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production incentives and payment methods in MAJOR TEXAS FLUID MILK MARKETS

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Summary

Milk marketing orders frequently include pricing and payment provisions to provide additional incentives for adjusting production rather than consumption. These provisions include supply-demand adjusters, Class I price differentials, base-excess, quotas and fall-premium plans. Analysis of data in five major Texas markets revealed wide differences in seasonalities of Class I sales and production. Pricing provisions alone were not sufficient to obtain a discernible shift in seasonality. Incentives to adjust the level of production were greatest in the two markets employing restrictive base-excess plans. These programs tied the level of base milk to that of Class I sales. In the market adopting this plan prior to the period studied, production was in a stable and close relationship to Class I sales. In the second market a change was made from an unrestricted to a restricted base-excess. Before the change, production increased more rapidly than sales. Following the change the relationship improved until annual production and sales were closely aligned. Production was not more responsive to sales in the market with individual handler blend pricing than in the one with blend pricing and market-wide pooling. In two markets having several changes in the number of handlers, and hence producers, it was difficult to evaluate changes or even general patterns. Analysis of 786 producers continually delivering to another market for 10 years provided results similar to the market-wide data, indicating that unless there are sudden large changes in the number of producers, market-wide data properly reflect producer adjustments.

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FEDERAL MILK MARKETING ORDERS are legal instruments which establish rules with which handlers must comply in purchasing milk from dairymen. The basic purpose of these orders is to establish marketing conditions which will assure consumers a continual and dependable supply of high quality milk. This goal is accomplished by stabilizing market conditions for fluid milk. They reduce much of the uncertainty which existed in many markets before regulation.

The many provisions of the orders can be summarized into four groups. First, the order establishes a means for pricing milk to handlers. The order establishes the method of determining minimum prices to producers and the time of payment. It establishes certain definitions such as the market area, qualifications to become a regulated handler, the obligation of other handlers selling milk in the area but not meeting regulation qualifications, producer qualifications and the treatment of "other-source-milk" which does not meet the requirements of producer milk. Finally, the order provides for an administrator, to be supported by handler assessments based on volume of Class I sales, who is obligated to safeguard the order provisions through auditing records to determine compliance.

The provisions of an order are developed and amended through public hearings where handlers, producers, consumers and other interested parties must provide evidence in support of their proposals. The Secretary of Agriculture is charged with evaluating these and preparing the order. Once an order is in effect, data concerning the operation of the market such as producer deliveries, importation of milk from other areas, sales by type of product and prices are assimilated and made available to any interested party. However, production and other data concerning individual handlers cannot be released.

Federal regulation of milk marketing in the United States has increased rapidly since enactment of the Agricultural Marketing Agreement Act of 1937. The first Texas milk market to be regulated by a federal order was North Texas late in 1951. Since that time all major Texas markets except one have obtained a marketing order.

From the beginning, orders have been concerned with the problem of adjustments in producer deliveries. Most orders contain a combination of provisions which are designed, at least in part, to encourage adjustment. In addition, many producer marketing cooperatives have supplemental programs to further encourage adjustment.

One of the primary features of federal orders is the so-called classified price system under which the minimum price which handlers must pay producers for milk depends on the broad classes of products in

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which the milk is utilized. Most markets have only two classes of utilization. However, in some instances there are three or four classes.

The justification for a classified pricing system is based on several concepts. First, state and local health authorities have established different standards for milk and the product form in which it is sold. Generally, fluid milk products must be made from Grade A milk meeting higher sanitary requirements than milk used in manufactured dairy products. Consequently, it is assumed that the cost of producing Grade A milk is greater than the cost of producing manufacturing milk, and if equilibrium conditions are to be achieved, there must be a differential in the price of the various types of milk.

The second factor is the difficulty in adjusting deliveries of Grade A milk. Historically, production has been highly seasonal because of the calving and lactation cycle. Furthermore, consumption of fluid products is seasonal, and during certain months of the year large volumes of Grade A milk must be used in manufactured dairy products.

The price elasticity of demand for fluid milk products is low. Therefore, even with extreme fluctuations in the price for Grade A milk, it may be difficult to obtain desired adjustments in consumption. For this reason, at least during certain seasons, some Grade A milk competes with manufacturing milk for use in non-Grade A products. There are also day-to-day variations in sales of fluid products. This indicates that a reserve is needed throughout the year if retail price stability of fluid products is to be provided. The two-price system is intended to provide a market for both the necessary reserve and any seasonal or annual surplus.

Class I use is the designation given to disposition of milk in certain products which usually must be made from Grade A milk because of local or state quality and standards codes. The primary products in this category are fluid whole milk, skim milk, cream and flavored milk. Milk used in these products receives a higher price than milk used in other products. This is called the Class I price, and under an order it is the minimum price which handlers must pay for milk used in these products.

Originally, the minimum Class I price was fixed under the order, but it was subject to change by the amendment process. Formulas were developed which were expected to make the price automatically responsive to changing market conditions. The value of producer milk, therefore, was affected by fluctuations in the class prices and the proportion that was used in each class.

Several producer payment methods have been developed which not only define an equitable means for allocating Class I and Class II sales to individual producers but which also are expected to provide the incentive for certain types of production adjustments.

Problems

Milk market administration personnel and milk producer cooperatives are interested in evaluating various methods of pricing milk and paying producers to determine which are most effective in stimulating desired adjustments. They are also interested in ascertaining whether any maladjustments have arisen that can be attributed to the program.

It is assumed that Grade A producers are interested in producing only for the Class I market, while realizing that a 10 to 20 percent reserve may be needed to insure an adequate availability of milk for short-term increases in sales.

It is possible to analyze the production adjustment problem on the basis of seasonality of producer deliveries and rate of growth. Ideally, the seasonality of producer deliveries should coincide with the seasonality of Class I sales. Likewise, the trend of producer deliveries should coincide with that of Class I sales but remain 10-20 percent higher to provide adequate reserves. Many authorities assume that a reserve of 10-20 percent is required. There are also recurring periods during which the Class I sales change considerably. For example, when schools open in September the Class I needs normally increase. Consequently, additional reserves during some months may permit some reduction in the yearly reserve. Production variations may occur in two ways: by producers entering and leaving the market and through changes in producer output.

