentrate feeding rate from time to time as these price relationships change. A Cornell study shows that some farmers do make some adjustment.[15] "This study suggests that differences in milk-feed price relationships of more than 5 to 10 percent are of economic significance and that the more able farmers do in time adjust feeding

[15]John W. Mellor and Conrad B. Strauss, *Farm Economics* No. 214, March 1958, Cornell University, Ithaca, New York, pp. 5753.

TABLE 7--THE EXTENT TO WHICH MILK PRICES INFLUENCE THE QUANTITY OF CONCENTRATES FED

| | None | Very Little | Moder-ately | Signifi-cantly | Total |
|---|---|---|---|---|---|
| | Percentage of Producer Replies | | | | |
| Small producers (Stratum I) | 68 | 16 | 11 | 5 | 100 |
| Average producers (Stratum II) | 68 | 19 | 13 | 0 | 100 |
| Large producers (Stratum VI) | 64 | 18 | 9 | 9 | 100 |
| New producers | 80 | 0 | 20 | 0 | 100 |
| All producers** | 74 | 14 | 11 | 1 | 100 |

** Past producers excluded; percentages weighted.

TABLE 8--THE EXTENT TO WHICH CONCENTRATE PRICES INFLUENCE THE QUANTITY OF CONCENTRATES FED

| | None | Very Little | Moder-ately | Signifi-cantly | Total |
|---|---|---|---|---|---|
| | Percentage of Producer Replies | | | | |
| Small producers (Stratum I) | 53 | 11 | 26 | 10 | 100 |
| Average producers (Stratum II) | 51 | 19 | 24 | 6 | 100 |
| Large producers (Stratum VI) | 82 | 9 | 9 | 0 | 100 |
| New producers | 80 | 0 | 20 | 0 | 100 |
| All producers** | 62 | 11 | 21 | 6 | 100 |

** Past producers excluded; percentages weighted.

rates to such differences. Evidence from other studies indicates that many farmers do not vary feeding rates with price conditions. More farmers might profitably learn to vary feeding rates with variation in milk-feed price relationships."

Concerning the influence of productivity per cow on the volume of concentrates fed, the largest producers ascribed the most influence to this factor and the smallest producers, the least. However, the factor was assigned substantial weight by producers in all strata (Table 9).

TABLE 9--THE EXTENT TO WHICH PRODUCTIVITY PER COW INFLUENCES THE QUANTITY OF CONCENTRATES FED

| | None | Very Little | Moder-ately | Signifi-cantly | Total |
|---|---|---|---|---|---|
| | Percentage of Producer Replies | | | | |
| Small producers (Stratum I) | 21 | 5 | 48 | 26 | 100 |
| Average producers (Stratum II) | 16 | 14 | 27 | 43 | 100 |
| Large producers | 27 | 0 | 18 | 55 | 100 |
| New producers | 10 | 0 | 50 | 40 | 100 |
| All producers** | 20 | 7 | 34 | 39 | 100 |

** Past producers excluded; percentage weighted.

Producers were asked how much the price of milk influenced their herd size (Table 10). If by stratum, by category, and by the market the "none" and "very little" replies are counted as "no" answers, and the remaining three choices as "yes" answers, then it was the new producer who gave the largest percentage (50) of "yes" responses and Stratum VI the largest percentage (82) of "no" replies. The general tendency was for dairymen to become less sensitive as their herds got larger. There is no significant difference though between any strata

TABLE 10--THE INFLUENCE THAT MILK PRICES HAVE ON DETERMINATION OF DAIRY HERD SIZE

| | None | Very Little | Some | A Great Amount | Most Important** | Total |
|---|---|---|---|---|---|---|
| | Percentage of Producer Replies | | | | | |
| Small producers (Stratum I) | 63 | 11 | 5 | 11 | 10 | 100 |
| Average producers (Stratum II) | 54 | 16 | 11 | 8 | 11 | 100 |
| Large producers (Stratum VI) | 64 | 18 | 18 | 0 | 0 | 100 |
| New producers | 30 | 20 | 30 | 20 | 0 | 100 |
| All producers† | 54 | 19 | 12 | 9 | 6 | 100 |

** The most important single influence.

† Past producers excluded; percentages weighted.

except at a probability level of 0.10. At this level the difference between the new producers and the producers in Stratum VI is significant (chi-square test).

All-important to the practical worth of these elasticity figures is their representative value. It must be stated that one of the most obvious weaknesses of this study is the fact that it took into consideration only present market producers. It did not take into account those dairymen who were producing manufacturing milk, those who were producing for another market, or those individuals who did not have a dairy enterprise but who would become producers if the price incentive became great enough. Information of this kind was impractical to gather. Thus, the inquiry takes into consideration supply response to price changes by new producers in the Kansas City market, current market producers, and potential market withdrawals; omitted from consideration are potential market entries.

Mitigating this shortcoming in some measure is the buffering effect that relatively rapid changes in dairy cow numbers have on total milk production. A relatively rapid build-up in the number of cows being milked is not accompanied by a proportionate increase in the supply of milk. Conversely, a relatively rapid decrease in the supply of dairy cattle is not accompanied by a proportionate decrease in the volume of milk marketed.

In fact, dairy cow numbers have been decreasing since 1945, yet the volume of milk marketed has been increasing. It is the low-producing cow that is sent to market in the culling process, but during an increase in cow numbers dairy-

men are not quite so selective concerning quality. For this reason, and also because the lactation period of a dairy cow usually begins in her second or third year of life, year-to-year production of milk is remarkably stable. One can infer from this that a short-run sharp increase in the supply of milk (other than seasonal fluctuations) in one Federal order market would come at the expense of a decrease in another area or at the expense of the manufacturing milk market. We can be quite certain that a short run sharp increase in the supply of milk in a particular area will not come as a result of increased dairy cattle quality. Neither does it seem that a non-seasonal sharp increase in the supply of milk would come about because of better or more liberal feeding.

The last conclusion is based on two considerations. One, once a dairyman has established a pattern of production it is not readily altered by improved feeding. The potential of a dairy cow is innate in her breeding and her pre-lactation care. Further, when we include the estimates of production changes of those producers who said that they would increase output by any and all methods in response to a short-run price incentive of 50 cents a hundred-weight, the elasticity amounts to only 0.02. This is not to say that a non-seasonal sharp increase in milk supply is impossible; it does, though, seem rather improbable. Thus, more than from any other source, it would appear that any greater supply response to a short-run price increase of this magnitude would come from a shift of manufacturing milk producers into the Grade A market.

The question arises as to whether the producers will do what they said they would. Are their plans too optimistic or pessimistic? Of course it is a human tendency not to accomplish all that has been planned. This might seem to indicate that the replies were overly optimistic. Yet, to refute this, is the planned rate of herd expansion over the next 10 years; it is only half as great as that which they actually made in the past three years.

In summary, it appears that producers in the Kansas City milkshed pay little heed to price changes which are expected to be only temporary. This is so at least within the range calculated (five cents to 50 cents).

Certainly no claim is made that the calculated elasticities could be used as a precise measure of supply response to future milk price changes. Calculations and projections contingent on human decisions are not subject to such precision. But it is believed that the calculations will give a close approximation.

## ATTITUDES TOWARD PRODUCTION ADJUSTMENT IN RESPONSE TO CHANGES IN THE PRICES OF BEEF, HOGS, AND CASH GRAINS

Producers were asked what price incentive would be necessary to induce them to expand, or enter, the following farm enterprises: hogs, beef, and cash grain. These are the enterprises which Kansas City dairymen think of as their main alternatives. They also were asked the price reduction that would cause

them to abandon hog and beef production. When the past-producer category was excluded, 17 percent of the dairymen had beef enterprises which contributed an average of 22 percent to their owners' net farm incomes. For hogs, the corresponding figures were 31 and 20; and for cash-grain crops, 62 and 22.

