BULLETIN 498 FEBRUARY, 1932

A Market Analysis of Farm Sales of Milk to Dealers in Four Ohio Cities

R. W. Sherman and C. G. McBride

OHIO
AGRICULTURAL EXPERIMENT STATION
Wooster, Ohio

This page intentionally blank.

CONTENTS

This page intentionally blank.

A MARKET ANALYSIS OF FARM SALES OF MILK TO DEALERS IN FOUR OHIO CITIES

R. W. SHERMAN AND C. G. McBRIDE

INTRODUCTION

This study is confined to some of the economic factors affecting market milk which may be dealt with through analysis of producer sales by months. It includes four Ohio markets—Cincinnati, Dayton, Columbus, and Canton—and involves data for the years 1925 to 1929, inclusive.

The purpose of the first phase of the study has been to determine the significance of the butterfat content of milk as a market factor. Some of the economic factors causing markets to vary in butterfat content of milk received by dealers are outside the scope of this study. Breed of dairy cattle is the most important of these factors not covered in this study; another factor is herd management.

There is a definite relationship between these factors and the factors studied. Breed and herd management practices greatly influence both the supply and fat content of the milk, and, in turn, buying plans and butterfat differentials affect herd management and breed choices.

The second phase of the study deals with average daily farm sales by months. This is a factor of considerable importance, because, in marketing practice, producers may be sorted into size groups and the character of supply influenced by the addition or elimination of producers on this basis. Production factors, such as breeds and herd management, are also related to size of daily sales but not as closely as in the butterfat phase of the study.

The method followed was a statistical analysis of sales of producers by the use of card tabulating machines. Individual producer records were first copied from the records of dealers and producer marketing associations upon cards which will be accumulated over a period of years by the Department of Rural Economics. It is hoped that these will become the basis for further extensions of the phases here presented and for additional studies in correlation, for which the present data cover too short a period of time.

This type of study becomes possible only through the most complete cooperation of the dealers and producer associations in making available the original producer records. This has been accorded those who have worked on the study in every market and at all times.

SUMMARY AND CONCLUSIONS

Milk market conditions are continually changing, both in demand for milk and in supply as furnished by the producer. The supply fluctuates very greatly with the season of the year and also changes with the dairy cycle. These changing conditions make it difficult to adjust the supply so as always to have a good market for all the milk and always to supply the market with milk of a satisfactory quality and in a satisfactory quantity.

This study deals with the relation of market practices to the butterfat content of the milk purchased by dealers and with some of the other market factors that have an influence upon the character of the supply. The practical value of this information arises from the fact that those factors are all under the control of producers and dealers. Once the facts are known, the character of the supply may be influenced by marketing practices.

The following facts pertinent to the market supply problems have been brought out in this study:

1. The butterfat content of milk received by dealers in a market is influenced by the base test set for the market. The average butterfat content of the market's total receipts tends to equal, or slightly exceed, the base test after enough time has elapsed to allow the producers to adjust their herds. It is generally conceded by those familiar with milk marketing that producers have a distinct desire to receive a price equivalent to, or above, the quoted market price. This fact is of importance, as the base test may be set at the point which is desired for the market, as an influence in securing milk of this test.

The butterfat differential is another influence on the test of milk received. This differential may accentuate the influence of the base test noted above or tend to cancel it. If the differential is above the market value of butterfat, it will tend to raise the test; whereas, if it is below the market value, it will tend to lower the test.

2. Milk produced by summer dairies averaged higher in test in all markets, except Columbus, than did the milk from winter dairies. This difference was never very great, and in only one instance did it amount to as much as one-tenth of one per cent for

the year's milk. This difference, however, is considerable when applied to total market receipts. The most important difference between these two divisions of producers is the difference in butterfat content at different times of the year. The summer dairies were much more variable than the winter dairies. The low tests for both came in the spring months, with the high tests in the fall months. Using 100 as the average for the period studied, the summer dairies varied from 94.6 to 108.6; whereas the corresponding figures for the winter dairies were 96.1 to 105.2. It is evident, therefore, that any plan of buying which will tend to equalize supply will also help to equalize, to a great extent, the butterfat content.

3. Milk sales of small producers were higher in butterfat content than those of larger producers. This is so pronounced in some markets that it amounts to as much as one-half of one per cent in test between the groups of highest and lowest average sales. When the supply is to be adjusted to the market needs, it would, therefore, make a considerable difference in butterfat content of milk whether those producers concerned in the adjustment were large or small producers.

4. Probably the most important fact brought out in the analysis comparing regular producers with irregular producers was the tendency for the irregulars to increase the butterfat content of milk sold much more than did the regulars. The irregulars, in fact, accounted for practically all butterfat increases in the markets where irregular shippers' records were taken.

5. Sales per day per dairy were highest in Canton, with Columbus next, Cincinnati third, and Dayton lowest. Length of selling experience in a fluid milk market, degree of intensity of dairy industry, and the popularity of different breeds in different sections are some of the factors which affect the average per day per dairy sales. There are other conditions affecting the daily sales per dairy, such as the dairy cycle, but such influences probably have about the same effect on each market.

6. Winter dairies were higher in average sales per day per dairy than summer dairies. The winter producers, no doubt, make a more serious business of their dairying program than do the summer producers and, therefore, not only produce a more even supply of milk but produce more in a year's time than the summer producers. The relation between the two in all four markets studied remained about the same from year to year.

Irregular shippers were much lower in per day per dairy sales than either the summer or winter groups of the regulars. However, while the irregulars were actually shipping, they were not so much lower in size of shipments than the regulars.

7. Summer dairies were very much more variable in production than winter dairies. On an average, the summer dairies varied almost three times as much from their lowest production as did the winter dairies.

Due to this much wider variation of the summer dairies, they are not nearly such desirable producers for a fluid milk market as are the winter producers. They are the ones at whom buying plans are aimed in the attempt to even the market supply of milk.

8. Columbus was the only market studied which had a basic surplus buying plan. The sample from this market had 16 per cent less seasonal variation in milk receipts than Cincinnati, 21 per cent less than Canton, and 14 per cent less than Dayton. Most of this difference in seasonal variation in the Columbus market is, no doubt, due to the basic surplus buying plan. On the other hand, the other three markets were very similar to each other in seasonal variation.

9. There is a definite relationship between size of dairies and seasonal variation of receipts within the markets. The small dairies vary most, with a definite decrease in variation to the largest shippers. This, however, does not mean necessarily that the market with the smallest size dairies will have the most seasonal variation or that the opposite will hold true. The fact that Canton, with relatively large dairies, varies more than any of the other three markets and that Dayton, with very small dairies, varies less than any but Columbus shows this exception.

10. The summer dairies of all markets delivered about one-fourth of the year's milk during the last 4 months of the year; whereas the winter dairies delivered one-third of their milk during the same period. In markets where fall shortages occur, this is of much significance, but it is of less importance in markets where no shortages occur.

11. The fact that a producer is a summer producer one year is no assurance that he will be the same the next year, nor that the winter producer will be the same from year to year. There was much shifting both ways. In the majority of cases, those classed as winter producers failed to remain in this classification for the entire period studied.

SOURCE OF DATA

In each market studied, data taken consisted of the record of farm sales and butterfat tests of producers by months. From Cincinnati, the data taken were for 303 producers from 1925 to 1929, inclusive. These producers were selected from as many truck routes as possible in order to get a representative sample. From Dayton, the data were taken from the three largest distributing companies in the market. For one of these companies all the producers were taken, but for the other two only those producers who were in the market regularly for 3 years or more were taken. The Dayton samples ranged in number from 708 to 908 producers.

For Columbus, the records were taken from two companies for a period from 1927 to 1929, inclusive. Only the records for producers who shipped regularly during the period were taken. The sample consisted of 400 producers. For Canton, all records available were taken for the period 1925 to 1929, inclusive. This consisted of well over 90 per cent of the total number of producers shipping into Canton for 1927 to 1929, but not quite so high a percentage for 1925 and 1926.

Producers in this study have been divided into regular and irregular. The regular producer is one who is in the market at the beginning and the close of each 12-month period. He may, in a few instances, fail to sell any milk for a month or two in his shortest period of production, but, in practically all instances, he is in the market constantly. The irregular producer is one who appears in the market for a part of the year only or who may shift from one dealer to another, so that it is very difficult to get a continuous record of his sales.

In Table 1 is given a synopsis of the number of producer records taken in each market, by years, and classified as to regular or irregular.

TABLE 1.—Number of Producers Included in Markets Studied

Year	Dayton		Canton		Columbus	Cincinnati	Total
	Regular	Irregular	Regular	Irregular	Regular	Regular	
1925	.....	.....	287	226	.....	303	816
1926	233	475	305	206	.....	303	1522
1927	360	507	462	260	400	303	2292
1928	360	548	462	286	400	303	2359
1929	360	493	462	340	400	303	2358

PART I. BUTTERFAT CONTENT OF MARKET MILK

BUTTERFAT AS AN ECONOMIC FACTOR IN MARKET MILK

When a milk dealer quotes a certain price for milk of 3.5 per cent butterfat test with a stated differential for each one-tenth point above or below the base line, is the commodity that he purchases milk or butterfat? This is not an easy question to answer.

A hundred pounds of whole milk sold in the fluid market have a higher value than the combined values of the butterfat for manufacturing and skimmilk contained therein. This proves there is a whole milk value higher than the manufacturing value of the butterfat and skimmilk contents, and it would appear that the commodity purchased is primarily milk.

A different line of analysis, however, reveals that butterfat also must come in for consideration; for example, if 3.5 per cent is the base test for the market and the price happens to be $2.10 per hundred pounds for milk of this test and a 20-cent value is given to skimmilk, the value of butterfat is determined by dividing 3.5 into $1.90. This gives a value per pound of 54.3 cents for butterfat. It is the general practice to have a butterfat differential to apply above and below the base test somewhat higher than the sour cream market. If the differential in this market were 4 cents per point above and below the 3.5 per cent base, the butterfat represented in the variation from base test would be paid for or deducted at the rate of 40 cents per pound.

If, in this same market, a basic surplus plan is in effect, it is quite probable that the surplus milk will be paid for on a straight, Chicago extra butter market basis. This valuation is lower than either of the above.