Objectives

The purposes of this study are to determine the problem of maladjustment of producer deliveries to Class I sales in major Texas fluid milk markets and to evaluate alternative pricing and payment procedures as means for providing incentives for increasing the responsiveness of producer delivery patterns to Class I sales.

The specific objectives of this study follow:

1. Determine the effects of the various base plans and payment systems on seasonal and yearly milk deliveries and producer prices in Texas.

2. Evaluate various alternative milk pricing plans and determine which ones would be more efficient in obtaining an adjustment of milk supplies to market milk demand.

Methodology

Five markets in Texas are analyzed concerning pricing mechanisms and payment provisions and the response of producer deliveries as related to Class I sales. These five markets are North Texas, Austin-Waco, San Antonio, Corpus Christi and South Texas. All markets except the South Texas market are currently regulated by federal orders. These markets are located in the major Texas dairy-producing areas and have a variety of programs.

For example, North Texas employed a base-excess program under a market pool. Recently, the base-

excess program was substituted by a blend pricing program. In the Austin-Waco market an individual handler base-excess program was used originally, but that market later switched to a more restrictive program through the major producer cooperative in the market. San Antonio has used a market pool with a blend price payment program, while the Corpus Christi market used an individual handler pool with blend pricing.

The data used in the analysis include monthly producer deliveries and Class I sales for the regulated markets and producer deliveries of members of the cooperative in the Austin-Waco and the South Texas markets. The payment and pricing mechanisms, along with the changes and the reasons for the changes, and information concerning the actual class prices and blend values by months for each market is examined also.

For the North Texas market, data concerning producers that were on the market continuously for a 10-year period are analyzed to determine the characteristics of those which have adjusted their deliveries to conform closer to changes in Class I sales. To maintain homogeneity of the data, deliveries by producers entering and leaving the market have been excluded.

Management personnel of some dairy cooperative associations have expressed the opinion that base plans create a "race-for-base." If this were true, the production per producer would increase more rapidly in markets having base systems than in markets using a blend pricing system. Analysis of trends in producer deliveries by markets provides a measure of the existence of a race-for-base.[1]

Seasonality and changes in Class I, Class II and blend prices are compared with seasonality and changes in production to determine the relationship to changes in production.

Individual producer data for producers in the North Texas market for a 10-year period are analyzed for seasonality and production growth. This information provides a good indication of the existence of a race-for-base. It also eliminates the effect of producers entering and leaving the market. Analysis by size groups, location and date of conversion from cans to the bulk tank system provides an indication of characteristics that could be related to adjustments in deliveries by individual producers.

ANALYSIS OF ADJUSTMENTS

Imbalance Between Annual Producer Deliveries and Class I Sales

Although the four federal order markets included in this study became effective over about 5 years, from 1952 to 1956, each of them had 90 percent or more of producer milk utilized as Class I during the first year of operation. The general tendency in these four markets was for the percentage of producer milk utilized as Class I to decline during the first few years of operation under an order (Table 1). The major exception to this trend was the Austin-Waco market. The percentage in this market declined during the years that producers were paid according to the base-excess provisions of the order. Following the development of a type of restricted base-excess or quota program by the major cooperative in this market, the percentage increased to a level higher than the first year and remained at a high level through 1964.

TABLE 1. AVERAGE PERCENTAGE OF PRODUCER MILK DELIVERIES UTILIZED AS CLASS I, BY MARKETS, 1952-1964

Year	North Texas	San Antonio	Corpus Christi	Austin-Waco	South Texas
			Percentage		
1952	90.5				
1953	81.3	96.3			
1954	81.7	96.6			
1955	82.6	96.6		91.8[1]	
1956	77.7	95.7	93.1	89.1	84.2
1957	76.5	95.2	94.2	87.6	83.4
1958	76.6	88.4	94.9	92.9	81.1
1959	70.7	91.0	92.4	93.3	81.6
1960	73.8	87.0	92.1	93.2	80.2
1961	69.5	80.3	86.8	90.3	81.1
1962	69.9	87.6	86.5	92.2	81.7
1963	75.9	87.8	88.7	94.8	84.8
1964	72.5	80.2	87.8	93.5	83.2

[1]Data were available only for February through December 1955. January 1955 was estimated prior to determination of the average.

The utilization percentage for the major producer cooperative in South Texas did not decline appreciably from 1956 through 1964. The producer payment provisions of this cooperative had been in effect for several years before 1956. Apparently, adjustments to this program had preceded this period.

If orders result in more stable market conditions and improved farm prices, a decline can be expected in the percentage during the first few years. The reduction of variation and uncertainty in the price of a product normally is expected to result in greater profits and improved planning. Since expected future prices do not have to be discounted as much where price stability is improved, total production would be higher under equilibrium conditions provided the price stability was not gained at the expense of lowering the average price. However, if producer adjustments are made over a period of time, several years might be required to obtain a stable relationship between producer deliveries and Class I sales.

Different Payment Programs

Several different producer payment programs have been used in the five markets studied. The Corpus Christi market employed an individual handler pool with blend pricing so that all producers delivering to a given handler received the same price. However, the price to producers differed among handlers in the

[1]"Race-for-base" refers to the extra efforts of some producers to produce a maximum volume of milk during the base-forming period in order to be able to sell a constant or increasing volume at Class I prices during the period of peak production.

market due to different utilization percentages in Class I. This method of payment gives more incentive to expand to those producers delivering to rapidly expanding handlers than to those delivering their milk to a handler that is expanding at a slower rate.

The San Antonio market also employed a blend price technique, but it was based on a market-wide pool instead of an individual handler pool. This method does not discriminate among producers on the basis of the handler that receives the milk since payments by all handlers are pooled and a single uniform price is determined for all producers.