The questions above were asked in an attempt to establish which farm enterprises were competitive and which, if any, were complementary to dairying, and to what degree. The producers were allowed the prerogative of establishing a time period through which the stated prices must prevail before entry or expansion would be executed.

The base prices from which the hypothetical price changes were assumed were established at $19 per hundred pounds live weight for beef and $20 for hogs. Corn was priced at $1.25 per bushel, soybeans at $2.25 per bushel, and sorghum grains at $1.70 a hundredweight ($1.02 a bushel). These were the prevailing farm prices reported by newspaper and radio during the month in which the schedules were taken and the month preceding.

Because of imposed acreage and marketing restrictions, wheat was not a factor, though many said that they would like to expand wheat production at present prices were it not for government controls.

To get a percentage figure representing aggregate cash-grain crop response when producers indicated that they would expand more than one grain crop in the event of a price increase, an average was taken of the expansion percentage figures. The same method was applied to the price increases that would be necessary to induce the expansion. The average figures then were used to calculate the influence that the prices of cash-grain crops have on milk output.

Disregarding the time qualification imposed by the interviewee, replies indicated a 50¢ per hundredweight increase (above the base price) in beef prices would cause less than a 1 percent reduction in the market's producer-milk receipts. For a $1 increase in beef prices, milk receipts would decrease 2.7 percent; $2, $3, $4, $5, and $10 increases would bring percentage decreases of 6.4, 6.9, 8.1, 8.8, and 10.6. If we use $19 as the base price from which the price changes were made, the corresponding cross elasticities for 50¢ through $10 dollars are -.32, -.51, -.61, -.44, -.39, -.34, and -.20—all substantially less than unity.

For hogs, a 50¢ per hundredweight increase above the base price of $20 would cause market producers' milk receipts to decrease by less than 0.2 percent. For increases of $1, $2, $3, $4, and $5, the percentage decreases in market milk receipts were 1.8, 4.8, 4.8, 5.5, and 5.9. The corresponding cross elasticities (50¢ through $5) are -.08, -.36, -.48, -.32, -.28, and -.24. They indicate an inelastic response.

Of the three alternative farm enterprises, milk production showed the least response to price advances in cash-grain crops. Even when the hypothetical price advanced to the point where the market price of corn was doubled (and of the cash grain crops, corn was the most responsive to price advances), the reduction in the market's milk receipts amounted to less than 4.4 percent.

These elasticity figures are applicable if the price of milk is held constant at the current level and if the stated commodity and livestock prices are assumed to prevail over a period of time. For beef cattle, the imposed time requirements ran from two to 10 years, with a mode of 5; 3 being the next most common. For hogs, the time requirements ran from one to five years, two being the modal number and three the next most frequently given. For cash grain, the period most commonly given was two years; the next most frequent, five; with a range of one to seven.

It is not claimed that these elasticity figures possess a high degree of precision. They were not derived as a cardinal measure; rather they were calculated to ordinally express the degree to which these farm enterprises compete with or complement dairying. As such a measure, it is believed that they are satisfactory.

Fifty-seven percent of the producers said they would not enter or expand hog production as long as they were in dairying. For beef cattle, the figure was 63 percent, and for cash grain, 85 percent. Between large and small dairymen there was but little difference in response; the large dairymen (Stratum VI) were, however, a little more sensitive to price advances in alternative farm enterprises (Table 11).

TABLE 11--THE EXTENT THAT EMPHASIS IS SHIFTED FROM ONE ENTERPRISE TO ANOTHER IN RESPONSE TO PRICE CHANGE

| | Not at All | To a Small Extent | Is a Common Practice | Total |
|---|---|---|---|---|
| | Percentage of Producer Replies | | | |
| Small producers (Stratum I) | 89 | 11 | 0 | 100 |
| Average producers (Stratum II) | 84 | 13 | 3 | 100 |
| Large producers (Stratum VI) | 73 | 27 | 0 | 100 |
| New producers | 90 | 0 | 10 | 100 |
| All producers** | 84 | 13 | 3 | 100 |

** Past producers excluded; percentages weighted.

Of the producers (estimated number in the population, 1,127) who said that they would enter or expand hog production if given a price incentive, 82 percent stated they would not reduce their dairy herd size. The remaining dairymen would reduce theirs an average of 71 percent (58 percent of them would dispose of their dairy herds altogether; 28 percent would reduce them by one-half; and 14 percent, by one-tenth).

For those who said they would expand or enter beef production, given a price incentive (estimated number in the population, 1,029) 46 percent said that they would not reduce their dairy cow numbers upon entry or expansion. The others would reduce theirs by an average of 84 percent (16 percent would reduce their dairy herds by one-half and 84 percent would dispose of their entire herds).

For those who said they would increase cash grain, with an estimated population of 409, 44 percent would not reduce their dairy enterprise; the others would decrease their herd an average of 71 percent (43 percent would dispose of their herds; 43 percent would reduce them by one-half; and 14 percent, by one-fourth).

In all the foregoing comparisons, the assumption that milk prices are constant needs to be kept in mind. Since all farm product prices are influenced by the general economic situation, any substantial rise in the price of one probably will be accompanied by rises in the prices of others.

## ATTITUDES TOWARD PRODUCTION ADJUSTMENT IN RESPONSE TO CHANGES IN THE PRICES OF DAIRY COWS, DAIRY CALVES, ROUGHAGES AND CONCENTRATES

In a study of milk-supply response the price of dairy cows also must be taken into consideration, as must the price of dairy calves, roughages, and feed concentrates. The new producers ascribed more importance to dairy cow prices as an influence in determining their herd size than did the other groups. These men had assembled their herds more recently than others. In many instances the prospective dairyman has a fixed sum of money with which to purchase his herd. In such cases there is a inverse relationship between price of dairy cows and herd size. Excluding the new producers, dairymen with the smallest herds gave this factor the most weight; those with the largest herds gave it the least. The large scale dairymen usually raise their replacement heifers so that not much cash cost is involved.

Generally, the producers assigned more importance to dairy cow prices than they did to beef and hog prices (Tables 12 and 13). Dairy cow prices also took precedence over the cost of feed concentrates and roughages as determinants of herd size (Table 14). The dairy herd represents a large investment and makes up a large part of the fixed costs involved in the dairy enterprise. Feed costs are

TABLE 12--THE INFLUENCE OF THE PRICE OF DAIRY CATTLE ON THE DETERMINATION OF DAIRY HERD SIZE

| | None | Very Little | Some | A Great Amount | Most Important** | Total |
|---|---|---|---|---|---|---|
| | Percentage of Producer Replies | | | | | |
| Small producers (Stratum I) | 63 | 11 | 16 | 10 | 0 | 100 |
| Average producers (Stratum II) | 65 | 8 | 19 | 8 | 0 | 100 |
| Large producers (Stratum VI) | 91 | 0 | 9 | 0 | 0 | 100 |
| New producers | 40 | 10 | 30 | 20 | 0 | 100 |
| All producers† | 64 | 10 | 17 | 9 | 0 | 100 |

** The most important single influence.

† Excludes past producers; percentages weighted.

