

AN ANALYSIS OF THE TULSA MILK MARKET

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By

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FOREWORD

The Agricultural Department of the Tulsa Chamber of Commerce has had a desire for some time to obtain definite information regarding various parts of its market area on which to base its agricultural program. Likewise, the Agricultural Economics Department of the Oklahoma Agricultural and Mechanical College has been interested in the marketing problems in the agricultural industries in Northeastern Oklahoma. On April 27, 1938, these two agencies decided to cooperate in making a survey of the production and distribution of dairy and poultry products in 21 counties in Oklahoma, two in Kansas, two in Arkansas, and one in Missouri.

The present report on the Tulsa milk market presents only that material obtained in the survey pertaining to the fluid milk industry in Tulsa. Nothing is given regarding the production and distribution of sour cream, or the manufacture of dairy products.

In the first part a more or less detailed picture is given of the production and distribution of market milk for the Tulsa market. In the latter part per capita consumption in Tulsa is compared to per capita consumption in other cities where similar studies have been made. Also, interrelationships between production, price, and per capita consumption are discussed. An attempt is made to reveal some of the maladjustments in the market, and suggested recommendations for correcting these maladjustments are made.

METHOD AND SCOPE OF THE STUDY

The information forming the basis of this study was secured through personal interviews held with producers, managers of dairy plants, city health officials, retailers, and others closely connected with the dairy industry. Information was also obtained from the records of the city health department on the number and size of herds, the number of cows producing, and the amount of milk sold daily. Unfortunately information from many of the dairy plants could not be obtained in sufficient detail to be of value in the study.

TERMINOLOGY

Market milk, refers to milk which is supplied to consumers in the natural fluid state or which is prepared for human consumption without being converted into any other form or product.

Manufacturing milk, is milk which is converted into butter, concentrated milk, ice cream, cheese, or any other dairy product except market milk.

Producer-distributor, refers to a market milk producer who sells the milk produced by his herds, usually in bottles, to retailers or direct to consumers.

Plant producer, refers to a market milk producer who sells his milk to pasteurizing plants.

THE TULSA MARKET MILK SUPPLY AREA

Slightly less than 90 percent of Tulsa's market milk supply area is within a radius of 20 miles of the city. Figure 1 shows by civil townships the average number of pounds of fluid milk sold daily in Tulsa for the period January through June, 1938.

Market milk production is heaviest in the townships lying north, east, and southeast of Tulsa. Fluid sales from each of five adjoining townships between Broken Arrow on the south, and Collinsville on the north amount to over 6,000 pounds daily. The two heaviest of the five, each furnish daily over 14,000 pounds. A comparatively small amount of market milk is produced west of the city.

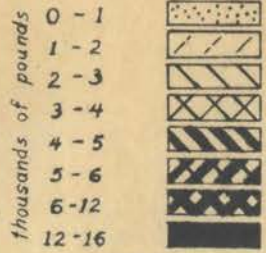
North and east of Tulsa, soil, topography, and other factors combine to make a region fairly well adapted to dairying. Pastures are usually good, except during dry summers. Sudan, rye grass, alfalfa, soy beans, and head crops can be grown fairly easily. The topography is rather rough in some places but as a rule slightly undulating to rolling. Soil northeast of the city is a prairie soil of limestone origin. South and east along the Arkansas River the soil is residual. Both are good for dairy production.

The land west of Tulsa is poorly adapted to dairying. Topography is rough and uneven. Soil is of a type not fitted for growing feed crops. Oil development has been great in the vicinity and the land in most places is poorly cared for.