The original federal order for the Austin-Waco market provided for a base-excess payment method. This method was terminated after 5 years and replaced by an individual handler pool with blend or uniform pricing. This new program was essentially the same as the one used in the Corpus Christi market. However, in the middle of the fourth year of the order the major producer cooperative in the market formed its own base-excess program. This cooperative repooled payments to its members. The producer members then received payment on the basis of the prices determined by the cooperative. Whenever total deliveries of members exceeded 110 percent of the Class I utilization allocated to the producer deliveries, base-excess prices were determined. At all other times producers were paid a blend price based on the funds in the cooperative pool.

Another feature of the cooperative program in the Austin-Waco market was that the producer member's base was determined by a 3-year moving average of deliveries during the base-forming period. This meant that it took 3 years before the impact of a producer's increased production on his allotted base was fully realized.

Finally, the allotted base was readjusted when payment was made by the base-excess pricing method. The producers' bases were proportionally reduced so that the total volume of base was only about 102 percent of the allotted Class I utilization. This resulted in the base price being composed of 98 percent of the Class I price and 2 percent of the Class II price. Hence, the only way for the volume of producer milk to reduce the base price was by its effect on the Class I price through the supply-demand adjuster.

The North Texas market employed market-wide pooling and the base-excess payment method during the spring. During months in which payments were not made according to the base and excess provisions, a market-wide blend price to producers was determined. Changes were made in both the base-forming period and the base-paying period during the time covered by the study.

Since there was no federal order for the South Texas market, the analysis was limited to the activities of the major producer cooperative in that market. This cooperative employed a restrictive base-excess program that was more like the method adopted by the leading cooperative in the Austin-Waco market than like the method employed under the North Texas federal order. The principal provisions of the program were to establish a new base each year and to establish the base price at about the level of the cooperative price (essentially a Class I type price) for fluid milk to handlers. It did not provide for a fixed base-forming period.

TABLE 2. AVERAGE DAILY DELIVERIES PER PRODUCER, BY YEARS, IN FIVE TEXAS MARKETS, 1952-1964

Year	South Texas	Corpus Christi	North Texas	San Antonio	Austin-Waco
			Pounds		
1952			543		
1953			558	869	
1954			584	874	
1955			642	915	694[1]
1956	718	752	688	961	756
1957	771	898	718	999	800
1958	818	916	744	1078	918
1959	892	1031	864	1185	1014
1960	933	1168	950	1278	1033
1961	976	1263	1058	1331	1053
1962	1079	1269	1137	1534	1341
1963	1134	1371	1169	1619	1456
1964	1214	1524	1325	1783	1617

[1]The calculation for 1955 was based on an estimate for January and actual deliveries for February through December 1955.

Producers could not be absolutely certain of the actual base-forming period since the record of deliveries during a stipulated number of weeks when producer deliveries were lowest was used to determine the established base. However, the seasonal pattern of deliveries indicates that the period used for the record probably did not vary much. The result of using the period of lowest deliveries almost assured the cooperative that the base deliveries in any month would be less than the Class I type sales. The producer deliveries were more seasonal than Class I sales. Additionally, in actually determining the allotted base, the deliveries on record for the period were proportionately reduced to a level that was expected to be less than Class I type sales.

Producer Growth Rates

In 1964, the average daily deliveries of producers ranged from 1,214 pounds per day for South Texas to 1,783 pounds for San Antonio (Table 2). In 1956, the average daily deliveries per producer were lowest (688 pounds) for North Texas. There are two reasons why the growth rate of producers in the North Texas market could be expected to be greater than in other markets. The first and most obvious reason is that the small producers would need to expand deliveries faster to take advantage of technological advances in production and transportation. Second, the base-excess program might have created a race-for-base which would result in greater expansion rather than a seasonal shift in deliveries.

If all factors except payment methods were the same among the markets, hypothetically, the producer growth rate would be expected to be greatest in the North Texas market, followed by San Antonio and Corpus Christi. These last two markets used blend pricing. The primary difference was that Corpus Christi used an individual handler pool and San Antonio a market-wide pool. Although some people feel that producers in individual handler pool markets have more direct encouragement from handlers to keep production in line with the handler's needs, the data concerning these markets do not support this contention. The change in the percentage of producer milk relative to Class I sales was not significantly different between Corpus Christi and San Antonio.

The growth rate of South Texas and Austin-Waco producers could be expected to be lower than for the other markets because of the restrictive quota plans used by the major cooperatives in these two markets. However, if barriers to entry were greater in these two cases, the producers might have been able to expand as rapidly as in the other markets without affecting the percentage of their milk utilized in Class I.

In Table 3, daily deliveries per producer are expressed as a percentage of 1956 to facilitate comparison in relative change in size. This indicates that, contrary to the foregoing hypotheses, producer size for Corpus Christi increased more on a percentage basis than all markets except Austin-Waco. By 1964 deliveries per producer in the North Texas market had increased to 192 percent of 1956. The percentage increase for South Texas was the lowest of all the markets, as was hypothesized.

The analysis of growth rates does not indicate that a race-for-base incentive in the North Texas market was sufficient to result in a greater growth rate than occurred in other markets. It does not confirm the hypothesis that the growth rate for Austin-Waco would be less than for the other markets nor the hypothesis that the rate for Corpus Christi would be the same, or lower, than that for San Antonio.

TABLE 3. AVERAGE DAILY DELIVERIES PER PRODUCER AS A PERCENTAGE OF 1956, BY MARKETS, 1952-1964

Year	South Texas	Corpus Christi	North Texas	San Antonio	Austin-Waco
			Percent		
1952			78.92		
1953			81.10	90.43	
1954			84.88	90.95	
1955			93.31	95.21	91.80[1]
1956	100.00	100.00	100.00	100.00	100.00
1957	107.38	119.41	104.36	103.95	105.82
1958	113.93	121.81	108.14	112.17	121.43
1959	124.23	137.10	125.58	123.31	134.13
1960	129.94	155.32	138.08	132.99	136.64
1961	135.93	167.95	153.78	138.50	139.29
1962	150.28	168.75	165.26	159.62	177.38
1963	157.94	182.31	169.91	168.47	192.59
1964	169.08	202.66	192.59	185.54	213.89

[1]Annual average for 1955 was based on actual percentage for February through December; January was estimated.