TABLE 13--THE INFLUENCE OF PRICE OF BEEF CATTLE AND/OR HOGS ON DAIRY HERD SIZE

| | None | Very Little | Some | A Great Amount | Most Important** | Total |
|---|---|---|---|---|---|---|
| | Percentage of Producer Replies | | | | | |
| Small producers (Stratum I) | 79 | 11 | 10 | 0 | 0 | 100 |
| Average producers (Stratum II) | 89 | 3 | 8 | 0 | 0 | 100 |
| Large producers (Stratum VI) | 82 | 9 | 9 | 0 | 0 | 100 |
| New producers | 90 | 0 | 0 | 10 | 0 | 100 |
| All producers† | 89 | 3 | 7 | 1 | 0 | 100 |

** The most important single influence.

† Excludes past producers; percentages weighted.

TABLE 14--THE INFLUENCE OF PRICE OF GRAIN AND/OR ROUGHAGE ON DAIRY HERD SIZE

| | None | Very Little | Some | A Great Amount | Most Important** | Total |
|---|---|---|---|---|---|---|
| | Percentage of Producer Replies | | | | | |
| Small producers (Stratum I) | 69 | 5 | 21 | 0 | 5 | 100 |
| Average producers (Stratum II) | 79 | 11 | 11 | 0 | 0 | 100 |
| Large producers (Stratum VI) | 91 | 0 | 9 | 0 | 0 | 100 |
| New producers | 100 | 0 | 0 | 0 | 0 | 100 |
| All producers† | 82 | 6 | 11 | 0 | 1 | 100 |

** The most important single influence.

† Past producers excluded; percentages weighted.

variable and are customarily paid periodically from the milk check. A larger herd means a larger milk check so that we would expect less concern over feed prices when considering herd size. But because the small producers are more sensitive to dairy cow prices than the large producers, the impact of these prices on milk supply is not as great as might be expected.

High dairy cow prices (due to high carcass value) induce dairymen to cull more closely and restrain those dairymen who are attempting to increase their dairy cow numbers. For dairymen who are induced by beef cattle prices to adopt a beef herd, the reduction in the dairy herd is generally quite high.

High dairy cow prices due to high milk prices could alter short-run supply only slightly; although, by retarding the normal culling process, there might be some increase in output. Such conditions could, however, influence long-run supply. Generally, it is believed that an increase in price of dairy cows induced by high milk prices, or anticipation of such, tends to cause farmers to keep more replacement heifers. The producers included in this study, however, didn't

place much emphasis on this factor (Table 15). Yet, if dairy cows are relatively high priced because of their carcass value, then it would seem that this would tend to decrease supply in both the short and long run. Herds would be culled more closely and some herds would be disposed of altogether.

TABLE 15--THE EXTENT TO WHICH MILK PRICES INFLUENCE THE NUMBER OF REPLACEMENT HEIFERS KEPT

| | None | Very Little | Moder-ately | Signifi-cantly | Total |
|---|---|---|---|---|---|
| | Percentage of Producer Replies | | | | |
| Small producers (Stratum I) | 79 | 5 | 16 | 0 | 100 |
| Average producers (Stratum II) | 82 | 8 | 5 | 5 | 100 |
| Large producers (Stratum VI) | 100 | 0 | 0 | 0 | 100 |
| New producers | 90 | 0 | 0 | 10 | 100 |
| All producers† | 96 | 0 | 3 | 1 | 100 |

† Past producers excluded; percentages weighted.

Producer responses do not show that veal prices exert much influence on the length of time that calves are allowed to nurse, yet it is greater than might be expected for Grade A milk producers (Table 16). Milk prices have somewhat

TABLE 16--THE EXTENT TO WHICH VEAL PRICES INFLUENCE THE LENGTH OF TIME THAT CALVES ARE ALLOWED TO NURSE

| | None | Very Little | Moder-ately | Signifi-cantly | Total |
|---|---|---|---|---|---|
| | Percentage of Producer Replies | | | | |
| Small producers (Stratum I) | 90 | 0 | 10 | 0 | 100 |
| Average producers (Stratum II) | 95 | 0 | 3 | 2 | 100 |
| Large producers (Stratum VI) | 100 | 0 | 0 | 0 | 100 |
| New producers | 90 | 10 | 0 | 0 | 100 |
| All producers** | 94 | 2 | 3 | 1 | 100 |

** Past producers excluded; percentages weighted.

more influence on the length of time that calves are allowed to nurse (Table 17). The price of veal did not receive much consideration by these dairymen in deciding the number of replacement heifers to keep (Table 18).

To summarize, a majority of the dairymen raise a cash-grain crop which contributes a substantial portion to their disposable income. At the time of interview, cash-grain production seemed to complement dairying; however, an increase in the amount of resources used in this enterprise would make it competitive—only a few of the dairymen would even consider enlarging cash-grain enterprises. It could be reasoned that all land suitable for such crops is now being utilized for this purpose. This reasoning, however, would force acceptance

TABLE 17--THE EXTENT TO WHICH MILK PRICES INFLUENCE THE LENGTH OF TIME THAT CALVES ARE ALLOWED TO NURSE

| | None | Very Little | Moder-ately | Signifi-cantly | Total |
|---|---|---|---|---|---|
| | Percentage of Producer Replies | | | | |
| Small producers (Stratum I) | 84 | 0 | 11 | 5 | 100 |
| Average producers (Stratum II) | 76 | 3 | 16 | 5 | 100 |
| Large producers (Stratum VI) | 82 | 9 | 9 | 0 | 100 |
| New producers | 70 | 10 | 10 | 10 | 100 |
| All producers** | 82 | 3 | 11 | 4 | 100 |

** Past producers excluded; percentages weighted.

TABLE 18--THE EXTENT TO WHICH VEAL PRICES INFLUENCE THE NUMBER OF REPLACEMENT HEIFERS KEPT

| | None | Very Little | Moder-ately | Signifi-cantly | Total |
|---|---|---|---|---|---|
| | Percentage of Producer Replies | | | | |
| Small producers (Stratum I) | 95 | 0 | 5 | 0 | 100 |
| Average producers (Stratum II) | 97 | 0 | 3 | 0 | 100 |
| Large producers (Stratum VI | 100 | 0 | 0 | 0 | 100 |
| New producers | 100 | 0 | 0 | 0 | 100 |
| All producers** | 97 | 0 | 3 | 0 | 100 |

** Past producers excluded; percentages weighted.

of an assumption that seems highly unlikely, *viz.,* that most producers have almost all such land employed in this use now, and for this reason the limit to entry or further expansion is already established.

A more likely premise is that these crops complement the dairy enterprise in the use of the farmers' labor and supplement their income; and that the acreage now grown balances out the producers' farm enterprises between pasture and small grains or row crops. Any increase in cash-crop acreage would be highly competitive in the allocation of land. As it is now, it permits a complementary use of land, labor, and capital (machinery).

Hog raising also is considered as a complementary enterprise by many dairymen, though it ranks considerably lower than cash-grain crops, both in the number of producers considering it and in the degree to which producers feel it complements the dairy project. An increase in hog production usually would come at the expense of milk output. Since this enterprise does not complement dairy cattle in use of labor or capital, the relationship is, by and large, one of competition.

Beef cattle raising is the least complementary to dairying. The two enterprises would to an extent complement each other in use of labor, but to offset

this is the extremely high degree of competition for feed which is associated with the use of land.

Thus it appears that dairymen consider cash-grain crops as a complementary enterprise; hogs as complementary to some extent, though on the whole, competitive; and beef cattle as competitive. Of these three, the price of beef influences milk supply the most. This is followed, in order of importance by hogs and cash-grain.