These illustrations show something of the complexity of the price problems in milk marketing. They prove that the two commodities—milk and butterfat—are closely interwoven and that distinctly different values are placed on butterfat in the same transaction. It is, therefore, evident that no analysis of milk marketing can be complete that does not take into account the pounds of milk and the pounds of butterfat delivered by the producer.

The producer is vitally interested in the matter of butterfat tests because of the important influence they have upon his returns. Within certain limits he can control the butterfat content of his milk. These analyses should be of some value to him as a guide in this procedure.

The dealer is as much concerned as is the producer. Different dealers have different tests which they consider ideal. The same dealer may find it to his advantage to have a different average fat content at one time than at another. The fat content required by city boards of health or desired by the customer of bottled milk is one factor determining the test which the dealer desires. The dealer's market outlet for surplus butterfat is another factor influencing his viewpoint on butterfat test.

This raises the important question as to the possibility of influencing this factor by market practices. The results so far obtained in this study indicate a distinct possibility of such influence.

BASE TESTS AND BUTTERFAT DIFFERENTIALS

Of the markets studied no two had exactly the same combination of base test and differential.[1]

The Cincinnati market, during the period studied, had a base test of 3.5 per cent, with a butterfat differential above and below of 4½ cents per point. Canton also had a 3.5 per cent base test but had a differential of 5 cents per point above and below. In the Dayton market, the base test was 4 per cent, with a differential of 5 cents. The Columbus market had a 4 per cent base with a differential of one-tenth of 115 per cent of the monthly average price of Chicago extra 92 score butter.

METHOD OF COMPUTING BUTTERFAT AVERAGES

All averages of butterfat quoted in this bulletin are weighted. These averages were computed by dividing the total pounds of milk by the total pounds of butterfat contained in the milk. Each month and each division of producers were handled in the same way in computing the butterfat averages. This method is used rather than the simple average of tests involved, as it gives the proper weight to the varying amounts of milk of different test.

COMPARISON OF AVERAGE BUTTERFAT TESTS

In Figure 1 are shown the weighted average tests by months for all shippers studied in the four markets. There is a striking contrast shown in the butterfat trends in the different markets.

[1]The base test and differential used in Cincinnati during the period of this study had been in use since 1923. In the other markets the base test and differential had been in effect at least 2 years previous to the time of the earliest data used.

Cincinnati was, for the period covered in this study, on a 3.5 per cent butterfat base; whereas Dayton was on a 4 per cent base. In 1926 there was but .05 of one per cent difference in the weighted average butterfat content of milk received. In 1929, after 3 more years of operation on this basis, the average for Dayton was .32 of one per cent higher than that of Cincinnati, a net change of .27 of one per cent.

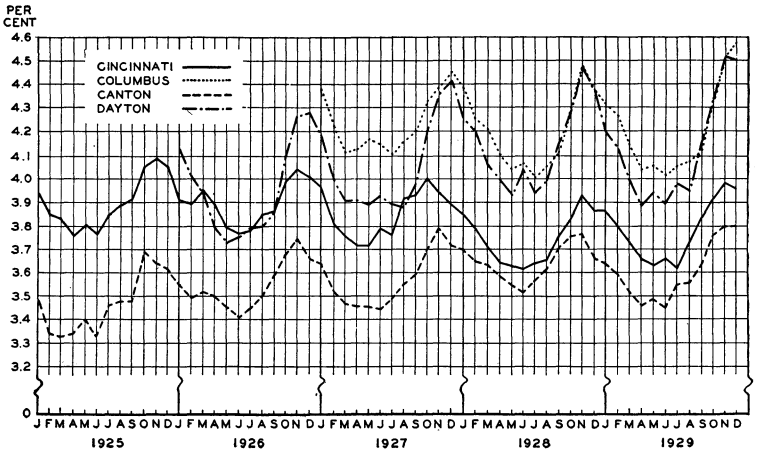

Fig. 1.—Weighted average butterfat tests of milk in samples studied, in Cincinnati and Canton 1925-1929, Dayton 1926-1929, and Columbus 1927-1929

The trend in Cincinnati was downward and in Dayton upward. Of the total change .11 of one per cent was due to decrease of the average of Cincinnati and .16 of one per cent was due to the increase in Dayton. In the samples studied, this was an average of 45.9 pounds less butterfat per year per producer in the Cincinnati market and an average increase of 35.9 pounds per producer in the Dayton market. The gain was 270 pounds of butterfat per 100,000 pounds of milk in favor of the Dayton market.

The tendency for the butterfat tests of markets with different butterfat bases to diverge and for markets on the same butterfat base to have approximately the same tests is shown clearly in this graph. In the case of Cincinnati and Canton, both on a 3.5 per cent fat base, the averages of butterfat content of the milk are converging. In the cases of Dayton and Columbus, the trends are not quite so striking but are apparent.

In all markets studied, after several years on the same fat base, the yearly average was above the base but fairly close to it. This can be accounted for by the fact that most shippers do not like to take less than the quoted price and, therefore, build up their herds

to test as near the base as possible or slightly above it. In the case of Cincinnati, where the fat base was lower than the producers' average butterfat test, the average test for the market has been coming down. This would seem to indicate that the differential of 4½ cents per point was not enough to encourage a test much above the base. The farmers changed from producing milk considerably above base test to producing milk closer to base test for which they received less per hundred pounds. It is significant that butterfat in base-test milk is paid for at a higher price than the fat above base test.

As can readily be seen from Figure 1, there has been a definite trend in average butterfat test in three of the four markets studied. The group of producers of the Columbus market showed practically no trend. This was probably due to the fact that they were already just slightly above the butterfat base for the market.

The Dayton producers raised their average test from 3.93 in 1926 to 4.09 in 1929. Since they are now above the market base test of 4 per cent, it is doubtful whether they will maintain this rate of increase. This will depend to some extent upon the butterfat differential.

The average butterfat test of the Cincinnati producers dropped from 3.89 per cent in 1925 to 3.77 in 1929. In 1925 they were .39 per cent above their base test; whereas in 1929 they were .27 per cent above base test. It remains to be seen whether this decrease will continue until it reaches the base test.

The Canton producers have shown a definite upward trend, except for 1929. In this year they fell .04 per cent. Their test for the full year's milk was never below the base test after 1925, when it was 3.45. Their increase in test for 1929 over 1925 was .14 of one per cent. For each 1,000,000 pounds of milk they were selling 1400 pounds more butterfat in 1929 than in 1925.

There was a temporary increase in test in May or June which occurred rather persistently in each market from year to year. The cause of this is evidently closely correlated with the turning of cows out on pasture. This rise, however, is not great enough to be of very great market significance.

Inasmuch as the yearly average butterfat tests are not shown on the graphs of the monthly tests, they are given in Table 2. These test figures are important in showing how the total amount of milk for the year is changing in butterfat content.

TABLE 2.—Weighted Average Butterfat Test, by Years, for the Different Divisions of Dairies in the Columbus, Dayton, Cincinnati, and Canton Markets

	Canton	Dayton	Columbus	Cincinnati
	Pct.	*Pct.*	*Pct.*	*Pct.*
Regulars				
Summer dairies				
1925	3.48	.....	.....	3.95
1926	3.54	4.02	.....	3.91
1927	3.54	4.07	4.21	3.86
1928	3.58	4.09	4.18	3.74
1929	3.54	4.07	4.16	3.78
Winter dairies				
1925	3.44	.....	.....	3.81
1926	3.49	3.96	.....	3.82
1927	3.55	4.03	4.26	3.80
1928	3.63	4.06	4.19	3.71
1929	3.53	4.00	4.24	3.74
Irregulars				
1925	3.43	.....	.....	.....
1926	3.54	3.88	.....	.....
1927	3.59	3.97	.....	.....
1928	3.75	4.19	.....	.....
1929	3.74	4.15	.....	.....
All shippers				
1925	3.45	.....	.....	3.89
1926	3.53	3.93	.....	3.88
1927	3.56	4.02	4.22	3.84
1928	3.63	4.12	4.19	3.73
1929	3.59	4.09	4.19	3.77

COMPARISON OF WINTER AND SUMMER DAIRIES AS TO BUTTERFAT

In classifying the regular producers as to summer or winter dairies an arbitrary division was used. Those dairies which shipped less than 75 per cent as much milk in November as in June were classed as summer dairies. Those which shipped 75 per cent as much in November as in June, or more, were classed as winter dairies. Only those dairies classed as regular were divided into the summer or winter classification. The irregulars were not classified since their records were not continuous. Their total performance was, therefore, not known in all cases.

Columbus market.—The butterfat tests for Columbus are pictured in Figure 2 A. The tests of the winter dairies are very definitely higher than those of the summer dairies during the months of February, March, April, May, and June. There is not as much difference between the summer and winter dairies in the fall months as in the Dayton group (see Figure 2 B). The range for the 3 years was .60 per cent for the summer dairies and .60 per cent for the winter dairies. This comparison in itself would be misleading, because, for any one year, the summer dairies were much more variable than the winter dairies. The reason for the high 3-year

variation figure of the winter dairies was the extremely high tests of November and December 1929. For some reason they went more than .2 per cent above their previous year's test.

Figure 2 A shows that during the 3 years studied, the butterfat test of this group of 400 producers has become much more variable. Very little trend has been shown except for a very slight downward movement of tests for the summer dairies.

The most striking thing about this group of shippers is that the test of the winter dairies rises in the fall almost as much as the summer dairies. It is also the only market to show a definitely higher average test for the winter dairies than for the summer dairies. The widest difference in test between the two types for any one month was only .20 per cent, occurring in November 1928, in favor of the summer dairies.

Dayton market.—In Figure 2 B are shown butterfat averages of the Dayton market. The winter dairies are much less variable in their tests over the year than are the summer dairies. The range in test for the 4 years was .45 per cent for the winter dairies and .73 per cent for the summer dairies. These comparative figures take in not only seasonal variation but a trend running through the period studied.

In general, the winter dairies of the Dayton group had higher tests than the summer dairies, in the months of April, May, and June, but much lower tests from August on through the fall months. For the yearly weighted average, the summer dairies are each year above the winter dairies, the greatest difference being .07 per cent in 1929. For 1929, on the total production of the 360 producers in the sample, this would have meant a difference of 7679 pounds of butterfat.