Despite the fact that the utilization percentage for Austin-Waco had remained rather high, the growth rate in daily deliveries per producer was greater than in the other four markets. This might have been the result of increases in Class I sales or because of reduction in the number of producers. Although the major producer cooperative in the Austin-Waco market developed a restrictive quota plan early in the period, it is possible that this had little impact on producer growth after the first 2 years of its operation. This plan was in operation only when producer deliveries exceeded Class I sales by a certain percentage. Except for this early period, the percentage did not exceed this level. After 1958, members of this cooperative received payment based on blend pricing. Consequently, the increased production did not result in producers receiving an excess price.

INCENTIVES: It was assumed in the analysis that a major goal of federal milk marketing orders and milk producer cooperatives was to provide incentives to bring about adjustments between Class I sales and producer deliveries on both an annual and seasonal basis. Because of the inelastic nature of consumer demand for Class I products, it was assumed that in order to preserve relatively stable prices to consumers most of the adjustments would be required from producer deliveries rather than from changes in Class I sales. Upon acceptance of these goals it becomes the proper function of federal orders and producer cooperatives to develop programs which will provide incentives for obtaining adjustments in the level of annual producer deliveries and their seasonality to coincide with the level and pattern of Class I sales.

The specific objective of base-excess payment techniques is to provide additional incentive for producers to adjust their deliveries seasonally so that a greater proportion is in the base-forming period. The more restrictive base-excess programs such as those employed by the Austin-Waco and South Texas cooperatives were expected to provide an additional incentive for regulating the annual rate of increase in producer deliveries. These methods provide higher prices to producers that restrict their rate of growth because the base price is not affected directly by the increase in total producer deliveries.

The typical federal order base-excess program does not restrict the volume of base milk to a percentage of Class I sales. Consequently, over time the base price may be reduced to a low level with an increasing proportion of Class II milk allotted to base.

The method of Class I pricing, plus the changes in the percentage of producer milk utilized as Class I should provide some incentive for adjustment both seasonally and in the general level of deliveries. Seasonal components were built into the Class I price

formula through the use of the prices in the northern dairy states, the Class I price differential and the supply-demand adjuster.

However, since the northern prices used to determine the basic formula price and the Class I utilization percentage used to determine the supply-demand adjuster were always obtained from recent history, it is possible to obtain a Class I price which lags changes in producer deliveries instead of proceeding them or coinciding with them. Much of this difficulty can be overcome by using a Class I price differential that varies more than the Class I basic formula price and the supply-demand adjuster.

It was found that the four federal order markets analyzed in this study all had a high percentage utilization of producer milk as Class I during the first year of the order. A decline in the percentage over time was experienced in these markets. The only exception to this was the producer deliveries of the Austin-Waco market. In this market the percentage declined until the producer cooperative established its own restrictive base-excess plan for payment to its members. Thereafter, it increased to a high level of Class I utilization.

Although the South Texas market was not regulated, deliveries by the producer association in that market were analyzed. The utilization percentages were not strictly comparable between this market and the federal order markets. However, it appeared that this utilization percentage stabilized at a level below that of the other markets with a similar restrictive base-excess program. This lower level might be due to the fact that the excess price of the South Texas cooperative may have been greater than that of the Austin-Waco cooperative. The management of the South Texas cooperative had stated that frequently the base deliveries were less than Class I sales and that these funds remaining in the cooperative pool were used to increase the excess price. Had the excess price been lower, the utilization percentage might have stabilized at a higher level.

However, a utilization percentage of 80 percent cannot be considered a major problem. If producers in a market are to provide their own reserves for fluctuations in the needs of handlers which cannot be achieved through seasonal adjustments, the excess quantity of milk in the South Texas market probably was not much greater than that which was required.

SEASONALITY: Class I sales in all markets exhibited a high fall and winter pattern of seasonality, with sales below average in the spring and summer. However, the seasonal patterns were by no means smooth. It is probable that different consuming habits exist between the summer and winter months and that special holidays also have important effects. The school year also has an important impact as a result of the school lunch program. These characteristics indicate that there would be some difficulty in adjusting milk deliveries to Class I needs even if this was the sole objective of all producers.

Although year-to-year variations existed in the seasonality of Class I sales for each market, there was little indication that the seasonal patterns were shifting. The total deviations of the median indices indicated the following ranking of the five markets according to the magnitude of the seasonality of Class I sales, from the most seasonal to the least seasonal pattern: (1) Austin-Waco, (2) North Texas, (3) South Texas, (4) Corpus Christi and (5) San Antonio.

The seasonality of producer deliveries typically peaked in the spring and was low in the fall. Deliveries by Texas producers on the North Texas market were found to have been reduced in seasonality during the period studied. With the inclusion of August in the base-forming period, the seasonality seemed to increase, although the amount of data available following this change was insufficient to ascertain whether this was just a temporary fluctuation in seasonality.

The nature of the change in seasonality in the North Texas market agreed almost entirely with the expected incentives of the base-excess program. Generally, indices increased for months in the base-forming period and decreased during the months of the base-paying period. There was a tendency for deliveries to increase seasonally in the month before the base-forming period and to decrease in the month before and immediately following the base-paying period.

Although deliveries in the North Texas market were more seasonal than in the other markets (except possibly for the San Antonio market) during the first years of the North Texas order, the seasonality appeared to be reduced to a level below that of the other markets before 1960.

Changes in Producer Number and Production Seasonality

Changes in the number of producers in a market serve only as a rough indicator of entry and exit. The information contained in Table 4 indicates that the percentage decline in number of producers has not been the same for all markets.

It is virtually impossible for producers to adjust their seasonality of production to a pattern as highly variable as the seasonality of Class I sales. To maintain a minimal and uniform percentage of milk in Class II, producer deliveries should reach a seasonal low in June, rise rapidly to a peak in October and then gradually decline.