## PRODUCERS' WILLINGNESS TO SHIFT EMPHASIS FROM ONE ENTERPRISE TO ANOTHER IN RESPONSE TO PRICE CHANGES

Given the structure of demand, price is pushed up or pulled down by the marginal unit—by the increment added to, or the decrement removed from, total supply. Individually, a producer in an industry comprised wholly of small firms cannot change market price by increasing or decreasing output. Collectively, producers or that portion of the producers who are price sensitive do influence market prices by their production adjustments. To the individual, price is given datum; collectively it is determined.

Producers who shift emphasis from one enterprise to another in response to price changes are more than proportionately responsible for the direction, velocity and magnitude of supply changes. For that reason the dairymen who indicated they effected such shifts were segregated from the rest of the population and analyzed. Ninety-three percent of this group came from the first five strata of current producers, 6 percent came from the new-producer category, and about three-fourths of 1 percent came from Stratum VI, the large producer stratum. They represent about 14 percent of all market participants and produce about 18 percent of the market's milk.

An inquiry into the characteristics of this group revealed that they were more or less typical dairymen, generally approaching the standard set up by the dairymen of Stratum I through V. They were a little older; they farmed a few more acres, and had a slightly larger herd; they had expansion plans which were a little more ambitious, and, on a per-cow basis, they possessed more productive herds. As with the average dairyman, dairying was becoming relatively more important in its contribution to their net farm income; other farm enterprises were becoming less so.

In the elasticity study that was made of these producers, their production figures indicated that they were a little more sensitive to milk price reductions but less sensitive to milk price advances than the average dairyman.

Sixty-four percent said that they would enter or expand hog production with varying price advances, compared to 43 percent for average producers. All indicated that such an expansion would not cause their dairyherds to be decreased.

Fifty percent said that, given a price incentive, they would enter or expand beef production. The corresponding figure for average producers was 40 percent. An expanded or newly adopted beef enterprise would entail a vigorous contraction in dairy cow numbers for this price-sensitive group: 98 percent would dispose of their herds.

Only 6 percent said that they would enter or expand cash-grain production, compared to 16 percent for the dairymen in Strata I to V.

Summarizing, these producers are livestock farmers but, first of all, dairymen.. They consider hog raising as an enterprise complementary to their dairy project and beef cattle as competitive. Their projected responses to price changes were similar in direction to those of the other producers. However, there was a substantial divergence in the degree of response. Earlier we concluded that of all alternative farm enterprises, the price of beef cattle yielded the greatest impact on the fluid milk supply. For the price-sensitive group of producers, this conclusion is even more meaningful. They are much more sensitive to beef cattle prices than the rest of the sample individuals. It is meaningful because the adoption or expansion of beef enterprises would entail a reduction in the number of dairy herds.

Thus, it is this one element, the fact that milk production decisions are relatively sensitive to beef cattle prices, that imparts to this group of producers an important role in this milk supply response study. They exercise more than a proportionate influence on changes in output.

## CONCLUSIONS

The depiction of a milk-supply function requires consideration of many factors. Categorically, but with no distinct lines of demarcation, we might classify them as economic, physical, biological, and social.

The site of a particular farm sets within limits the alternatives open to its operator; it delimits the enterprises that can compete successfully with the same enterprises at other sites. Just as the physical characteristics of the farm limit the alternatives of the individual farmer, those of an area also delimit the enterprises in which farmers may engage successfully to meet inter-regional competition.

It appears that dairymen have fewer alternatives than other farmers; most seem to believe that their opportunities lie in larger dairy herds and in more productive cows rather than in other farm enterprises or other jobs. As cost-price pressures arise, they search for ways to maintain their living standard. Little faith is placed in the use of more hired labor to achieve this end. Most of them turn to improved technology.

The dairymen with the largest herds seem to be less limited in their alternatives. As the hypothetical price of milk was lowered, they indicated a greater willingness to adopt substitute farm enterprises. The dairymen most willing to

produce fluid milk at reduced prices were those who were substantially larger than the average but smaller than the largest producers.

Dairymen consider cash-grain crops as an enterprise complementary to dairying; hogs are also deemed complementary to some extent, though, on the whole, competitive; beef cattle are regarded as competitive. Considering prices of cash-grains, beef cattle, and swine—farm enterprises that dairymen generally think of as their farm alternatives—it is the price of beef that influences milk supply the most. This is followed, in order of importance, by hogs and cash-grains.

Traditionally, dairying is viewed as a long-run business enterprise. The breeding program is ordinarily considered a life-long task. Characteristically, the industry is intolerant of the in and outer.

The typical dairyman is relatively insensitive to minor price changes. There is a certain inertia that must be overcome to alter direction and velocity of supply. For a majority of dairymen, prospects of profit or loss must be fairly large to overcome the ruling inertia. These producers comprise the hard core of the dairy industry. They are farmers who know and like dairying and who have become accustomed to the regularity of an income that is fairly stable from one interval to the next and is quite predictable.

For these reasons, unless returns from dairying become seriously mal-aligned with returns from other enterprises or jobs, present trends will continue. In the immediate future we can expect dairymen in the area to furnish more milk for the market from one year to the next. Nevertheless, in the periphery around the hard core of producers are farmers who are less rigidly held to an enterprise, farmers who are more sensitive to price changes and who respond accordingly. Supply adjustments come through market entries, market exits, and changes in output by continuing producers. These marginal increases and decreases of supply tend to keep the incomes of dairymen in line with those of farmers who depend on other enterprises, and with people in other lines of work. Though often obscured by technological upheavals, the size of the supply of any product depends on returns to the resources engaged in furnishing this supply, compared with returns that these resources could receive in other uses.

## SUMMARY

1. During the sample year 402 or about 13 percent of the market participants withdrew from the Kansas City market. During the same period 247 new producers entered the market for a net loss of 155 producers. Of the market withdrawals, one-fourth (100) still have dairy herds. Sixty of these now produce Grade A milk for other markets and 40 produce manufacturing milk.

2. Poor management was the factor that accounted for the largest number of market withdrawals. This was followed by handler policies, and then old age or poor health.

3. Thirty-five percent of the past-producer category withdrew from dairying because it did not furnish an acceptable level of income.

4. New producers supplied an estimated 5.9 percent of the market's producer milk and represented 8.2 percent of the market's producers. They entered dairying because they liked the work, it furnished them a stable and steady income, and their farms were best adapted to this enterprise. Of all the categories under study, the new producers seemed the most determined to remain in dairying. This determination was attributed largely to the new investment in specialized facilities.

5. To dairy farmers, dairying is becoming more important as a source of income, both relatively and absolutely. The number of dairymen that have other enterprises is decreasing and the contributions of these enterprises to the owners' net farm incomes also is diminishing.

6. Excluding the new and past producer categories, the rate of increase in herd size in the previous three years was 5 percent per year. Planned expansion for the next 10 years was at only half this rate.

7. Along with the increase in cow numbers per dairy farm, there has been an upward trend in production per cow. This is attributed to more selective culling, closely followed in order of importance by better breeding and better feeding. Artificial insemination was given the most credit for higher-quality replacement stock. Improved pasture furnished the major part of the gains due to better feeding. Next in importance was higher-quality roughage.

8. Producers raise most of their own replacement stock in the belief that this method is more economical and, at the same time, lessens the possibility of introducing a disease into the herd. This propensity has a retarding effect on short-run supply increases in a particular market.