Both the winter and summer dairies show an upward trend in test, except in 1929 when both fell somewhat. Practically the same relation is maintained between the two from year to year.

Canton market.—The average tests of the summer and winter dairies of the Canton market are shown in Figure 2 C. This is on practically a full market basis rather than on a sample basis. The irregular shippers, however, are not on this graph as they were not classified as to summer and winter dairies.

The trend of the test of the regular shippers has been upward, except for a drop in 1929. This drop was back about to the 1927 level for the regular shippers, but the test for the whole market dropped but little in 1929. This was due to a considerable rise in test on the part of the irregular shippers.

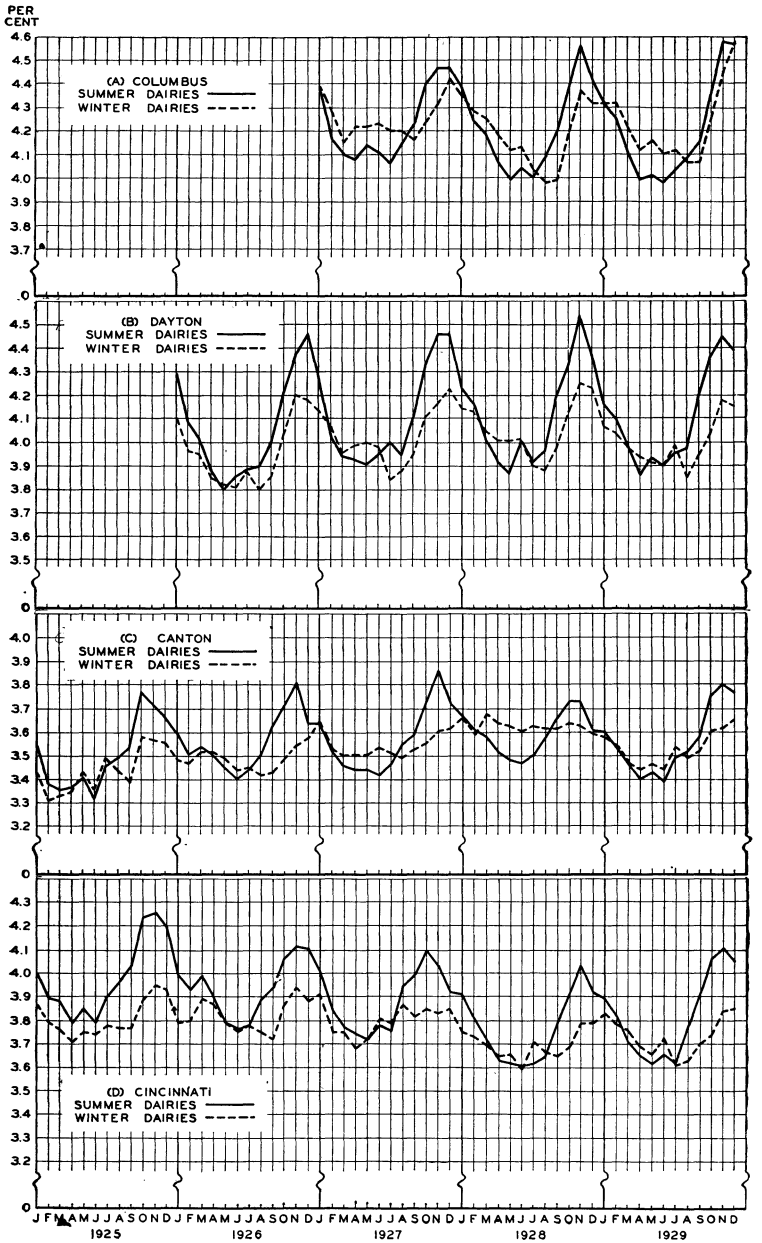

Fig. 2.—Weighted average butterfat tests of summer and winter dairies in Canton and Cincinnati 1925-1929, Dayton 1926-1929, and Columbus 1927-1929

In average test, there was little difference on the whole, between the two types of dairies, and this difference was in favor of the summer dairies. The summer dairies showed much more seasonal variation than the winter dairies. For the 5-year period, the range in test for the summer dairies was .54 per cent and for the winter dairies, .37 per cent. The winter dairies on the Canton market showed less seasonal variation in test from year to year than any other market studied; in 1928 they varied less than one-tenth of a per cent.

Cincinnati market.—The butterfat tests for the group of 303 dairies in the Cincinnati market shown in Figure 2 D show a definite downward trend, except in 1929 when the average test was up slightly. This was the only market of the four studied which showed a falling test; most of this drop was in the summer dairies. During the period studied, the winter dairies never had a higher test than the summer dairies until June 1927. For the 5 years, they were higher than the summer dairies in only 10 months of the 60; whereas, the summer dairies were higher for 47 months. Three times they were the same. The greatest difference in test was in October 1925, with a .35 per cent advantage for the summer dairies. The advantage shown, of the winter dairies over the summer dairies, in the other markets during the spring and early summer months is lacking here, except in 1928 and 1929. In these 2 years, the tests of these months favor the winter dairies, but to no great degree.

The range in test for the 5-year period of the summer dairies was .65 per cent and of the winter dairies, .36 per cent.

SEASONAL VARIATION OF BUTTERFAT CONTENT OF MILK

The best way to compare the seasonal variation of average test, as between markets and between classifications in the markets, is by the use of relatives.

These relatives are computed as follows: All Januarys are averaged for the January test; the same is done for each month of the year. These 12 tests are then added and divided by twelve to secure the average test of the period. This is used as the base and divided into each of the 12 months' tests. The results are the series of relatives shown in Figure 3. When the curve is above the 100 per cent line, it means that for that particular month the test was above average; when below that line, the test was under average.

One advantage of the use of relatives to compare seasonal variation is that the differences of actual tests between markets are eliminated. This method also eliminates all trend except average yearly trend, making the figures for the different markets more comparable. From these relatives it is possible to forecast the fat content of milk delivered by the same group of shippers in different months of the year; for example, if the January relative was 102 and the June relative 96, then a volume of milk which, in January, yielded 102 pounds of fat would, in June of the same year, be expected to yield 96 pounds.

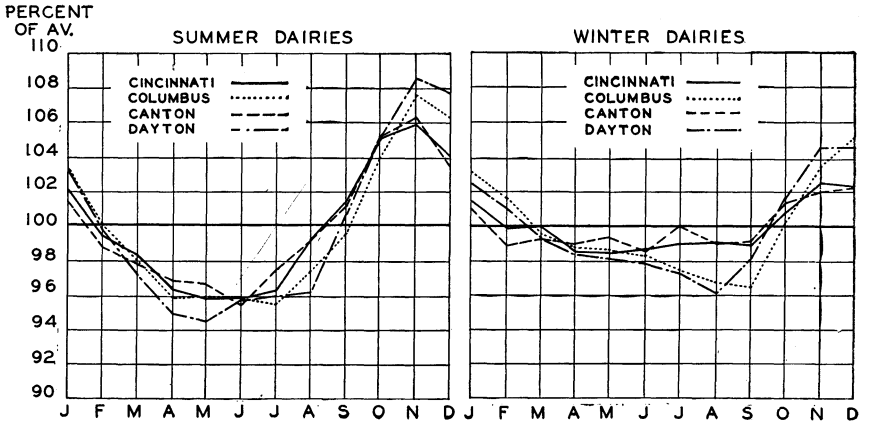

Fig. 3.—Seasonal variation of weighted average butterfat tests for summer and winter dairies of Columbus, Dayton, Canton, and Cincinnati, 1927-1929

It is shown in Figure 3 of the relatives for the summer dairies that a peak came invariably in November, with quite a percentage variation from average. The Dayton group rises to 108.6 per cent of average, with Columbus next at 107.7 per cent. For the winter dairies, the peak comes in November and December. The peaks of the winter dairies were much lower than those of the summer.

On the whole, the Canton and Cincinnati markets were much less variable than Columbus and Dayton. The winter dairies of Cincinnati and Canton were relatively uniform, with less than 3 per cent variation from average. Their summer dairies were also considerably less variable than those of Dayton and Columbus. The tests of the Dayton and Columbus winter dairies dropped in July, August, and September and rose in November and December, showing that these two markets were much more variable in test than Cincinnati and Canton.

COMPARISON OF BUTTERFAT TEST OF REGULAR AND IRREGULAR SHIPPERS

The comparison of the regular and irregular shippers has been confined to the Canton and Dayton markets, inasmuch as records of only regular shippers were taken from Columbus and Cincinnati. These comparisons are shown in Figure 4.

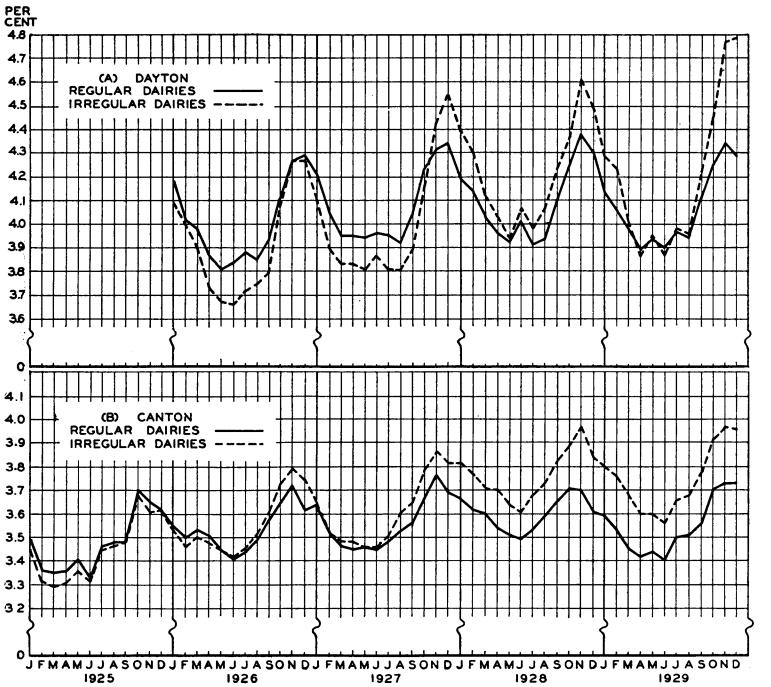

Fig. 4.—Weighted average butterfat tests of regular and irregular shippers in Dayton 1926-1929 and Canton 1925-1929

In both markets the tendency has been for the irregular shippers to increase in test more than the regular. This trend is very pronounced in the case of Canton. In 1925 the weighted average test of the irregulars was 3.43 per cent and for the regulars was 3.46 per cent. In 1929 the regular's test was 3.53 per cent and the irregular's was 3.74 per cent. This shows a gain of .07 per cent over the 1925 figures for the regulars and of .31 per cent for the irregulars, or a net gain of .24 per cent by the irregulars over the regulars. In Dayton, there was a net gain of .21 per cent in favor of the irregulars. Here the irregulars gained .27 per cent from 1926 to 1929; whereas the regulars gained but .06 per cent.