The analysis of seasonality of deliveries by Texas producers on the North Texas market suggests that a shift in seasonality has occurred in the form of less in the spring to more in the fall. This shift reduced

TABLE 4. AVERAGE NUMBER OF PRODUCERS IN EACH MARKET AS A PERCENTAGE OF 1956

Year	North Texas	San Antonio	Corpus Christi	Austin-Waco	South Texas
			Percent		
1952	88.21				
1953	101.27	87.01			
1954	100.16	90.94			
1955	97.14	94.29		115.82[1]	
1956	100.00	100.00	100.00	100.00	100.00
1957	101.72	103.54	115.03	90.62	95.65
1958	97.43	101.18	110.88	80.86	89.20
1959	90.66	105.51	106.74	74.61	84.63
1960	83.25	107.87	97.41	63.28	81.43
1961	81.54	106.10	93.01	71.29	77.63
1962	78.28	90.16	96.11	62.50	73.10
1963	73.28	83.46	87.56	59.37	66.65
1964	68.00	81.10	81.86	54.49	60.11

[1]Annual average for 1955 was based on actual numbers for February through December; January was estimated.

the seasonality of deliveries since the spring had been the period of greatest deliveries and the fall the period of below-average deliveries.

Although the base program of the cooperative in the South Texas market had been in effect for several years, the reduction in the total deviations indicated that producer deliveries were becoming less seasonal during the period. Since both the North Texas and South Texas producers operated under a producer payment program which rewarded producers that adjusted away from a high-spring seasonal pattern and the other markets did not exhibit a tendency for a reduction in seasonality, it can be concluded that this type of program provides more incentive for reduction in seasonality.

COMPARATIVE ANALYSIS OF MARKET-WIDE and INDIVIDUAL PRODUCER ADJUSTMENTS

Individual producer data were obtained on a monthly basis for 786 Texas resident producers in the North Texas market who delivered milk every month during the 10-year period 1953-1962. These 786 producers comprised 25 percent of all producers delivering milk on the North Texas market in 1953 and 35 percent of all producers in 1962. Analysis of these data was conducted with two primary questions in mind. First, what was the nature of the differences in producer adjustments during this 10-year period? The second question was concerned with the adequacy of market-wide data in depicting the adjustment of producer deliveries and with whether the long-term producers (those continuously on the market for 10 years) adjusted in a manner that coincided with the patterns observed in the data for the whole market.

Comparison of Producer Adjustments

Comparative analysis of adjustments by those 786 Texas producers continually on the North Texas market for 120 months from 1953 through 1962 was done on the basis of four variables: (1) average daily milk deliveries during the first year of the series, (2) percentage change in size or volume of milk deliveries during the 10-year period, (3) the date that producers converted from 10-gallon milk cans to the bulk tank system of operation and (4) seasonal pattern of production during the 10-year period.

Producers whose deliveries in 1962 were below their 1953 level represented 6 percent of all the producers studied. Those that delivered from 100 to 199 percent of their 1953 level represented 46 percent of producers, while 31 percent of the producers delivered from 200 to 299 percent as much milk in 1962 as they did in 1953. Producers whose deliveries in 1962 were in the range of 300-399 percent of their 1953 output represented 11 percent of the total. Four percent increased their deliveries from 400 to 499 percent of the 1953 level, and the remaining 2 percent increased by 500 percent or more.

The third variable considered was the year in which the producer changed from 10-gallon milk cans to a bulk milk tank. By the end of 1954, 5 percent of the producers had bulk tanks (Table 5). An additional 29 percent obtained bulk tanks in the period 1955-56. During the next 2 years 38 percent obtained tanks. Bulk tanks were obtained by an additional 23 percent of the producers during 1959-1960. Five percent of the producers either obtained tanks only in the last 2 years or had not obtained tanks during the 10-year period.

The comparison between the year a bulk tank was installed and the size of the producer in 1953 indicates that small producers generally installed tanks later than larger producers (Table 5).

The last variable considered was the seasonal pattern of production. Producers were divided into three groups according to their average pattern of deliveries during the 10-year period. The first pattern consisted of those producers with deliveries that peaked

TABLE 5. COMPARISON OF YEAR BULK TANK WAS INSTALLED AND PRODUCER SIZE IN 1953

Year bulk tank installed	Pounds of milk delivered per day in 1953				
	Less than 500	500-999	1,000-1,499	1,500 and above[1]	All producers
			Percent of producers		
1953-1954	2	4	18	11	5
1955-1956	15	40	40	47	29
1957-1958	41	38	30	34	38
1959-1960	33	16	12	8	23
1961-1962[2]	9	2	0	0	5
Total	100	100	100	100	100
Number of producers	378	297	73	38	786
Percent of producers	48	38	9	5	100

[1]Two producers in excess of 5,000 pounds.
[2]Includes four producers that had not installed bulk tanks.

TABLE 6. COMPARISON BETWEEN THE YEAR OF INSTALLATION OF BULK TANK AND PRODUCER GROWTH

1962 production as a percentage of 1953	Year bulk tank installed					
	1953-1954	1955 1956	1957 1958	1959 1960	1961 1962	All producers
	Percent of producers					
Less than 100	6	2	8	8	10	6
100-199	50	47	41	50	44	46
200-299	36	30	33	29	29	31
300-399	2	13	11	10	10	11
400-499	6	5	5	1	5	4
500 and above	0	3	2	2	2	2
Total	100	100	100	100	100	100
Percent of producers	5	29	38	23	5	100

in the spring and tended to be low in the fall and winter. A total of 39 percent of the producers were in this category. The second group included producers whose deliveries peaked in the spring and also those whose deliveries tended to have a double peak: in the spring and in the fall or winter. This group composed 40 percent of the producers. The third group comprised producers whose deliveries tended to peak in the fall or winter but exhibited little tendency for a secondary peak in the spring. Included in this category were the remaining 21 percent of producers.