9. Slightly more family labor is contributing to the dairy enterprise now than three years ago, and the same is true of hired labor. However, there is a certain reluctance on the part of most dairymen to use hired labor to directly tend the herd. This unwillingness stems from the inability of dairy farmers to find suitable herdsmen or to hire them at a price which they feel they can afford to pay. This reluctance tends to retard both short-run and long-run supply increases.

10. Limited labor supply received the most weight as a deterrent to herd expansion. This was followed by limited cooler space and limited barn and land facilities. By far the greatest obstacle to herd contraction is the investment in specialized facilities.

11. Dairymen can be depicted launching a crash program upon entry into the Grade A milk market, and also upon installation of a bulk tank, or a bulk tank and pipe-line. This explains in part why the new producers have the lowest production per cow of the three categories under study, new,current, and past dairymen. Most of the rapid build-up in herd size comes the first year; a good portion is also added the second. Objective is to use buildings, facilities, and

labor more fully, and build the herd to a size that the farm will best support.

12. Fifty percent of the producers would continue Grade A production with a price spread of 50¢ between Grade A and manufacturing milk, and two-thirds would do so for a premium of $1. The producers from Stratum IV were the most willing to produce for a small premium.

13. Producers indicated that milk prices had little influence on the quantity of concentrates fed. Concentrate prices appeared to have a greater influence on the amount of feed grains and protein supplements fed than did milk prices.

# APPENDIX

## DEFINITION OF TERMS

**Sample Year.** The period of study was July 1, 1956, to June 30, 1957.

**The Kansas City Market.** This term refers to the Greater Kansas City Milk Marketing Area covered by Federal Order Number 13, as it was during the sample year. It refers to the area in which handler sales were regulated by the Order. Its area of jurisdiction included all the territory in Jackson County, Mo.; that part of Clay County, Mo., south of Highway 92, beginning at the Platte County and Clay County line, east to the west section line of section 26 in Washington Township, north to the north section line of said section 26, east to the Cass County and Ray County lines; Lee, Waldron, May and Pettis Townships in Platte County, Mo.; Wyandotte County, Kans.; Shawnee and Mission Townships in Johnson County, Kans.; and Delaware, Leavenworth, and that part of Kickapoo and High Prairie Townships east of the 95th principal meridian in Leavenworth County, Kans.

**The Kansas City Milkshed.** This term refers to the area in which producers were located during the sample year. The milkshed covers 64 counties: 40 in Missouri, 19 in Kansas, and five in Iowa (Table 19, right, and Figure 1, page 7). It will be noted that St. Joseph and the surrounding counties are not in the milkshed. Dairymen producing fluid milk in these counties are members of a rather strong local producers' marketing association and market their milk in St. Joseph.

**Producers.** This term includes all dairymen who, during the sample year, sold Grade A milk for a period of at least one month to handlers who were subject to the provisions of Federal Order Number 13. It does not include dairymen who retailed only their own milk. The number of producers by county is shown in Table 19.

**Current Producers.** These are producers who were selling milk at the beginning of the sample year and at the end. Production for this period need not have been continuous, however.

**New Producers.** Producers who began selling milk after the sample year began.

**Past Producers.** Any producer who terminated sales during the sample year, unless sales were resumed and continued through the end of the sample year, was classified as a past producer. Any producer who began selling milk after the sample year started and terminated sales during the same period was counted as both a past and new producer. A period of two months was allowed after the date of the last sale before a producer was considered to have terminated sales.

**Significant and Very Significant Values.** If the difference in the values of two independent random variables is such that we would expect this much deviation, one from another, as a result of chance fluctuations alone only five times out of a hundred, then the values are designated as significantly different; if only one time out of a hundred, the difference is said to be very significant. When the degree of relationship between two non-independent random variables is great enough that chance fluctuations alone would account for the high correlation only five times out of a hundred, the correlation is said to be significant; if only one time out of a hundred, the correlation if designated as very significant.

TABLE 19--COUNTIES, BY STATE, IN WHICH PRODUCERS ARE LOCATED AND NUMBER OF PRODUCERS IN EACH

| County | June, 1956* | December, 1956* | June, 1957** |
|---|---|---|---|
| Missouri | | | |
| Atchison | 0 | 1 | 1 |
| Barton | 10 | 10 | 10 |
| Bates | 318 | 317 | 293 |
| Benton | 9 | 9 | 8 |
| Boone | 2 | 2 | 1 |
| Caldwell | 19 | 16 | 15 |
| Carroll | 30 | 36 | 36 |
| Cass | 310 | 311 | 298 |
| Cedar | 25 | 32 | 30 |
| Chariton | 22 | 23 | 21 |
| Clay | 30 | 33 | 32 |
| Clinton | 24 | 27 | 26 |
| Cooper | 18 | 18 | 18 |
| Dade | 9 | 15 | 15 |
| Daviess | 16 | 17 | 17 |
| DeKalb | 13 | 14 | 13 |
| Gentry | 5 | 4 | 4 |
| Grundy | 12 | 15 | 16 |
| Harrison | 37 | 36 | 36 |
| Henry | 49 | 54 | 53 |
| Hickory | 9 | 12 | 12 |
| Howard | 13 | 12 | 12 |
| Jackson | 163 | 144 | 137 |
| Johnson | 130 | 130 | 127 |
| Lafayette | 112 | 125 | 120 |
| Linn | 12 | 13 | 12 |
| Livingston | 16 | 16 | 15 |
| Mercer | 8 | 7 | 7 |
| Miller | 4 | 4 | 4 |
| Moniteau | 1 | 1 | 1 |
| Morgan | 12 | 12 | 11 |
| Pettis | 41 | 38 | 34 |
| Platte | 10 | 10 | 9 |
| Polk | 10 | 13 | 15 |
| Randolph | 3 | 3 | 3 |
| Ray | 36 | 41 | 35 |
| St. Clair | 18 | 22 | 23 |
| Saline | 25 | 27 | 27 |
| Sullivan | 4 | 4 | 4 |
| Vernon | 49 | 59 | 61 |
| TOTAL 40 | 1634 | 1683 | 1612 |
| Kansas | | | |
| Allen | 0 | 1 | 1 |
| Anderson | 32 | 32 | 32 |
| Atchison | 60 | 43 | 42 |
| Bourbon | 4 | 4 | 4 |
| Coffey | 29 | 32 | 31 |
| Doniphan | 8 | 7 | 7 |
| Douglas | 185 | 175 | 161 |
| Franklin | 92 | 102 | 97 |

TABLE 19--CONTINUED

| County | June, 1956* | December, 1956* | June, 1957** |
|---|---|---|---|
| Kansas (cont.) | | | |
| Greenwood | 1 | 1 | 1 |
| Jackson | 8 | 10 | 9 |
| Jefferson | 79 | 66 | 64 |
| Johnson | 165 | 158 | 163 |
| Leavenworth | 208 | 198 | 185 |
| Linn | 46 | 44 | 39 |
| Lyon | 0 | 1 | 1 |
| Miami | 125 | 128 | 108 |
| Osage | 21 | 26 | 22 |
| Shawnee | 9 | 9 | 9 |
| Wyandotte | 42 | 34 | 30 |
| TOTAL 19 | 1114 | 1071 | 1006 |
| Iowa | | | |
| Adams | 0 | 1 | 1 |
| Decatur | 9 | 10 | 9 |
| Page | 0 | 3 | 2 |
| Taylor | 0 | 4 | 4 |
| Union | 0 | 4 | 4 |
| TOTAL 5 | 9 | 22 | 20 |

* From "Compilation of Statistical Material for the Greater Kansas City Marketing Area, 1956, and January and February 1957: Supplement to Years 1953-54-55."