This means that for each 100,000 pounds of milk received from the regular shippers in the Canton market in 1929, there were but 70 pounds more butterfat than in 1925. For a like amount of milk from the irregular shippers, the fat content was 310 pounds higher. In the Dayton market, the increase in fat content of the same volume of milk for the regular shippers was only 60 pounds and for the irregulars was 270 pounds.

The fact that both markets advanced in average butterfat test over the period studied was due largely to the big gain in test of the irregular shippers. The regulars in both cases gained in average test but in neither case was their gain as much as one-fourth the gain for the irregulars.

As far as range of test for each year is concerned, there is but little difference between regulars and irregulars in the Canton market. The only difference here is due to the trend of the irregulars being more pronounced than that of the regulars. In the Dayton market sample, there was decidedly more range in the test of the irregulars. The difference in range between the two markets no doubt can be explained by the difference in size of dairies.

In the Dayton market, the irregular shippers were a group of extremely small producers; most of them shipped no milk in some of the fall months. In the Canton market, the irregular shippers were much larger producers, which may account for the fact that they were more nearly like the regulars in yearly range of tests.

In practically every month the variations, up and down, of the tests of both classifications were surprisingly alike, both in direction and amount. This shows that, if the irregulars could be divided as to summer and winter classes, the division would approximate that in the regulars.

Comparing the irregulars with the summer and winter divisions of the regulars, it seems that in the Dayton market the irregulars compare rather closely to the summer dairies with respect to monthly variation. They are much more variable, however, than the winter dairies. There is a more pronounced upward trend for the irregulars than for either the summer or winter dairies of the regulars.

In Canton the irregulars are even less variable in test than the summer dairies but are more variable than the winter dairies. In fact, the variability is just about the average of the two divisions of the regulars as shown in Figure 4 B. The upward trend of the irregulars of the Canton market corresponds closely to that of the Dayton market.

Combining the regulars into three size classes and also combining all years, the comparison between the regulars and irregulars as to size is shown in Figure 5. For Dayton this shows the irregulars to be lower in test in each size group than the regulars. This does not, however, mean that, for the test of the whole amount of milk shipped by each group, the regular shippers were the higher of the two. In fact, they were almost identical, both being about 4.05 per cent. The irregulars were weighted more heavily toward the smallest shippers, thereby giving more weight to the higher test. This influence of the small producers was more marked with the irregulars than with the regulars, which made it possible for the tests of the entire shipments of the two to be about alike.

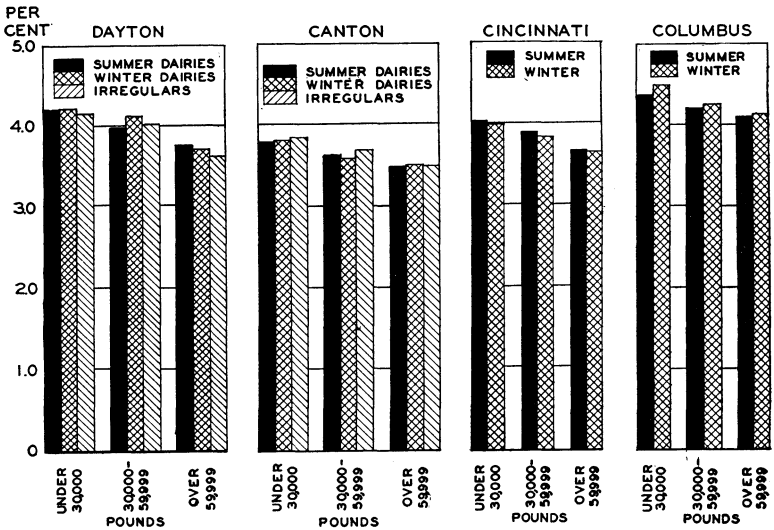

Fig. 5.—Weighted average butterfat tests of milk by volume of yearly shipments in the Dayton, Canton, Cincinnati, and Columbus markets

Both regulars and irregulars of the Dayton market fell in test about .50 per cent from smallest to largest shippers, as shown by the data for the 4-year period. These figures would be slightly off, if figuring on effect at present, due to the fact that where a definite trend enters into a series of data the average is not a good figure by which to forecast, being either too low or too high. The difference in the trend of the two divisions is shown in Figure 4.

Canton had a reverse relationship to that of Dayton in this respect. Here the irregulars are higher in two of the three classes and just the same as the regulars in the other class. For total

shipments the irregulars were .07 of one per cent higher than the regulars. In other words, for each 100,000 pounds of milk contributed by each, that of the irregulars contained about 70 pounds more butterfat than the same amount from the regulars.

The difference between the small and large shippers of Canton is not so much as in Dayton, being .30 per cent for the regulars and .36 per cent for the irregulars. These smaller differences for Canton can be expected on account of the lower test throughout the Canton market. This difference between the smallest and largest shippers in the two markets in percentage, with the small shipper's test as base, is 12 per cent for Dayton and 8.7 per cent for Canton.

All these differences are significant in comparison of markets and also in each market's problems. Markets differ in character of shipping list, both as to size of shipments and as to percentage of regular and irregular shippers. The problems of the dealers of each market would be different with regard to changing the number of shippers; for instance, in the Canton market, if 10,000 pounds of milk were to be thrown off, less difference in test would result from throwing off either small or large, regular or irregular shippers than would occur in the Dayton market.

BUTTERFAT TEST BY VOLUME OF YEARLY SHIPMENTS

For this study, the producers were divided into classes according to the pounds of milk shipped per year. The basis used was average yearly sales, with class intervals of 10,000 pounds each up to 100,000 pounds; above this, all were placed in the last class. This makes a total of eleven classes, which were used in all four markets studied.

Each market had a different distribution within this classification, due to difference in size of dairies. Table 3 shows how the distribution varies by markets, with the class intervals combined into three classes for ease of comparison. This combination brings out the difference in distribution with greater emphasis than by separate class intervals of 10,000 pounds.

In this table Dayton is shown with an overwhelming per cent of dairies in the class under 30,000 pounds per year. Canton is shown at the other extreme, with a small per cent in the low class. The Columbus sample has less than a fourth of the shippers in the first class, and Cincinnati has 38 per cent. When comparing these figures, those of Columbus and Cincinnati should be compared with the figures for the regular groups in Dayton and Canton, as only regulars were studied in the first two markets mentioned. In the

second size class, Columbus has the greatest per cent of dairies, and Dayton has the least. The third, and largest, size class shows Canton with much the highest per cent and Dayton with the lowest.

TABLE 3.—Per Cent of Dairies Falling Within Given Size Class Limits

Market	Yearly volume of shipments, in pounds			Total
	Below 30,000	30,000–59,999	Above 60,000	
Dayton—Regulars	69	25	6	100
Irregulars	81	17	2	100
Canton—Regulars	14	46	40	100
Irregulars	32	44	24	100
Columbus—Regulars	22	57	21	100
Cincinnati—Regulars	38	46	16	100

Butterfat averages were figured for the 30,000-pound class intervals, as well as for the 10,000-pound intervals. The three bars under each class (Figure 5) for Dayton and Canton markets represent the tests of the three types of producers within the 30,000-pound class. First, the shippers were divided as to regular and irregular shippers. Then, the regulars were divided into the summer and winter division, as explained before. The first bar represents the weighted average test of the summer dairies, the second bar the test of the winter dairies, and the third bar the test of the irregular shippers. Figure 5 also presents similar data for Columbus and Cincinnati, except for the omission of irregulars.

For each market the tests given were the averages for all the years studied. This average gives a test on a much larger sample than that of single years and, in addition, gives a résumé of what has happened for the entire period studied.

These weighted average tests, as figured by the 10,000-pound class intervals, are given in Tables 4 and 5.

TABLE 4.—Weighted Average Butterfat Test of Milk by Volume of Shipments in the Canton Market (1925-1929) and the Dayton Market (1926-1929)