There appeared to be little or no relationship between the level of deliveries in 1962 compared to 1953 and the date that bulk tanks were installed (Table 6). However, the date of installation of the bulk tanks appeared to be related to the seasonal pattern of producer deliveries (Table 7). This relationship tends to confirm the hypothesis that the date of tank installation might be a rough indicator of managerial ability. Of the producers that installed

TABLE 7. COMPARISON BETWEEN DATE BULK TANK INSTALLED AND SEASONAL PATTERN OF PRODUCTION

Seasonal production pattern	Years bulk tank installed					
	1953-1954	1955-1956	1957-1958	1959-1960	1961-1962[1]	All producers
	Percent of producers					
A[2]	31	33	36	50	54	39
B[3]	44	43	42	32	34	40
C[4]	25	24	22	18	12	21
Total	100	100	100	100	100	100
Number of producers	36	224	301	184	41	786
Percent of producers	5	29	38	23	5	100

[1]Includes four producers that had not installed tanks by the end of 1962.

[2]The 10-year average daily deliveries peaked in March through May, with deliveries for September through December being at a low level compared to the other months.

[3]The 10-year average daily deliveries peaked in the period June through August or there was a tendency for a double peak, one in the spring and one in the fall or winter.

[4]The 10-year average daily deliveries peaked in the fall or winter months.

TABLE 8. COMPARISON BETWEEN PRODUCER SIZE IN 1953 AND PRODUCER GROWTH

1962 Production as a percentage of 1953	Pounds per day in 1953				
	Less than 500	500-999	1,000-1,499	1,500 and above	All producers
	Percent of producers				
Less than 100	3	7	11	21	6
100-199	37	51	62	58	46
200-299	35	29	25	21	31
300-399	15	10	1	0	11
400-499	7	2	1	0	4
500 and above[1]	3	1	0	0	2
Total	100	100	100	100	100
Number of producers	378	297	73	38	786
Percent of producers	48	38	9	5	100

[1]Ten producers out of 17 in this class had deliveries in 1962 which were between 500 and 599 percent of their 1953 deliveries.

a bulk tank in the 1953-1954 period, 69 percent appeared to have a seasonal pattern different from the high-spring, low-fall pattern which existed in the market during the first 2 years of the order. This percentage dropped to 67, 64, 50 and 46, respectively, in the consecutive 2-year periods of bulk tank installations.

On a percentage basis small producers increased in size more than large producers (Table 8). Only 3 percent of the producers under 500 pounds had smaller deliveries in 1963 than in 1953. This percentage increased to 7, 11 and 21, respectively, for producers in the other three size categories. The data excluded producers that quit dairying during the period. It is probable that a greater proportion of the small producers left the market than the larger producers.

TABLE 9. COMPARISON OF PRODUCER SIZE IN 1953 AND SEASONAL PATTERN OF PRODUCTION

Seasonal production pattern	Pounds per day in 1953				
	Less than 500	500-599	1,000 1,499	1,500 and above	All producers
	Percent of producers				
A[1]	42	36	35	34	39
B[2]	37	40	51	53	40
C[3]	21	24	14	13	21
Total	100	100	100	100	100
Number of producers	378	297	73	38	786
Percent of producers	48	38	9	5	100

[1]The 10-year average daily deliveries peaked in March through May, with deliveries for September through December being at a low level compared to the other months.

[2]The 10-year average daily deliveries peaked in the period June through August or there was a tendency for a double peak, one in the spring and one in the fall or winter.

[3]The 10-year average daily deliveries peaked in the fall or winter months.

The proportion of the producers with a seasonal pattern which peaked the spring and was low in the fall or winter was greatest for the producers with daily deliveries of less than 500 pounds in 1953 (Table 9). The percentage was less for each succeeding class. The percentage of producers who appeared to have a seasonal peak of deliveries in the fall or winter did not increase with the size. However, the percentage for the spring-high and fall-spring double high pattern increased with the larger size group.

The last comparison, between seasonality and producer growth, also indicates some interesting relationships (Table 10). A high percentage, 72 percent, of the producers that had smaller deliveries in 1962 than in 1953 possessed a high-spring, low-fall pattern of seasonality. This value was only 46 percent for the producers that were at least as large but not twice the size in the last year compared to the first. For the 200-299, 300-399, 400-499 and the 500-and-above groups the percentages of producers with a high-spring, low-fall pattern was 34, 20, 16 and 18 percent, respectively. Only 8 percent of the producers that had smaller deliveries in 1962 than 1953 possessed a high-fall, low-spring pattern. This percentage was greater for each succeeding class. Of the producers whose deliveries in 1962 were at least 500 percent of 1953, 59 percent possessed a high-fall or winter pattern with a seasonal drop in the spring.

Comparisons of Market Data and Producers Continuously on the Market

In 1953, average daily deliveries per producer for the North Texas market were 558 pounds (Table 11). The average daily deliveries per producer in 1953 for 786 Texas producers that delivered milk to this market

TABLE 10. COMPARISON BETWEEN PRODUCER GROWTH AND SEASONAL PATTERN

Seasonal production pattern	Producer growth[1] Less than 100	100-199	200-299	300-399	400-499	500 and above	All producers
	Percent of producers						
A[2]	72	46	34	20	16	18	39
B[3]	20	41	42	41	39	23	40
C[4]	8	13	24	39	45	59	21
Total	100	100	100	100	100	100	100
Number of producers	49	356	245	88	31	17	786
Percent of producers	6	46	31	11	4	2	100

[1]Percent that 1962 deliveries were of 1953.

[2]The 10-year average daily deliveries peaked in March through May with deliveries for September through December being at a low level compared to the other months.

[3]The 10-year average daily deliveries peaked in the period June through August or there was a tendency for a double peak—one in the spring and one in the fall or winter.

[4]The 10-year average daily deliveries peaked in the fall or winter months.

TABLE 11. AVERAGE DAILY DELIVERIES PER PRODUCER FOR ALL PRODUCERS ON THE MARKET AND 786 PRODUCERS CONTINUOUSLY ON THE MARKET 10 YEARS, NORTH TEXAS, 1953-1962

Years	786 Producers	All producers	Difference	786 Producers as a percent of all producers
	Percent			Percent
1953	658	558	100	117.9
1954	695	584	111	119.0
1955	777	642	125	121.0
1956	860	688	182	125.0
1957	901	718	193	125.5
1958	956	744	212	128.5
1959	1,054	864	190	122.0
1960	1,117	950	167	117.6
1961	1,220	1,058	162	115.3
1962	1,294	1,137	157	113.8

continuously from 1953 through 1962 were 658 pounds. The average deliveries for these 786 producers were greater than the average for all producers for the entire 10-year period, 1953 through 1962. The difference was at least 100 pounds per day throughout this period. This indicates that, on the average, new producers coming on the market as well as old producers leaving the market were considerably smaller than these long-term producers.