** From "Compilation of Statistical Material for the Greater Kansas City Marketing Area, Year 1957: Supplement to Years 1953-54-55-56."

## SAMPLING PROCEDURE

**Determination of Sample Size.** To achieve the desired degree of precision, the sample size was determined by finding the variance of a simple random sample of all producers selling fluid milk in the Kansas City Market for the year January 1, 1956, to December 31, 1956. Because production figures were available, and because it was believed that annual market receipts per producer would be a valid criterion, they were used to calculate variance.

At the beginning of the period there were 2,869 producers. During the year, 245 new producers entered the market making a total of 3,114 during the period under consideration. The sample size was 100, giving a sampling fraction of 0.03211.

The total product for each producer in the sample was computed for the period from the Milk Market Administrator's records and used to calculate variance. The total production of all producers during the period was also obtained. It amounted to 457,749,917 pounds of milk, which gave a mean product of 146,997 pounds per producer. The mean of the sample was 148,358.

The variance was found to be $8.664 \times 10^7$, giving a standard error of the sample mean equal to 9,300 pounds and a probability coefficient of 0.88. Thus, in 88 cases out of 100 we would expect this much difference (1,361 pounds) between the sample mean and the population mean to be a result of chance alone.

**Basis of Strata and Reason for Stratification.** The market participants during the sample year (July 1, 1956 to June 30, 1957) resided in a geographical area comprised of 64 counties (40 in Missouri, 19 in Kansas, and five in Iowa) extending in a somewhat irregular pattern outward from Kansas City. They were divided into three categories: current, past, and new producers. Each was treated as a separate population from which samples were drawn. The current producer population was further divided into sub-populations.

Failure of the normal approximation occurs mostly when the population contains some extreme individuals which dominate the sample average when they are present. These extremes also have the much more serious effect of increasing the variance of the sample and decreasing its precision. For these reasons, current producers were divided into two groups, one of which contained Strata I through V, and the other, Stratum VI. Stratum VI included all producers who had an annual product of 700,000 pounds and greater. These individuals were excluded from the main body of current producers to reduce the skewness and improve the normal approximation; because of their weight on the supply side the 11 were sampled 100 percent.

After removing Stratum VI from the current producer population, there still was a slight skewness. Because of this and because of the belief that many of the sampling attributes would be closely correlated with size of the dairyman's output, it was thought that the precision of the estimates could be increased through stratification. A geographic stratification was considered, but rejected, when within-stratum variance (as compared to the variance without stratification) indicated that nothing would be gained in precision. The characteristic used to measure variance was the average yearly output per producer by county within selected geographic subpopulations. The strata, five in number, were composed of contiguous counties grouped in such a manner as to achieve the greatest possible homogeneity.

The factors that were considered in the attempt to group contiguous counties into strata with the least possible within-stratum variance were climate, topography, soil type, type of farming, and distance from the Kansas City Market. This is not to say, of course, that there may not be a significant difference between attributes (other than yearly production per producer) from one geographic area to another. For this study, however, there was not sufficient data concerning other characteristics from which variance could be measured. These considerations, along with the hypothesis that output is the correlator of other attributes, led to a single-factor stratification—yearly output per producer.

**Drawing the Samples.** Srata I through V represent the majority of all producers, as well as the main body of current producers. Composed of 2,349 individuals, they make up 78.07 percent of all producers and 99.57 percent of all current producers.

The sample size decided upon for the main body of current producers was 80, giving a sampling fraction of 0.03406 and an expansion factor of 29.360.* Applying the variance as calculated in the early study to the sample size of 80, and using a con-

*By using the equation $n = \frac{k^2v^2}{D^2}$, the sample size for the producers in Strata I to VI was determined, with k as the symbol of the multiplier for the coefficient of variation, specifying the precision to be sought in a given sampling operation. In working with a confidence coefficient of 0.9545, $k = 2$; with 0.997, $k = 3$. The relative difference between an estimated population mean and the true mean is designated as D, the sample size as n, and the relative variance as $v^2$.

fidence coefficient of 0.997, the relative difference between the means, true and estimated, is slightly over 2 percent. We would expect a greater difference to occur only three times out of a thousand. This is true, of course, only if the population is normally distributed, and only for the one characteristic; that is, yearly physical production.

From a list of all producers who had entered the Kansas City Market within the sample year (July 1, 1956, to June 30, 1957) a random sample was drawn. The size of the parent population was 247, that of the sample, 10, giving a sampling fraction of 0.04049 and an expansion factor of 24.7005. The same technique was applied in drawing the past-producer sample. The size of the parent population was 402; that of the sample, 20, making a sampling fraction of 0.04975 and an expansion factor of 20.1005. Both of these sampling fractions are somewhat larger than that of the main body of current producers, and it was this fraction on which the sample sizes of the new and past producers were based.

The early investigation indicated that the current producer population was skewed to the right. After the removal of Stratum VI it still was skewed somewhat, so to insure representation at all levels of production, the population was divided into subpopulations and a proportionate sample ($f = 0.03406$) was drawn from each stratum. The strata were divided according to the magnitude of the yearly production of the individuals in the population so that each stratum represented a production range of 100,000 pounds of milk for the year. Strata that were too small to permit proportionate sampling were grouped, and a random sample was then taken from the grouped strata. The strata were five in number, and all except Stratum V have a class interval of 100,000 pounds. Stratum V has a production range of 300,000 pounds of milk annually—from 400,000 to 700,000 (Table 20).

The sampling fractions for the strata are not perfectly uniform (Table 20) but uniform enough, it is believed, that the overall sampling fraction may be applied when using sample statistics as an estimate of parameters.**

It will be noted that the period used to determine the sample size (January 1, 1956, to December 31, 1956) does not coincide with the period in which the actual study was made (July 1, 1956, to June 30, 1957). It is believed that this condition in no way invalidates the conclusions reached. The periods do overlap to the extent of six months, and the dairy industry is a stable one: the aggregate production figures from one year to the next rarely vary by more than 3 percent.

The explanation for the non-coicidence of periods is this: Preliminary work was started in the early part of 1957, at which time the Milk Market Administrator's Office had complete records up to the first of the year but not much beyond. The latest possible data were wanted for the study; hence, the discrepancy.

Some alternates were drawn along with the samples from each stratum of current producers. Alternates were also selected at random from new and past-producer populations. Three of the alternates were used, one for past producers and two for current producers.

**According to Hansen, Hurwitz and Madow, it usually is acceptable to disregard small departures from uniformity and use a uniform factor equal to the over-all sampling fraction for the entire population. *Sampling Survey Methods and Theory,* Vol. I. (London: Chapman and Hall, 1953), p. 186.