Amount of yearly shipments	Summer dairies					Winter dairies					Irregulars				
	1925	1926	1927	1928	1929	1925	1926	1927	1928	1929	1925	1926	1927	1928	1929
Pounds	Pct. fat	Pct. fat	Pct. fat	Pct. fat	Pct. fat	Pct. fat	Pct. fat	Pct. fat	Pct. fat	Pct. fat	Pct. fat	Pct. fat	Pct. fat	Pct. fat	Pct. fat
Canton															
Under 10,000	.....	.....	3.45	3.89	4.20	.....	.....	.....	.....	.....	3.49	4.26	4.24	3.28	3.83
10,000–19,999	3.58	4.06	3.81	3.81	3.83	4.89	3.96	3.90	4.41	3.69	3.53	3.86	3.70	3.96	4.05
20,000–29,999	3.68	3.85	3.78	3.82	3.72	3.66	3.66	3.73	3.86	3.79	3.62	3.65	3.86	3.89	3.95
30,000–39,999	3.59	3.80	3.76	3.77	3.70	3.51	3.58	3.63	3.70	3.78	3.64	3.66	3.65	3.90	3.89
40,000–49,999	3.43	3.53	3.56	3.63	3.57	3.60	3.56	3.55	3.62	3.54	3.46	3.71	3.71	3.87	3.73
50,000–59,999	3.45	3.55	3.57	3.66	3.62	3.45	3.57	3.65	3.47	3.47	3.36	3.55	3.63	3.68	3.70
60,000–69,999	3.55	3.54	3.53	3.54	3.52	3.32	3.48	3.54	3.67	3.52	3.43	3.50	3.53	3.62	3.59
70,000–79,999	3.44	3.44	3.47	3.51	3.46	3.28	3.43	3.58	3.53	3.54	3.46	3.59	3.49	3.67	3.83
80,000–89,999	3.51	3.57	3.58	3.57	3.47	3.46	3.55	3.35	3.62	3.52	3.31	3.42	3.51	3.39	3.57
90,000–99,999	3.34	3.36	3.39	3.45	3.38	3.22	3.31	3.31	3.43	3.34	3.39	3.33	3.39	3.70	3.59
Over 99,999	3.39	3.40	3.38	3.42	3.37	3.41	3.39	3.49	3.71	3.53	3.29	3.30	3.43	3.54	3.50
Average of all classes	3.48	3.54	3.54	3.58	3.54	3.44	3.49	3.55	3.63	3.53	3.43	3.54	3.59	3.75	3.74
Dayton															
Under 10,000	.....	3.91	4.18	4.08	4.14	.....	4.39	3.95	4.45	4.32	.....	4.02	4.05	4.28	4.26
10,000–19,999	.....	4.17	4.29	4.26	4.21	.....	4.24	4.19	4.21	4.22	.....	4.01	4.11	4.23	4.23
20,000–29,999	.....	4.03	4.21	4.23	4.25	.....	4.13	4.20	4.36	4.20	.....	4.01	4.07	4.23	4.23
30,000–39,999	.....	3.96	3.96	4.06	4.03	.....	3.98	4.26	4.21	4.15	.....	3.92	3.96	4.14	4.12
40,000–49,999	.....	3.74	3.95	4.02	3.90	.....	3.87	4.21	4.13	4.36	.....	3.89	3.99	4.25	4.21
50,000–59,999	.....	4.11	4.04	4.10	3.94	.....	3.63	3.93	4.05	4.20	.....	3.89	3.79	3.75	4.11
60,000–69,999	.....	3.20	3.90	3.88	3.73	.....	3.46	3.93	3.93	3.88	.....	3.67	3.69	3.97	3.88
70,000–79,999	.....	.....	4.39	4.19	4.19	.....	3.88	4.14	4.34	4.53	.....	3.37	4.22	3.64	3.17
80,000–89,999	.....	.....	.....	.....	3.59	.....	3.88	3.72	3.69	3.56	.....	3.57	3.59	4.23	3.35
90,000–99,999	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.81	.....	.....
Over 99,999	.....	.....	3.57	3.56	3.72	.....	3.54	3.62	3.65	3.48	.....	3.21	3.29	3.81	3.75
Average of all classes	.....	4.02	4.07	4.09	4.07	.....	3.96	4.03	4.06	4.00	.....	3.88	3.97	4.19	4.15

TABLE 5.—Weighted Average Butterfat Test of Milk by Volume of Shipments in the Cincinnati Market (1925-1929) and the Columbus Market (1927-1929)

Amount of yearly shipments Pounds	Summer dairies					Winter dairies				
	1925 Pct. fat	1926 Pct. fat	1927 Pct. fat	1928 Pct. fat	1929 Pct. fat	1925 Pct. fat	1926 Pct. fat	1927 Pct. fat	1928 Pct. fat	1929 Pct. fat
Cincinnati										
Under 10,000	.....	4.34	.....	4.18	.....	4.32	.....	4.34	.....	4.27
10,000-19,999	4.06	4.09	4.02	3.93	3.95	4.00	3.77	4.08	3.89	3.99
20,000-29,999	4.09	4.07	4.06	3.92	4.02	4.05	4.03	3.93	3.95	3.93
30,000-39,999	4.10	4.13	4.00	3.90	3.95	3.94	3.90	4.02	3.86	3.90
40,000-49,999	4.10	3.88	3.84	3.85	3.76	3.83	4.06	4.01	3.81	3.99
50,000-59,999	3.78	3.86	3.76	3.68	3.66	3.79	3.74	3.70	3.63	3.66
60,000-69,999	4.02	4.00	3.85	3.69	3.68	3.83	3.85	3.77	3.61	3.75
70,000-79,999	3.55	3.57	3.63	3.45	3.43	3.81	3.55	3.56	3.44	3.36
80,000-89,999	4.05	4.12	3.67	3.57	3.67	3.55	3.68	4.08	2.95	2.95
90,000-99,999	3.79	3.70	3.79	3.67	3.75	3.65	3.75	3.60	3.60	3.64
Over 99,999	3.57	3.53	3.56	3.48	3.47	3.55	3.62	3.55	3.49	3.55
Av. of all classes	3.95	3.91	3.86	3.74	3.78	3.81	3.82	3.80	3.71	3.74
Columbus										
Under 10,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10,000-19,999	.....	.....	4.30	4.17	4.27	.....	.....	4.46	4.57	4.64
20,000-29,999	.....	.....	4.44	4.40	4.36	.....	.....	4.34	4.47	4.63
30,000-39,999	.....	.....	4.20	4.25	4.22	.....	.....	4.52	4.35	4.56
40,000-49,999	.....	.....	4.22	4.23	4.17	.....	.....	4.38	4.16	4.29
50,000-59,999	.....	.....	4.20	4.15	4.19	.....	.....	4.14	4.09	4.07
60,000-69,999	.....	.....	4.08	4.06	3.98	.....	.....	4.23	4.14	4.29
70,000-79,999	.....	.....	4.35	4.31	4.16	.....	.....	4.25	4.20	4.31
80,000-89,999	.....	.....	4.36	4.23	4.35	.....	.....	4.22	4.21	4.27
90,000-99,999	.....	.....	3.98	4.14	4.37	.....	.....	4.06	3.78	3.86
Over 99,999	.....	.....	4.00	3.93	3.98	.....	.....	4.03	4.09	3.92
Av. of all classes	.....	.....	4.21	4.18	4.16	.....	.....	4.26	4.19	4.24

The difference in test between the size classifications is very striking in each market, showing a definite decline from the smallest shippers to the largest, in all four markets studied.

These differences in butterfat content of milk, according to size of farm sales, are another reason for the differences in tests as between markets. All other conditions being the same, the market with the smallest sales per day per dairy will have the highest test. The reverse relation will also hold true.

The actual difference in tests between the large and small producers when divided into three classes ranged from .30 per cent in the Columbus market to .49 per cent in the Dayton market. There is no marked difference between the summer, winter, and irregular dairies within the size classification, except in some cases where there were few producers in the classification.

PART II. MILK SALES PER DAIRY

PER DAY PER DAIRY SALES

Figure 6 shows graphically the sales per day per dairy for all markets studied. These averages were computed by using all records obtained for each market.

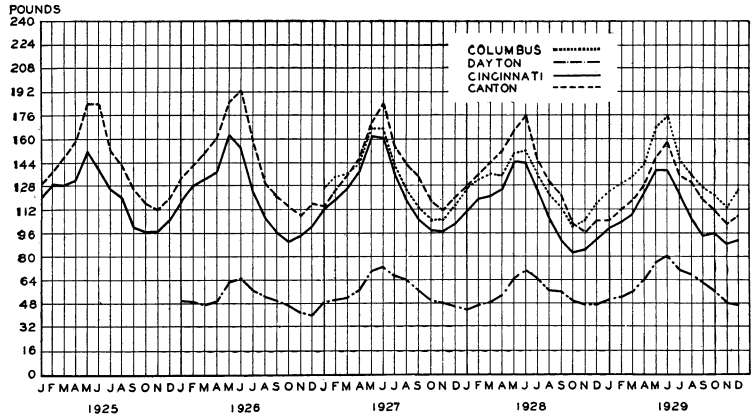

Fig. 6.—Average sales per day per dairy in Canton and Cincinnati 1925-1929, Dayton 1926-1929, and Columbus 1927-1929

A wide variation is found between markets in sales per day per dairy. If records for irregular shippers had been taken for Columbus and Cincinnati as in the other two markets the averages for the Columbus and Cincinnati markets might be a little lower than shown, since the average of the irregulars is lower than that of the regular shippers.

The Dayton shippers were much lower in average daily sales than those of the other three markets; for the 4 years, 1926 to 1929, their per day per dairy average by months varied from a low of 40 pounds to a high of 81 pounds. In the 3 years covered, the Columbus shippers varied from 101 pounds per day to 174.6 pounds. The Canton shippers for the 5-year period never were below 96.5 pounds per day per dairy, and their highest average was 193.5 pounds. For Cincinnati, the lowest for the 5 years was 82.5 pounds, and the highest was 163.1 pounds. The size of the per day per dairy shipments of the Canton shippers was just about two and one-half times that of the Dayton shippers. Cincinnati was below Canton at all times, but the 400 regular shippers in the Columbus market were above the Canton shippers during all of 1929.

The trends in size of shipments of Dayton and Columbus producers were upward; whereas those of Canton and Cincinnati were definitely downward. The Dayton shipments of the sample studied were exactly 20 per cent higher in 1929 than in 1926. Columbus shipments were 4.1 per cent higher in 1929 than in 1927. Cincinnati fell off 9.6 per cent in average size of shipments from 1925 to 1929; and Canton fell off 13.6 per cent in the same period.

The high and low points in per day per dairy shipments in all the markets corresponded closely and came each year at approximately the same time. This is brought out clearly in Figure 8 which shows the per cent of average shipped per dairy each month.

When the dairies of Canton and Dayton were divided into regular and irregular shippers and the regular shippers of all four markets were further divided into summer and winter divisions, some interesting facts are brought out. These comparisons are shown graphically in Figure 7.

The most striking thing shown in these figures is the difference between the summer and winter dairies in variability of production. This is shown definitely in all four markets. The irregular shippers were about the same as the summer dairies division of the regular dairies in variability.

Table 6 gives these figures comparing variability for the four markets on a percentage basis. These figures were obtained by dividing the lowest per day per dairy average of the period studied into the difference between the lowest and highest average for the period. The resulting figure is multiplied by 100, which gives the percentage variation from the lowest per day per dairy average.

TABLE 6.—Difference Between Highest and Lowest Monthly per Day per Dairy Sales for Entire Period, in Per Cent of Lowest

Market	Winter dairies	Summer dairies	Irregulars
	Per cent	*Per cent*	*Per cent*
Columbus	39½	112	.....
Cincinnati	82	152	.....
Canton	48	129	145
Dayton	42	162	140

These figures are significant in showing how much more milk can be expected from each kind of producer in high production time than in the low period over a number of years. For any one year these percentages would be lower, as trend is responsible for a part of this variation. The winter dairies of Dayton showed very little variation per year, most of the 42 per cent being due to an upward trend.