The compound growth rate for these 786 producers was 7.87 percent, while the growth rate for all producers on the market was 8.02 percent. Hence, the difference amounted to only .15 percent even though a considerable difference existed in the average size. Therefore, at least in this case, the growth rate obtained from the market data provides a useful indication of the tendency of producers to increase in size over time. The effect of smaller-than-average producers leaving the market evidently was slight, or it could have partially offset by newer producers having a slower rate of growth than the 786 producers in the special study.

The 786 producers grew at a higher average rate than the average for the whole market through 1958. After 1958 the rate for the whole market grew faster. This suggests that the more recent producers in the market were growing faster than the producers that had been on the market longer.

Analysis of the data indicates that there was a decline in seasonality of deliveries by the 786 producers. However, median indices of seasonality for this group and the Texas producer data on the North Texas market indicate a close agreement between the two series.

This suggests that eliminating the impact of producers leaving and coming on the market may not contribute much to a better understanding of producer data. However, differences may be much greater for a small market such as Corpus Christi which has greater short-term variation in the number of producers. This type of variation may be reduced by using average daily deliveries per producer rather than average daily deliveries.

Although the rate of change in seasonality appeared to be greater for the North Texas market producer data than for the 786 Texas producer data, these differences were generally small and a significant difference existed for only 1 month during the 10-year period.

It was found that in the North Texas market the seasonal pattern for Texas producer data was similar to the seasonal pattern of deliveries of the 786 Texas producers that were continuously on the market for a 10-year period. The individual producer data for the North Texas market also indicated that the average producer growth rate can be determined adequately from market data. However, market data may slightly over estimate the growth rate since many producers leaving the market can be expected to be smaller than the average producer for the market.

LIMITATIONS: Major limitations of the analysis were (1) the frequent major changes in the pricing and payment provisions in several of the markets over a relatively short time, (2) the short period for which data were available for some markets and (3) the disturbances resulting from factors such as changes in the number of handlers regulated in some markets which appeared to have a major impact on both producer deliveries and Class I sales. These problems not only made it difficult to evaluate the seasonal and growth patterns of the markets but also restricted detailed evaluation of changes in seasonality and comparisons among markets.

CONCLUSIONS

Historically, a malalignment has existed between the seasonality of production of Grade A milk and consumption of Class I products. Additionally, many markets have been faced with a more rapid increase in producer deliveries than in sales. Since the demand for these products is highly inelastic, large price fluctuations are required to match consumption with production patterns. Without such adjustment, it is accepted practice to price excess production competitively with manufacturing grade milk.

Milk marketing orders frequently include pricing and payment provisions to provide additonal incentives for adjusting production rather than consumption. These provisions include supply-demand adjusters, Class I price differentials, base-excess quotas and fall-premium plans.

Five Texas milk markets (North Texas, Austin-Waco, San Antonio, Corpus Christi and South Texas) were studied because they contained a variety of provisions and represented the major Texas fluid milk markets. Data were obtained from federal market order administrators and producer cooperatives in Texas. The analysis covered the period from the first year of operation of the respective orders through 1964, a period of 9 to 13 years. Since there is no order in the South Texas market, data were restricted to the 9-year period of cooperative records: 1956-1964.

It was thought that entry and exit of producers on a market might seriously distort market-wide seasonality and growth characteristics. In two markets having several changes in the number of handlers, and hence producers, it was difficult to evaluate changes or even general patterns. Analysis of 786 producers continually delivering to another market for 10 years provided results similar to the market-wide data, indicating that unless there are sudden large changes in the number of producers, market-wide data properly reflect producer adjustments.

Analysis revealed wide differences in seasonalities of Class I sales and production. Pricing provisions were not sufficient to obtain a discernible shift in seasonality. A significant shift in seasonality of production was found only in one market employing a base-excess system. The shifts agreed with the incentives of this program.

Another market using a restrictive base-excess plan did not possess a shift, but the plan existed prior to the period covered by the data. Seasonality of producer deliveries in this market was lower than in the other markets.

Incentives to adjust the level of production were greatest in the two markets employing restrictive base-excess plans. These programs tied the level of base milk to that of Class I sales. In the market adopting its plan before the period studied, production was in a stable and close relationship to Class I sales. In the second market a change was made from an unrestricted to a restricted base-excess system. Before the change, production increased more rapidly than sales. Following the change the relationship improved until annual production and sales were closely aligned.

Production was not more responsive to sales in the market with individual handler blend pricing than in the one with blend pricing and market-wide pooling. A race-for-base in unrestricted base-excess programs contributing to a higher growth rate of producers is frequently a criticism of these programs. However, the growth rate in this type of market was not statistically greater than in the markets using blend pricing.

Finally, this analysis indicates the existence of a wide variety of seasonal patterns and growth rates between producers. Clearly, all producers do not view the incentives for adjustment in a similar fashion. This suggests the need for major educational programs among producers concerning the advantages and disadvantages of various alternative adjustment programs resulting from market order provisions.

A wide variation in producer size, growth rates, and seasonal patterns were found to exist in the North Texas market. The following characteristics were found:

(1) A greater proportion of the small producers had higher growth rates than large producers.

(2) A greater proportion of the producers that had small deliveries in 1953 appeared to maintain a high-spring, low-fall seasonal pattern throughout the period than was the case with large producers.

(3) The proportion of the producers having a high-spring, low-fall pattern of deliveries was lower among the groups that had greater growth rates. Nearly three-fourths of the producers whose deliveries in 1962 were less than in 1953 had an average pattern of high-fall, low-spring deliveries. Only 17 percent of the producers whose deliveries in 1962 were at least four times the 1953 level had an average pattern of high-spring, low-fall deliveries.