TABLE 20--PRODUCTION DATA FOR CURRENT PRODUCERS AND RELIABILITY OF SAMPLE ESTIMATES AS MEASURED BY PRODUCTION FIGURES*

| | Stratum I | Stratum II | Stratum III | Stratum IV | Stratum V | Stratum I to VI | Stratum VI | All Strata |
|---|---|---|---|---|---|---|---|---|
| Production range (1000 lbs.) of milk per year | 0-100 | 100-200 | 200-300 | 300-400 | 400-700 | 0-700 | 700-1200 | 0-1200 |
| Individuals in the parent population (No.) | 570 | 1,081 | 475 | 148 | 75 | 2,349 | 11 | 2,360 |
| Individuals in the sample (No.) | 19 | 37 | 16 | 5 | 3 | 80 | 11 | 91 |
| Total production, parent population (1000 lbs.) | 41,560 | 157,042 | 112,635 | 50,922 | 37,748 | 399,906 | 9,295 | 409,201 |
| Total production, Sample (1000 lbs.) | 1,393 | 5,418 | 3,823 | 1,703 | 1,486 | 13,823 | 9,295 | 23,118 |
| Production mean, parent population (lb.) | 72,912 | 145,275 | 237,126 | 344,066 | 503,302 | 170,245 | 844,986 | 173,390 |
| Production mean, sample (lb.) | 73,314 | 146,444 | 238,948 | 340,551 | 495,301 | 172,790 | 844,986 | 175,903 |
| Standard error of sample mean (lb.) | 5,245 | 3,972 | 6,209 | 7,473 | 46,955 | 20,052 | 0 | ... |
| Difference between sample and population mean, (percent) | 0.55 | 0.81 | 0.77 | 1.02 | 1.59 | 1.50 | 0 | 1.45 |
| Difference between sample and population mean, (pounds) | 402 | 1,169 | 1,822 | 3,515 | 8,001 | 2,545 | 0 | 2,513 |
| Sampling fraction | 0.0333 | 0.0342 | 0.0337 | 0.0338 | 0.0400 | 0.0341 | 1.000 | np** |
| Expansion factor | 30.00 | 29.24 | 29.67 | 29.59 | 25.00 | 29.36 | 1.00 | np** |
| Production, percentage of current producer milk | 10.16 | 38.38 | 27.53 | 12.44 | 9.22 | 97.73 | 2.27 | 100.00 |
| Production, percentage of total producer milk | 9.02 | 34.08 | 24.44 | 11.05 | 8.19 | 86.78 | 2.02 | 88.80 |

* The data shown concerning the parent population are actual data supplied by the Kansas City Milk Market Administrator's Office.

** Not proportionate.

## METHOD USED TO CALCULATE AVERAGE PRODUCTION PER COW

An attempt was made to get a weighted average of the number of cows in each herd during that part of the sample year in which milk was produced for the Kansas City Market. Milk production may have been for the full period or only a part of it.

At the Milk Market Administrator's Office, milk sales figures were available for all the producers in the population. After the samples were drawn, yearly milk sales data were secured from this source for each producer in the sample. To get all of the figures based on a uniform period (365 days), a weighted multiplier was derived from a system of index numbers giving months different weights according to the average daily milk receipts per producer over a period of five years as applied to the production figures of those producers whose receipts did not cover a full year (Table 21).

TABLE 21--AVERAGE DAILY RECEIPTS (BY MONTH) PER PRODUCER IN THE GREATER KANSAS CITY MILKSHED*

| Month | 1953 | 1954 | 1955 | 1956 | 1957 | Average | Index (402 = 1.00) |
|---|---|---|---|---|---|---|---|
| January | 315 | 349 | 386 | 439 | 478 | 393 | 0.979 |
| February | 323 | 360 | 387 | 439 | 475 | 397 | .988 |
| March | 329 | 366 | 397 | 448 | 475 | 403 | 1.002 |
| April | 343 | 401 | 449 | 473 | 477 | 429 | 1.067 |
| May | 377 | 434 | 450 | 485 | 524 | 454 | 1.129 |
| June | 349 | 393 | 398 | 440 | 473 | 410 | 1.022 |
| July | 335 | 321 | 360 | 418 | 422 | 371 | .923 |
| August | 297 | 313 | 340 | 406 | 418 | 355 | .883 |
| September | 292 | 326 | 370 | 432 | 444 | 373 | .928 |
| October | 313 | 342 | 405 | 453 | 461 | 395 | .983 |
| November | 335 | 378 | 428 | 469 | 473 | 417 | 1.038 |
| December | 340 | 387 | 429 | 477 | 491 | 425 | 1.058 |
| Average | 329 | 364 | 399 | 448 | 468 | 402 | 1.000 |

* From "Compilations of Statistical Material for the Greater Kansas City Marketing Area: 1953-1957," Office of the Market Administrator.

With the size of each producer's herd known, the average production per cow by producer, by stratum, and by category was computed. Results are in Table 22.

Because of an omission on the schedule, producer milk consumed at home could not be calculated. For correlation problems, producer receipts as indicated by the Milk Market Administrator's records had to be adjusted. For this adjustment each producer's household was arbitrarily assigned a family of five and each member was allowed a milk consumption rate half again as great as the national average. This raised the average yearly production per cow for all producers by 200 pounds, and average production figures unadjusted for producer milk consumed at home would be understated by slightly more than 3 percent. The understatement would be larger than this for small producers and somewhat smaller for large producers.

It is not claimed that this method of calculating production figures is without bias. It is believed, however, that on the whole the totals arrived at are quite representative of the actual averages and are especially valuable in comparing producer groups. Let us consider some of the known and possible deficiencies and sources of error.

TABLE 22--PRODUCTION DATA BY STRATUM, BY CATEGORY, AND FOR THE MARKET

| | Current Producers | | | | | | | All Current Producers | New Producers | Past Producers | All Producers |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stratum I | Stratum II | Stratum III | Stratum IV | Stratum V | Stratum I to V | Stratum VI | | | | |
| Average daily receipts per farm (lbs.) | 201 | 401 | 655 | 933 | 1,357 | 473 | 2,315 | 482 | 373 | 364 | 457 |
| Average herd size | 16.9 | 24.8 | 31.6 | 47 | 56 | 26.7 | 104.4 | 27 | 24 | 22.6 | 26.2 |
| Average yearly per-cow production (unadjusted)* | 4,339 | 5,909 | 7,571 | 7,185 | 8,845 | 6,479 | 8,097 | 6,508 | 5,648 | 5,885 | 6,372 |
| Average yearly per-cow production (adjusted)** | 4,650 | 6,121 | 7,737 | 7,295 | 8,938 | 6,631 | 8,147 | 6,703 | 5,866 | 6,117 | 6,572 |
| Percentage increase of adjusted over unadjusted production figures | 7.16 | 3.59 | 2.19 | 1.53 | 1.05 | 2.35 | .62 | 3.00 | 3.86 | 3.94 | 3.14 |

* Unadjusted for producer milk consumed at home.

** Adjusted for producer milk consumed at home.

We can be fairly certain that the method used to adjust the production figures for home-consumed producer milk deserves some criticism. Farm families are larger than urban families. Also, when a permanent hired man is kept, he and his family are customarily supplied with milk from the producer's herd; hence, the average of five members per household. Families who have dairy herds also are generally believed to consume more milk than others. Thus, both adjusting figures seem realistic. It may be, however, that the consumption rate assigned to the family members is high. This could be true because many of the producers buy manufactured dairy products rather than make them themselves as was once customary. It will be noted, though, that all the remaining biases have the effect of decreasing average production figures.

If milk fed to calves had been included, this too would have pushed the average up, but the first few days' milk after each lactation period is ordinarily excluded from production records. This omission, then, probably injects negligible error into the study.

The inclusion of occasional handler rejections of producer milk would also increase the average. But again, this figure is such a small percentage of total producer milk that it would be trivial on a per-cow basis. The use of weighted numbers to expand fractional yearly production to a 365-day basis might also have introduced some bias in the estimate.

Also, we must take into account the very human tendency to exaggerate one's worldly possessions when conversing with most people—other than tax accessors. If this factor were present, it too would make the estimates low. This would be true since actual sales data on each herd were secured from the administrator's office. The use of an inflated herd size figure, then, would give an average production per cow somewhat lower than the actual figure.