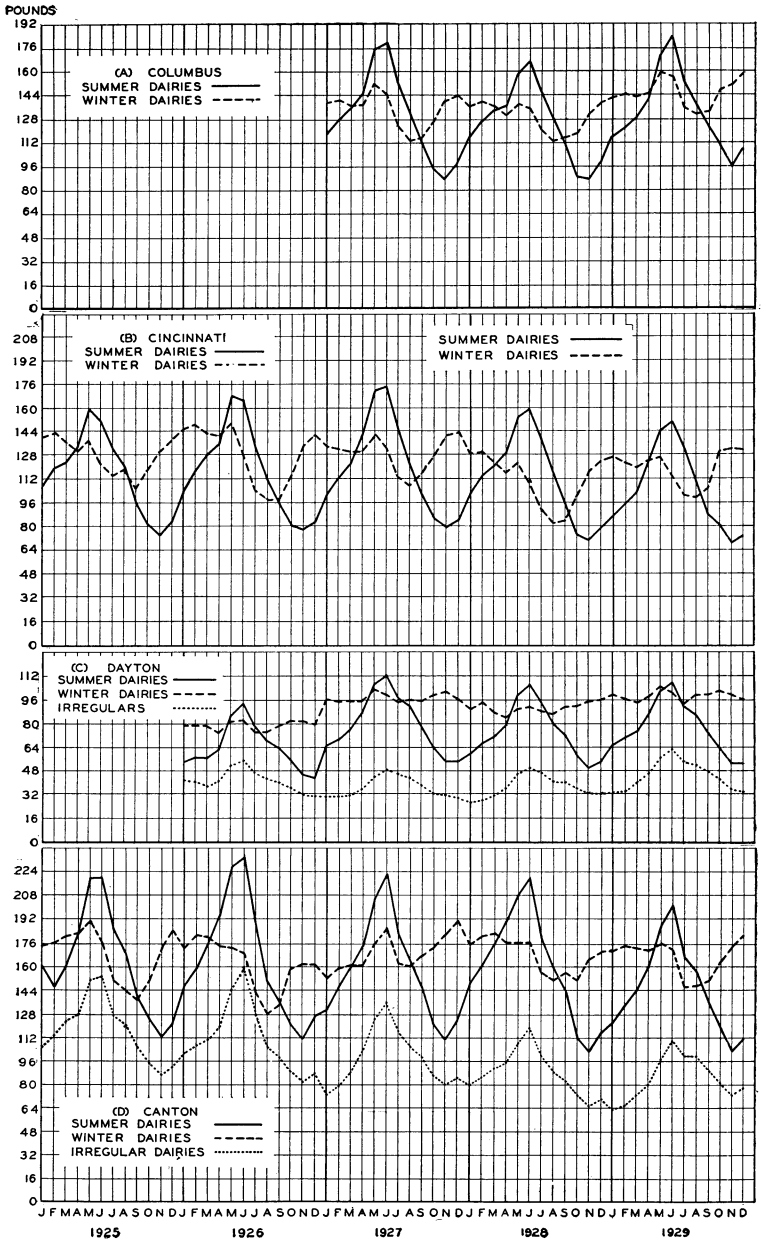

Fig. 7.—Average sales per day per dairy by types of dairies, in Canton and Cincinnati 1925-1929, Dayton 1926-1929, and Columbus 1927-1929

There was not much difference in trend of the different divisions within the market, except for the Canton shippers. In this market the downward trend in size of sales was quite largely due to the irregular shippers.

The highest average per day per dairy shipment of milk for one year in the Dayton market was 61.2 pounds; in Canton, the highest was 142.7 pounds. It can easily be seen that assembling costs would tend to be much higher per hundred pounds in securing milk from the Dayton shippers than from the Canton shippers.

That dealers recognize the greater cost of getting milk from very small size shipments is shown by some of the methods proposed to increase the average size of deliveries. One method is the paying of quantity differentials which amount to a penalty for the small shipper; another method is the setting of a minimum daily sale. Still another method which has been proposed in the Cincinnati market is the use of a can charge which will discourage shipments of such small quantities of milk as are unprofitable to handle.

The months in which the high and low points of production occur are significant. Both the high point and the low point of production of the winter dairies occur ahead of those of the summer dairies. Between markets, the dairies of the same classification show little variation in these points.

YEARLY SHIPMENTS OF PRODUCERS

In Table 7 is given the amount of milk delivered per shipper per year by the different divisions into which the shippers were divided.

TABLE 7.—Amount of Milk Delivered per Shipper Each Year, by Divisions of Shippers, in Canton, Dayton, Cincinnati, and Columbus Markets, 1925-1929

Market	1925	1926	1927	1928	1929
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Canton					
Summer dairies	58,478	60,122	57,508	58,548	52,993
Winter dairies	61,441	58,851	61,943	61,535	60,947
Irregular	42,630	40,665	35,863	32,343	30,828
Dayton					
Summer dairies	.....	23,253	29,269	27,248	28,399
Winter dairies	.....	28,843	35,717	33,150	36,169
Irregular	.....	15,053	13,320	13,603	16,426
Cincinnati					
Summer dairies	42,105	42,569	43,877	41,379	38,309
Winter dairies	46,770	47,042	47,093	40,534	43,571
Columbus					
Summer dairies	.....	.....	47,400	45,732	48,390
Winter dairies	.....	.....	49,199	47,496	53,110

No great difference is shown between the summer and winter dairies, but the irregular dairies are very much lower than either of the other two. The winter dairies shipped a greater volume of milk than the summer dairies in all but two instances, 1926 in Canton and 1928 in Cincinnati.

The irregular shippers of Canton shipped far more milk than those of Dayton and also a higher percentage of the amount shipped by the summer or winter dairies than in Dayton.

PER DAY PER DAIRY SALES OF IRREGULAR SHIPPERS

The figures in Table 8 represent the amount of milk shipped per day per dairy for the irregular shippers. There was no way to tell from the data used whether the producers classed as irregular were in and out of the market or merely shifted from one dealer to another. First, it was assumed that all the milk of these irregular

TABLE 8.—Sales per Day per Dairy for Irregular Shippers of the Dayton Market (1926-1929) and the Canton Market (1925-1929)

Market and month	Actual monthly average for entire year					Corrected to number of months in market				
	1925	1926	1927	1928	1929	1925	1926	1927	1928	1929
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Dayton										
January	.....	41.9	29.6	26.0	33.4	.....	61.7	58.9	47.2	50.2
February	.....	40.1	29.5	27.8	34.7	.....	60.7	58.3	49.6	52.8
March	.....	37.1	30.5	30.8	39.6	.....	59.5	59.0	49.4	59.5
April	.....	41.1	35.3	35.8	46.3	.....	64.5	74.0	56.7	69.4
May	.....	52.2	44.4	46.1	57.2	.....	81.0	87.2	68.5	83.4
June	.....	54.7	48.8	50.5	62.3	.....	83.9	90.4	76.2	88.2
July	.....	46.9	45.9	46.9	54.4	.....	74.5	80.0	71.7	76.7
August	.....	42.8	43.3	41.0	52.1	.....	71.4	76.3	62.8	71.8
September	.....	39.7	37.6	40.2	47.5	.....	66.4	65.0	59.6	63.3
October	.....	36.4	31.9	36.0	42.2	.....	61.0	57.3	52.9	56.1
November	.....	31.3	31.1	32.2	35.3	.....	54.3	46.9	46.5	47.2
December	.....	30.1	28.9	31.9	33.8	.....	54.1	44.9	46.7	45.4
Average	.....	41.2	36.5	37.2	45.0	.....	66.4	65.9	57.6	63.6
Canton										
January	106.6	101.2	74.0	80.6	62.8	131.6	139.9	115.2	116.4	102.2
February	114.0	107.1	79.2	85.2	66.6	146.8	144.2	127.2	123.1	105.9
March	123.3	110.6	88.6	91.1	73.3	154.0	155.0	135.5	130.4	115.9
April	127.1	120.1	102.1	95.0	80.1	167.1	164.9	145.0	132.5	127.8
May	150.8	144.8	124.6	108.9	98.0	192.5	192.4	172.3	151.2	152.9
June	153.8	158.3	135.8	118.5	109.7	190.0	202.6	182.9	164.5	160.0
July	126.5	130.3	116.6	99.9	99.2	155.4	159.7	155.5	136.7	138.8
August	120.4	106.3	106.7	88.7	99.4	146.3	134.3	138.0	121.4	137.4
September	106.3	98.9	99.2	83.0	89.7	129.9	126.6	125.2	101.9	124.0
October	93.6	89.0	86.1	73.2	81.7	116.9	116.1	110.8	91.9	113.9
November	86.2	82.4	79.8	65.4	74.1	110.7	106.1	101.7	82.8	100.8
December	92.2	87.4	84.9	70.5	77.2	121.1	112.6	110.3	93.0	103.8
Average	116.7	111.4	98.3	88.4	84.5	146.9	146.0	134.9	119.6	123.7

shippers was represented by the records obtained and that this was all they furnished to the market. Then an adjusted figure was computed, which was the average daily sales per dairy for the months that each shipper actually delivered milk. If they were in and out of the market, the unadjusted figure was the average of shipments, but, if they were shifting between dealers, the adjusted figure shows more accurately their actual contribution to the market.

This adjusted figure was lower than the shipments of either the winter or summer dairies in both Canton and Dayton, with one exception. This exception was in 1926 for Dayton, when the irregular shippers averaged 2.7 pounds more per day per dairy than the summer dairies.

SEASONAL VARIATION OF PER DAY PER DAIRY SHIPMENTS OF MILK

Figure 8 shows the per cent which each month's sales per day per dairy were of the monthly average for the year, for each market. This is the same method used in showing the seasonal variation of butterfat tests, and the same method of computation was used as for the butterfat seasonal averages. (See Page 14).