(4) The proportion of producers with a high-spring, low-fall pattern was greater among producers that installed their first bulk farm milk tank late in the period studied.

(5) The proportion of producers installing bulk tanks during the first 4 years of the study (including those that had installed a tank before the period studied) was highest among the larger producers.

These findings indicate that there is a close relationship between adjustments of producers to both installation of improved equipment, seasonal adjustment of milk deliveries and growth rates. It suggests that the more astute managers adjust more quickly to those factors that improve income. Additionally, the adoption of a seasonal pattern which more closely followed the market requirements probably placed these producers in a more favorable position to increase production more rapidly than other producers. Finally, the data suggest the need for concentrated educational efforts among some producers concerning the income benefits of different seasonal patterns of production. This points up the need for further research on the comparative costs of producing certain annual volumes of milk under alternative seasonal patterns. Since marketing cooperatives and many pricing and payment programs are concerned with the seasonal adjustment problem, the complete benefits or limitations of the programs can be made known to dairymen only if production costs and returns for the alternative seasonal patterns are known.

SUGGESTIONS FOR ADJUSTMENT

Seasonal Adjustment

The study indicates that it is difficult to determine the seasonal patterns for Class I sales and producer deliveries in markets that have frequent changes in the number of regulated handlers. This is especially the case when changes in number result from changes in the proportion of Grade A products which handlers sell in the regulated market.

In the five markets studied the base-excess payment method appears to be the most effective payment procedure employed to obtain a seasonal adjustment of producer deliveries to seasonal pattern of Class I sales. Because of the nature of the adjustment problem, a base-forming period of September through January is recommended.

There was little indication of a change in seasonality of producers' deliveries for the Austin-Waco market or by members of the major producer cooperative. This was also true of the producer deliveries for the San Antonio and Corpus Christi markets.

However, there was a significant change in three of the indices of seasonality of producer deliveries for the major producer cooperative in the South Texas market. Additionally, the total deviations of the indices from 100 were smaller each succeeding year. The lack of conclusive evidence of a change in seasonality for this market may be related to the adoption of a restrictive base-excess program several years before the period for which data were available.

Production could be expected to increase seasonally in August, and perhaps in July, as producers attempted to prepare for the base-forming period. By having the base-forming period continue through January the tendency for a premature reduction in deliveries for the spring months would be reduced.

A base-paying period of March through July would provide a 1-month separation between the base-forming and base-paying period in which no penalty would be incurred by receiving the excess price or by having the deliveries included for record in constructing the new base. A blend pricing system could be used during the months which were not established as the base-paying period.

If deliveries were eventually switched to the point that seasonally they were too high in the base-forming period, the base-paying period could be extended to cover the entire year. Producers who had over-adjusted their seasonal pattern would then receive an excess price for part of their deliveries during the base-forming period. If this were not sufficient incentive for seasonally reducing deliveries in the fall, the seasonality of the Class I price differential could be reduced.

Critics of the quota system argue that it penalizes the producers who attempt to increase their efficiency by becoming larger. They also contend that it reduces the incentive for producers to adopt new technological developments. This objection can be reduced with a base-excess program such as that employed by the cooperative in the Austin-Waco market. The 3-year moving average of daily deliveries during the base-forming period provides a base which results in a producer accepting the impact of his additional deliveries for a longer period of time. It would take 3 years before a given increase in deliveries would be fully realized in the producer's allotted base.

Provision For New Producers

The 3-year moving base creates a problem with new producers. New producers would receive an

excess allocation for a large part of their deliveries the first, and even the second year, unless base was purchased from existing producers. This problem could be overcome in part by arbitrarily assigning a base to a new producer, since orders are not designed to prohibit entry of new producers. For example, one method could be to assume that a new producer would adopt a compound growth rate of 10 percent and would have a seasonal pattern which would average 10 percent more deliveries per day during the base-paying period than during the base-forming period. If the new producer came on the market after the base-forming period was over, he could then be provided an allocation of 80 percent of his deliveries as base and 20 percent as excess.

The following year the producer's effective base could be established as 90 percent of his average deliveries during the base-forming period. This would account for a 10 percent growth rate and the deliveries during the base-forming period would establish the proper effect of his seasonal pattern. If the new producer started delivering milk early in the base-forming period, this procedure would be followed during his first base-payment period instead of using the method described in the preceding paragraph.

The next year the producer's base would be one-third of the sum of 1.90 times his average deliveries the first base-forming period, plus the average for the second base-forming period. Finally, the next year the producer would have delivered milk during the base-forming period for three consecutive years so his base could be calculated in the same manner as for all other producers.

The last suggested proposal for the base-excess payment program contained a provision intended to protect the producer from a base price which would decline over time as a result of expansion of base deliveries. One method of protecting the producer would be to determine his base price from the level of his deliveries relative to his assigned base and the proportion of total market base deliveries that were assigned to Class II. Under this method the producer that delivered his entire allotted base during the month would receive the base price for his base deliveries. However, by delivering less than his assigned base the producer could receive up to the Class I price. The Class I price would be received if the percentage of his assigned base which was actually delivered was no greater than the percentage of the total market base deliveries assigned a Class I utilization.

Base deliveries between the two extremes would receive the proper proportional value of Class I and Class II prices. For example, if 80 percent of the market base deliveries were Class I and a producer delivered 90 percent of his assigned base he would receive the Class I price for 80 percent of his assigned base, or about 90 percent of his actual deliveries. The remainder would be valued at the Class II price.

Another alternative to this method would be to proportionately reduce the assigned base for each producer so that the base price could not fall below a specified relationship between the Class I and Class II prices. This method was used by the cooperative in the Austin-Waco market. Both of these methods would provide additional incentives for producers to regulate their growth rates.

The programs proposed should not be expected to provide the greatest level of adjustments under all situations. Modifications of the programs would probably be required from time to time in most markets. However, to insure that the producers will respond to features of any pricing and payment provisions in the way anticipated, producer knowledge of the provisions and their implications on their incomes is crucial. Without intensive educational efforts, attainment of adjustments would be expected to take a longer period of time and perhaps never reach their potential.

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