We would conclude then that if the estimated averages are biased it is in a downward direction and the figures as presented do not give the producers quite as favorable a per-cow output as they merit.

## CORRELATION STUDIES

The difference between the average yearly per-cow production (adjusted for producer milk consumed at home) of the main body of current producers (Strata I through V) and Stratum I alone is very significant. The differences between the average (Strata I through V) and Strata III, V, VI and new producers were significant. Comparisons of Stratum I with Stratum II and of Stratum II with Stratum III showed a very significant difference. Although the number of units in Stratum IV and Stratum V were so small (five producers comprised the sample for Stratum IV and three for Stratum V) that little reliance can be placed in the estimates based on them, the differences between IV and V, as well as between III and V were significant. With the exception of Strata IV and VI, as the size of herd increased, the production per cow was greater. As a whole, then, these data suggest a positive correlation between the size of a producer's herd and his production per-cow.

Because of this, a correlation was calculated to explore this relationship (Table 23). Due to the inverse relationship within a couple of the strata very little overall correlation was revealed.

It is a commonly held belief that the dairy cow breeding program is a life long task. If this is true, there should be a positive relationship between the number of years that a producer has been in dairying and the productivity of the animals that comprise his herd. Since there is a positive correlation (though not significant) between the age of a dairyman and the number of years that he has been in dairying, the older dairymen should have higher-producing cows than the younger men. Correlation problems were calculated in part to validate or refute this commonly held belief.

The relationships should also indicate to what extent credit is a factor in determining the success of a dairy enterprise, for the younger dairymen can be expected to have smaller herds. If they do not and if credit availability plays an important role, the herds should be poorer in quality as indicated by per-cow production data. It was concluded in the analysis of the past-producer category that the failure of a dairy enterprise to furnish an adequate income for a reasonable standard of living could be attributed largely to inferior management. These correlations are in part an attempt to approximate the weight that must be given to management in forecasting success with a dairy enterprise.

In Table 23, it is noted that with a probability of 0.05, only in two instances are the correlation coefficients significant.In Stratum VI there is a significant negative correlation between herd size and average production per cow in the herds.

The other case in which there is a significant correlation is in the producer group Strata I to V. In this case, there is a significant positive correlation between average per-cow productivity and the producer's age. For producers in Stratum VI there also is a positive correlation, though not significant. It seems odd that for the current producers (excluding Stratum VI) there is a significant correlation between a producer's age and his average production per cow, but no correlation between the number of years that a man has been in dairying and average production per cow. This indicates that experience is not a substitute for ability. The correlation between number of years in dairying and average per-cow yearly production is made less meaningful by the common practice of fathers of passing their dairy herds on to their sons. Thus the solution to the problem may lie in the answer to this unexplored question: How long has the herd been in existence?

There is an inverse relationship between a producer's age and his herd size. This would seem to indicate that the non-availability of credit is not as important as often purported to be in determining the success of a young farmer's dairy enterprise. A distinction should be made, however, between the non-availability of credit and the reluctance to incur debt. This facet would have to be explored before a statement could be made about the inavailability of credit as a barrier faced by young dairymen.

The negative relationship between herd size and production per cow exhibited by the large producers in Stratum VI suggests that large herds are more demanding of their management.

TABLE 23--THE LINEAR RELATIONSHIP BETWEEN SOME SAMPLE CHARACTERISTICS, THE STANDARD ERROR OF ESTIMATE, THE COEFFICIENT OF CORRELATION, AND SIGNIFICANT VALUES OF THE CORRELATION COEFFICIENT AT THE 0.05 PROBABILITY LEVEL

| Sample attributes | Current Producers Strata I to V $Y = a + bX$[c] | $S_{yx}$[d] | r[e] | P = .05[f] |
|---|---|---|---|---|
| Size of herd (X)[a] Average production (Y)[b] (lbs./cow/year) | Y = 6255 + 14.21X | 1722 | 0.096 | 0.2201 |
| Size of herd (X) Producer's age (Y) | Y = 48.6 - 0.114X | 12 | -0.109 | 0.2201 |
| Size of herd (X) Years in dairying (Y) | Y = 14.3 - 0.121X | 11 | -0.126 | 0.2201 |
| Average production (lbs./cow/year) (X) Producer's age (Y) | Y = 33.1 + 0.0018X | 13.7 | 0.231 | 0.2201 |
| Average production (lbs./cow/year) (X) Years in dairying (Y) | Y = 17.5 + 0.000004X | 11.1 | 0.0006 | 0.2201 |
| | Stratum VI | | | |
| | $Y = a + bX$ | $S_{yx}$ | r | P = .05 |
| Size of herd (X) Average production (Y) (lbs./cow/year) | Y = 14625 - 58.86X | 1267 | -0.804 | 0.6021 |
| Size of herd (X) Producer's age (Y) | Y = 53.75 - 0.082X | 14.4 | -0.165 | 0.6021 |
| Size of herd (X) Years in dairying (Y) | Y = 17.59 - 0.0013X | 15.4 | -0.002 | 0.6021 |
| Average production (lbs./cow/year) (X) Producer's age (Y) | Y = 22.11 + 0.0027X | 13.4 | 0.391 | 0.6021 |
| Average production (lbs./cow/year) (X) Years in dairying (Y) | Y = 6 + 0.00134X | 15.3 | 0.187 | 0.6021 |
| | New Producers | | | |
| | $Y = a + bX$ | $S_{yx}$ | r | P = .05 |
| Size of herd (X) Average production (Y) (lbs./cow/year) | Y = 5439 + 14.35X | 1558 | 0.123 | 0.6319 |
| Size of herd (X) Producer's age (Y) | Y = 46.5 - 0.358X | 9.2 | -0.4568 | 0.6319 |
| Size of herd (X) Years in dairying (Y) | Y = 10 - 0.1305X | 6 | -0.2765 | 0.6319 |
| Average production (lbs./cow/year) (X) Producer's age (Y) | Y = 54 - 0.0029X | 10.3 | -0.0654 | 0.6319 |

TABLE 23--CONTINUED

| | New Producers (cont.) | | | |
|---|---|---|---|---|
| | Y = a + bX | Syx | r | P = .05 |
| Average production (lbs./cow/year) Years in dairying (Y) | Y = 20.7 - 0.0024X | 5.5 | -0.606 | 0.6319 |
| | **Past Producers** | | | |
| | Y = a + bX | Syx | r | P = 0.05 |
| Size of herd (X) Average production (Y) (lbs./cow/year) | Y = 4221 + 70X | 1939 | 0.310 | 0.4438 |
| Size of herd (X) Producer's age (Y) | Y = 61.2 - 0.416X | 13.2 | -0.2734 | 0.4438 |
| Size of herd (X) Years in dairying (Y) | Y = 27.1 - 0.274X | 16.3 | -0.1501 | 0.4438 |
| Average production (lbs./cow/year) (X) Producer's age (Y) | Y = 51.8 + 0.00017X | 13.7 | 0.0545 | 0.4438 |
| Average production (lbs./cow/year) (X) Years in dairying (Y) | Y = 25 - 0.00077X | 16.4 | -0.095 | 0.4438 |

a) (X) is the independent variable.

b) (Y) is the dependent variable.

c) The equation of average linear relationship.

d) The standard error of estimate; y is the dependent variable, and x, the independent.

e) The coefficient of correlation.

f) Significant values of the correlation coefficient at a probability level of 0.05. The values were either interpolated or taken directly from Introduction to Statistics, Frederick C. Mills, page 575.