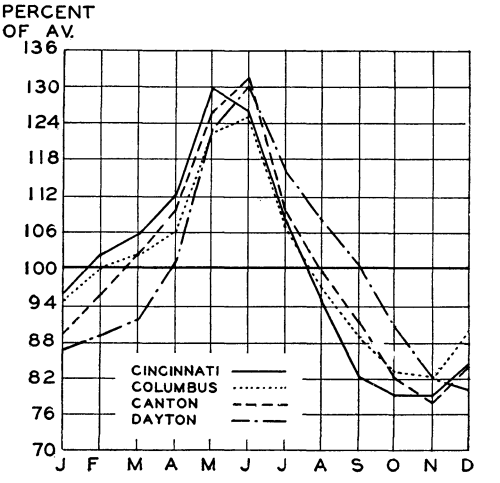

Fig. 8.—Seasonal variation of sales per day per dairy for Canton, Dayton, Columbus, and Cincinnati

A considerable difference between markets is shown in Figure 8. The Dayton market lagged to a marked degree in movements up and down from the highest point of averages, but the high point came at about the same time as in the other markets. These differences are important in that they reflect to a large degree the amount of market surplus or shortage and the time of year when it occurs.

The Columbus market was the only one of these four which was consistently using a basic surplus buying plan during the period studied. Under this plan the producer stated the daily average for

each month which he agreed to deliver during the year. The following is Section 5 of the Agreement, pertaining to payment to producer on this plan:

5. "The producer shall receive base price for his stated base amount. All milk produced and delivered by the producer in excess of his stated base amount shall constitute manufactured milk, and for this the producer shall receive manufactured price.

In the event the producer falls below his monthly total as established by his daily average, he shall receive base price for the actual amount delivered, but there shall be deducted from the amount of money due him for the month, a sum equal to the number of pounds shortage multiplied by the difference in price between base and manufactured milk, but in no event shall the price paid be below the manufactured price for the month."

This market showed less seasonal variation than any of the others, which would seem to show that the buying plan had some influence on seasonal variation.

In Figure 9 is shown the seasonal variation of milk deliveries of three divisions of shippers, according to the size of their yearly shipments. Milk receipts of the four markets were combined for this analysis in order to obtain a general picture of the seasonal variation of milk deliveries of different size producers. The seasonal curve of Figure 9 was derived in the same manner as the seasonal curve of Figure 8.

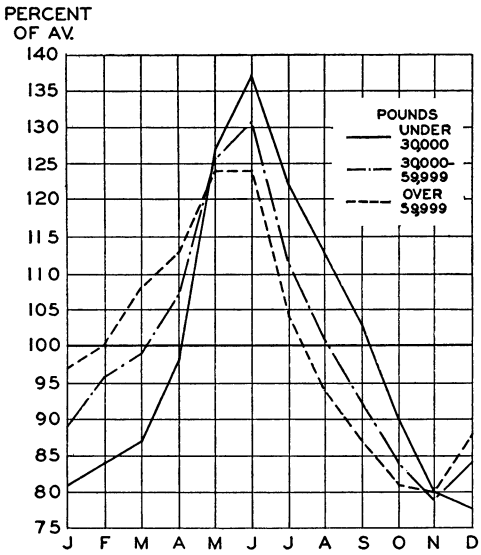

Fig. 9.—Seasonal variation of combined samples of Columbus, Cincinnati, Dayton, and Canton, classified by size of yearly shipments.

There is a definite decrease of seasonal variation from the smaller producers to the larger. If the month of lowest deliveries in each group is used as the base, those under 30,000 pounds per year varied 75.6 per cent, those delivering 30,000 to 59,999 pounds varied 65.8 per cent, and those above 59,999 varied 55 per cent.

From the graph it can be seen that the larger producers reach their average sales for the calendar year 2 months before the small producers and one month before the medium size producers. The peak of average daily sales reached by the group of largest shippers is somewhat ahead of the other two. The lag in coming back to

average daily sales is almost the same as that occurring in the rise. In the decline from the summer peak of production the small shippers never reached as low a percentage of their average yearly sales as did the larger shippers until November.

The placing of those shippers who delivered over 100,000 pounds yearly as a separate class further confirms the evidence of this influence of size of shipment on seasonal variation. This group showed still less variation than any of the others. On the same basis of calculation, the variation in this group of largest shippers was only 48.7 per cent.

COMPARISON OF PER CENT OF PRODUCERS IN EACH SIZE CLASS AND PER CENT OF MILK SHIPPED BY EACH

In Figure 10 is shown the distribution by size group of the shippers and the per cent of milk shipped by each group, bringing out a striking difference between markets.

Dayton is the only market studied which received an important amount of its milk from shippers falling into the two classes delivering below 20,000 pounds of milk per year. Almost 25 per cent of the milk came from these shippers; slightly over 50 per cent of the shippers were in these two classes, showing that it took slightly over half the shippers to produce one-fourth the milk of the market.

The Cincinnati and Columbus samples were most nearly alike of the four markets studied, each getting a large percentage

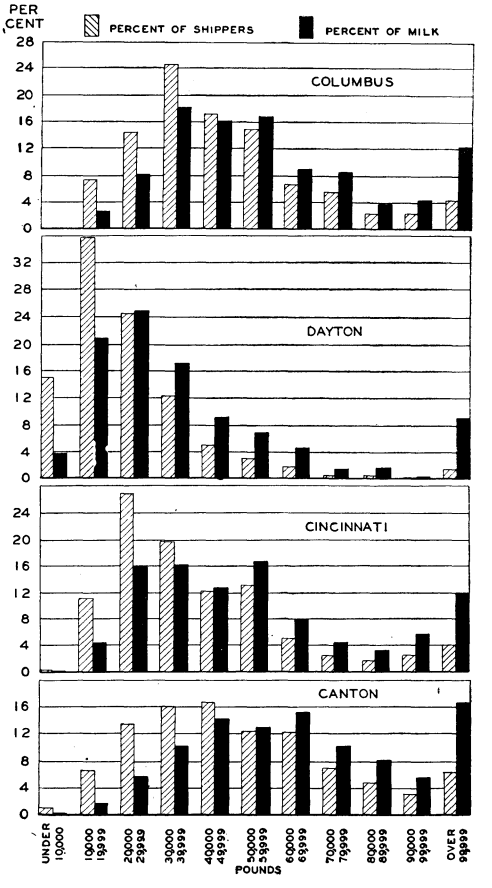

Fig. 10.—Per cent of shippers and per cent of milk delivered, by size classes, in samples studied

of its milk from the shippers delivering from 20,000 to 60,000 pounds per year.

In the Canton market there was no very great predominance of either per cent of shippers or per cent of milk delivered in any size class. It was the only market receiving more milk from the large shippers in the class of those shipping over 99,999 pounds per year than from any other size class. From this class, comprising 6.5 per cent of all the shippers, the market received 16.64 per cent of its milk.

Only 4 per cent of the shippers of the Dayton market shipped 70,000 pounds or more per year; whereas in Canton 21.5 per cent were in these classes, 14.4 per cent in Columbus, and 10.9 per cent in Cincinnati.

SHIPMENTS OF LAST FOUR MONTHS OF YEAR

For an adequate milk supply it must be assured that the available milk in the months of low production will be sufficient to meet the market's maximum fluid demands. The shortage period of milk supply in Ohio has always fallen in the fall months, usually sometime in the period September to December. For this reason it is important to know how much of the year's milk is delivered during the shortage months. To serve this purpose Tables 9 and 10 have been computed showing what per cent of the milk for the year was delivered during the last 4 months of the year by each group of shippers in each market.

For the supply to be evenly distributed over the year each group of dairies should have delivered 33⅓ per cent of its year's sales during these 4 months. The only group to approach this was the winter dairies who delivered almost exactly this amount as an average. The summer dairies delivered as an average for the four markets about 25.5 per cent of their year's shipments in the same period. The irregular shippers delivered a higher per cent of their milk in the fall months than did the summer dairy group of the regular shippers, but less than did the winter dairy group of the regulars. The variation from year to year was very similar in the winter, summer, and irregular dairies. This would indicate that weather conditions had about the same effect on each class.

A few of the percentage figures were unusually high or low for some of the classes of small shippers and also for some of the large shippers. This was due to the fact that only one or two shippers fell into certain classes. Smallness of sample might cause such wide deviations.

TABLE 9.—Shipments of Last 4 Months of Year as Percentage of Total Year's Shipments, Classified by Amount of Milk Shipped per Year per Producer

Yearly shipments	Summer dairies					Winter dairies					Irregulars				
	1925	1926	1927	1928	1929	1925	1926	1927	1928	1929	1925	1926	1927	1928	1929
Pounds	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Canton															
Under 10,000	.....	.....	17.1	5.1	22.5	.....	.....	.....	.....	.....	22.6	34.6	33.2	33.2	23.1
10,000–19,999	28.0	27.2	27.5	27.4	27.6	25.5	46.7	33.3	33.6	12.0	28.5	29.7	26.9	37.1	36.9
20,000–29,999	27.4	25.1	24.9	25.4	26.6	33.5	34.3	36.2	32.6	35.5	29.9	27.2	33.5	29.0	33.0
30,000–39,999	26.2	26.6	26.3	24.5	27.3	36.0	33.9	36.9	33.7	36.9	29.2	30.3	31.6	27.4	32.2
40,000–49,999	26.0	24.0	25.9	24.5	25.5	33.1	32.6	36.6	31.6	34.6	29.1	28.2	27.1	26.8	30.5
50,000–59,999	26.0	26.0	27.2	24.2	27.2	32.6	31.8	34.8	31.7	31.2	24.8	25.5	29.9	26.6	32.7
60,000–69,999	25.8	26.4	26.3	24.0	27.3	32.5	30.7	35.4	31.2	34.2	26.3	27.9	28.9	28.7	31.6
70,000–79,999	26.9	25.3	25.7	24.4	28.1	33.2	32.5	32.6	33.5	33.4	28.7	21.4	27.6	26.8	27.5
80,000–89,999	23.9	25.1	27.3	25.3	26.7	30.8	30.6	33.8	30.7	32.5	24.4	24.3	32.0	33.8	31.0
90,000–99,999	27.8	22.9	28.6	24.1	28.2	34.5	30.6	32.5	31.6	33.1	34.1	26.4	28.7	22.1	29.8
Over 99,999	26.1	24.5	27.4	25.3	26.4	29.5	31.4	35.1	31.6	32.8	20.5	27.1	30.2	22.3	35.8
All classes	26.1	25.2	26.6	24.6	27.0	32.1	32.0	35.1	31.8	33.6	27.1	26.8	29.8	27.6	31.9
Dayton															
Under 10,000	.....	24.0	25.2	23.6	24.6	.....	40.1	36.4	41.0	41.4	.....	24.7	35.6	31.0	33.4
10,000–19,999	.....	27.7	25.5	27.9	26.6	.....	36.8	35.0	37.9	37.5	.....	28.3	33.9	33.5	33.1
20,000–29,999	.....	27.6	26.0	26.4	26.0	.....	35.2	35.0	38.9	32.9	.....	27.9	31.1	30.4	29.2
30,000–39,999	.....	27.7	27.1	26.6	25.6	.....	33.5	33.9	35.9	35.9	.....	25.7	29.9	29.1	28.8
40,000–49,999	.....	23.6	24.8	23.6	25.3	.....	36.4	31.7	36.1	33.5	.....	30.1	27.2	30.0	27.5
50,000–59,999	.....	24.2	25.8	28.6	26.0	.....	32.0	31.7	35.5	31.8	.....	32.4	23.5	34.2	28.4
60,000–69,999	.....	31.0	28.4	26.7	29.7	.....	30.2	32.2	28.9	31.5	.....	28.2	30.1	18.1	23.5
70,000–79,999	.....	.....	29.5	29.4	29.1	.....	32.5	36.4	31.8	29.3	.....	29.8	31.2	.....	8.1
80,000–89,999	.....	.....	.....	.....	26.1	.....	32.1	31.0	30.6	31.5	.....	11.8	.....	24.8	.....
90,000–99,999	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43.5	.....	.....
Over 99,999	.....	.....	24.4	23.6	26.6	.....	31.2	34.0	30.2	32.6	.....	30.7	14.1	95.7	26.7
Average of total	.....	27.0	26.1	26.3	26.2	.....	34.2	33.6	34.7	33.7	.....	27.9	29.7	31.5	29.5

TABLE 10.—Shipments of Last 4 Months of Year as Percentage of Total Year's Shipments, Classified by Amount of Milk Shipped per Year per Producer

Yearly shipments	Summer dairies					Winter dairies				
	1925	1926	1927	1928	1929	1925	1926	1927	1928	1929
Pounds	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Cincinnati										
Under 10,000	.....	22.3	.....	20.3	.....	44.3	.....	65.0	.....	30.9
10,000-19,999	20.3	22.9	22.8	21.4	23.5	31.7	32.1	35.3	37.3	45.2
20,000-29,999	24.0	24.0	23.4	22.6	25.0	33.5	33.9	35.7	32.5	36.5
30,000-39,999	25.2	23.1	23.8	22.7	23.1	33.8	34.3	34.0	33.4	33.8
40,000-49,999	25.4	23.7	23.4	22.3	24.8	33.2	33.3	33.3	30.4	34.2
50,000-59,999	25.7	24.6	25.7	24.6	24.7	29.6	32.3	33.8	30.7	32.9
60,000-69,999	24.5	25.1	25.6	25.8	25.6	33.1	30.7	32.6	31.9	32.8
70,000-79,999	23.1	25.7	22.8	20.4	27.7	31.4	31.5	35.3	33.8	35.2
80,000-89,999	19.6	23.9	25.5	20.5	22.6	27.3	26.1	35.3	29.6	46.4
90,000-99,999	24.0	22.8	24.3	24.5	23.8	37.7	31.3	33.0	32.0	33.0
Over 99,999	24.9	24.5	25.4	25.6	27.2	33.1	28.0	34.0	31.5	35.9
All classes	24.4	24.0	24.3	23.4	24.8	32.3	31.7	34.1	32.1	34.8
Columbus										
Under 10,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10,000-19,999	.....	.....	25.1	30.3	27.7	.....	.....	34.4	37.1	34.5
20,000-29,999	.....	.....	25.5	25.9	29.1	.....	.....	33.9	33.1	34.7
30,000-39,999	.....	.....	25.6	25.7	28.0	.....	.....	32.9	34.2	33.6
40,000-49,999	.....	.....	25.3	27.2	26.7	.....	.....	32.7	34.4	36.0
50,000-59,999	.....	.....	25.7	25.6	27.1	.....	.....	32.3	32.5	35.4
60,000-69,999	.....	.....	25.2	24.0	27.5	.....	.....	33.3	31.2	32.7
70,000-79,999	.....	.....	24.6	25.7	26.3	.....	.....	31.6	31.1	33.5
80,000-89,999	.....	.....	22.8	22.2	29.6	.....	.....	32.8	30.4	35.0
90,000-99,999	.....	.....	23.3	25.5	26.9	.....	.....	30.7	29.0	29.7
Over 99,999	.....	.....	25.2	24.4	26.7	.....	.....	32.2	32.0	32.2
All classes	.....	.....	25.2	25.7	27.4	.....	.....	32.6	32.5	34.0

SHIFTING OF SUMMER AND WINTER DAIRIES

Producers in many cases changed in their June-November production ratio from year to year—in some cases increasing and in some cases decreasing. This caused a noticeable shifting between the summer classification in which November production was less than 75 per cent of June and the winter classification in which November production was 75 per cent or more than that of June. Table 11 shows this shift in each market for the years 1927 to 1929. These figures show the net shifting and not the ones who shift and are offset by the opposite shifting of others.

TABLE 11.—Number of Summer and Winter Dairies, by Volume of Shipments in the Dayton, Cincinnati, Columbus, and Canton Samples, 1927-1929

Volume of shipments	1927		1928		1929	
Pounds	Summer dairies	Winter dairies	Summer dairies	Winter dairies	Summer dairies	Winter dairies
Dayton						
Under 10,000	10	6	10	6	12	4
10,000-19,999	76	37	68	45	86	27
20,000-29,999	72	34	73	33	84	22
30,000-39,999	39	19	36	22	39	19
40,000-49,999	13	15	16	12	20	8
50,000-59,999	9	6	8	7	12	3
60,000-69,999	5	4	4	5	3	6
70,000-79,999	2	1	1	2	2	1
80,000-89,999	.....	2	.....	2	1	1
90,000-99,999	.....	.....	.....	.....	.....	.....
Over 99,999	4	6	4	6	5	5
Total	230	130	220	140	264	96
Cincinnati						
Under 10,000	.....	1	1	.....	.....	1
10,000-19,999	23	11	24	10	25	9
20,000-29,999	60	21	54	27	59	22
30,000-39,999	43	17	41	19	43	17
40,000-49,999	26	12	27	11	25	13
50,000-59,999	27	13	29	11	24	16
60,000-69,999	10	6	11	5	11	5
70,000-79,999	5	3	5	3	6	2
80,000-89,999	3	2	4	1	4	1
90,000-99,999	5	3	4	4	3	5
Over 99,999	6	6	9	3	6	6
Total	208	95	209	94	206	97
Columbus						
Under 10,000	.....	.....	.....	.....	.....	.....
10,000-19,999	19	10	15	14	18	11
20,000-29,999	37	21	36	22	43	15
30,000-39,999	69	30	66	33	75	24
40,000-49,999	44	25	44	25	43	26
50,000-59,999	38	22	30	30	33	27
60,000-69,999	14	13	10	17	17	10
70,000-79,999	14	8	12	10	13	9
80,000-89,999	4	5	2	7	6	3
90,000-99,999	6	3	5	4	3	6
Over 99,999	10	8	12	6	12	6
Total	255	145	232	168	263	137
Canton						
Under 10,000	1	.....	1	.....	1	.....
10,000-19,999	12	4	14	2	15	1
20,000-29,999	36	13	37	12	35	14
30,000-39,999	56	16	56	16	55	17
40,000-49,999	63	21	67	17	60	24
50,000-59,999	38	22	50	10	49	11
60,000-69,999	49	16	49	16	39	26
70,000-79,999	30	8	34	4	29	9
80,000-89,999	23	3	21	5	18	8
90,000-99,999	13	3	9	7	7	9
Over 99,999	20	15	25	10	21	14
Total	341	121	363	99	329	133

About the same amount of shifting occurred among the large shippers as among the small shippers. The average size shippers shifted less than either the large or small shippers. Between markets difference in shifting was only minor as far as shifting within each size class was concerned. However, net shifting of all shippers was much different between markets. The Cincinnati sample was almost the same from year to year as shown by the totals. Dayton and Columbus were very much alike in yearly comparisons, both falling very materially in percentage of winter dairies in 1929. Canton changed just opposite to these last two markets each year.

It would seem that a smaller percentage of the small producers would be classed as winter dairies than of the larger producers. This is not borne out by this study to any great degree. The only size classes of producers where this is shown is in the two largest classes where with all markets combined the percentage of winter dairies runs much higher than in any other classes.

CORRELATION OF SEASON AND BUTTERFAT TEST

Statistical correlation provides a method by which it is possible to measure the relation between the month of the year and the butterfat content of milk sold. Two such measures are shown in Table 12. All figures were determined on a 36-month period, 1927 to 1929, and the same curve fitted to the data for each year.

TABLE 12.—Measures of Relationship Between Month of Year and Butterfat Content of Milk Receipts

Market	Index of determination	Index of correlation
Canton	.733	.856 ± .0445
Dayton	.672	.820 ± .0547
Cincinnati	.692	.832 ± .0513
Columbus	.846	.920 ± .0257

The more imporant of the two measures computed is the Index of Determination. The Index of Correlation is an abstract measure of relation between two or more series of data. The Index of Determination indicates the relationship in a more direct manner. This Index is computed by squaring the Index of Correlation, and this result is multiplied by 100 to change it to a percentage basis. This percentage figure is the per cent of the total determining factor of change in test which can be attributed to season or month.

The Canton Determination Index can be used as an example. This figure in percentage is 73.3. This means that 73.3 per cent of the change in test from one month to the next can be attributed to season and its component influences. The other 26.7 per cent of the change is due to other factors, such as trend and incidental factors. These determining percentages would seem to indicate that not much can be done to change the test for any one month over that of the preceding month since such a large part of the change is due to seasonal change. This would be true if the seasonal change were due merely to weather effects. The stage of lactation has always been tied up closely with season but this could be changed materially if desired and has been changed in several markets where basic surplus plans were in effect.

This page intentionally blank.