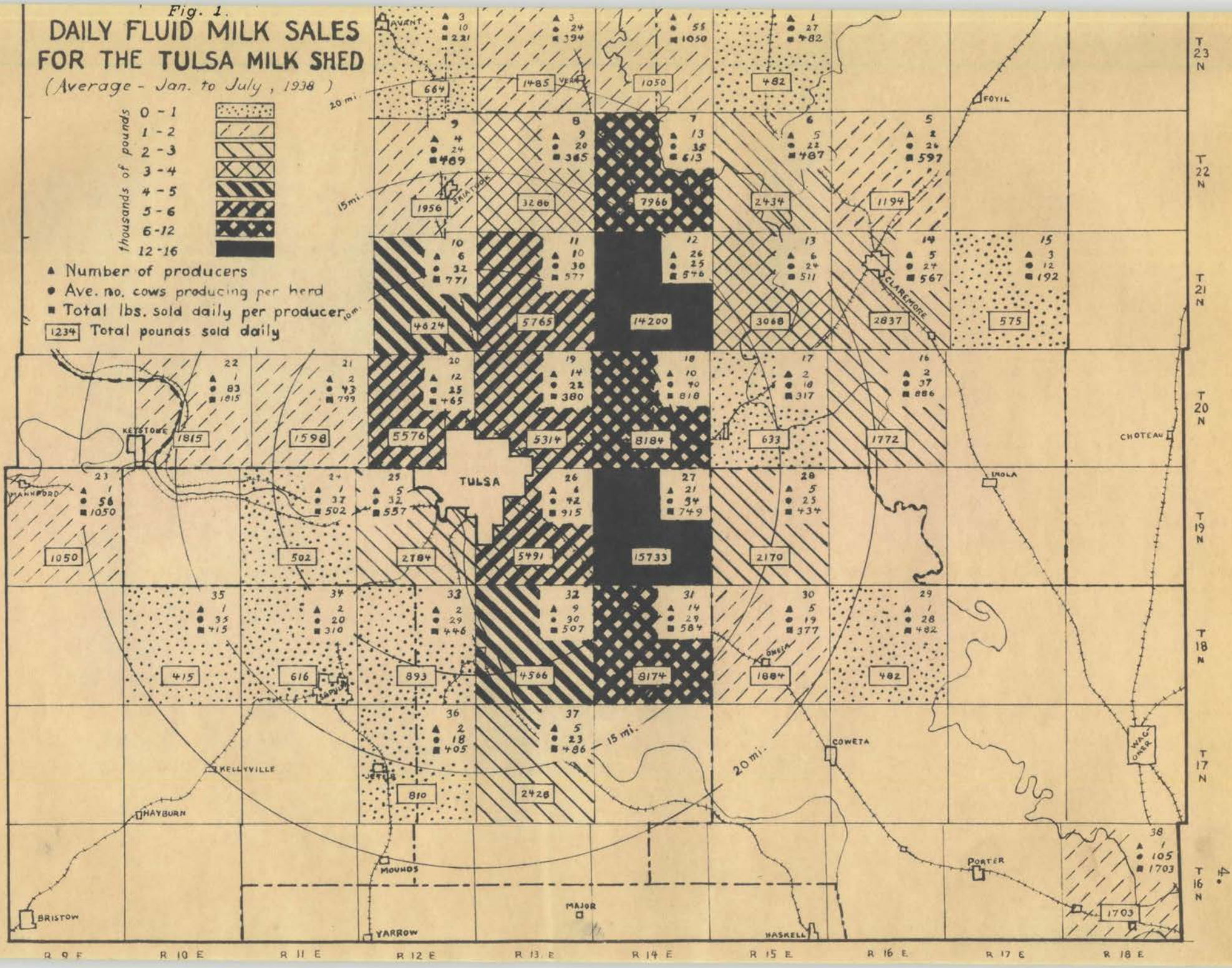
The greatest handicap to dairying in any part of the milkshed is insufficient moisture during dry years for growing summer feeds. It has also been necessary at times to haul water for the stock.

If expansion of the area should take place, the logical direction seems to be further north and east of the city. There has been in the

Fig. 1.
DAILY FLUID MILK SALES
FOR THE TULSA MILK SHED
(Average - Jan. to July, 1938)



- ▲ Number of producers
 - Ave. no. cows producing per herd
 - Total lbs. sold daily per producer
- 1234 Total pounds sold daily



last few years, according to Tulsa health officials, a gradual movement of dairies from southwest of the city to other parts of the supply area. Some expansion has taken place recently in a small part of Osage County and around Broken Arrow.

On Figure 2^{1/} the locations are shown of the 236 market milk producers who regularly supplied Tulsa with its fluid milk, the first five months of 1938. During this period there were 52 producer-distributors selling milk in bottles to retailers or direct to consumers. The remaining 185 sold their supply to pasteurizing plants.

Over 60 percent of the producer-distributors are located within a 15 mile radius of the city. (Table 1 and Figure 2). On the other hand, over half the plant producers are within two zones, included between 10 and 20 miles.

Dairying in the milkshed is for the most part conducted on a specialized basis. Because of its perishable nature, special equipment and care are necessary for handling milk. The Health Department of Tulsa has set up rigid sanitary measures regarding the conditions under which milk is produced and the manner in which it is handled on the way to the consumer. If the dairyman is to make a living from the sale of milk alone, a fairly large herd is required. About 60 percent of the herds of plant producers, and about 75 percent of the producer-distributor herds consist of 26 or more dairy cattle. Eight plant producers have over 100 cattle in their herds. (Table 2).

Producer-distributors probably are more specialized than plant producers. All the producer-distributors in the area sell their milk in

^{1/} Map prepared with the assistance of Dr. H. G. Ross, Head of the Milk and Dairy Inspection Division of the Tulsa Department of Health.

Fig. 2
MARKET MILK PRODUCERS
in the
TULSA MILK SHED

July, 1938

- Plant Producer
- + Producer Distributor
- Paved road
- - - Improved road
- ++++ Railroad

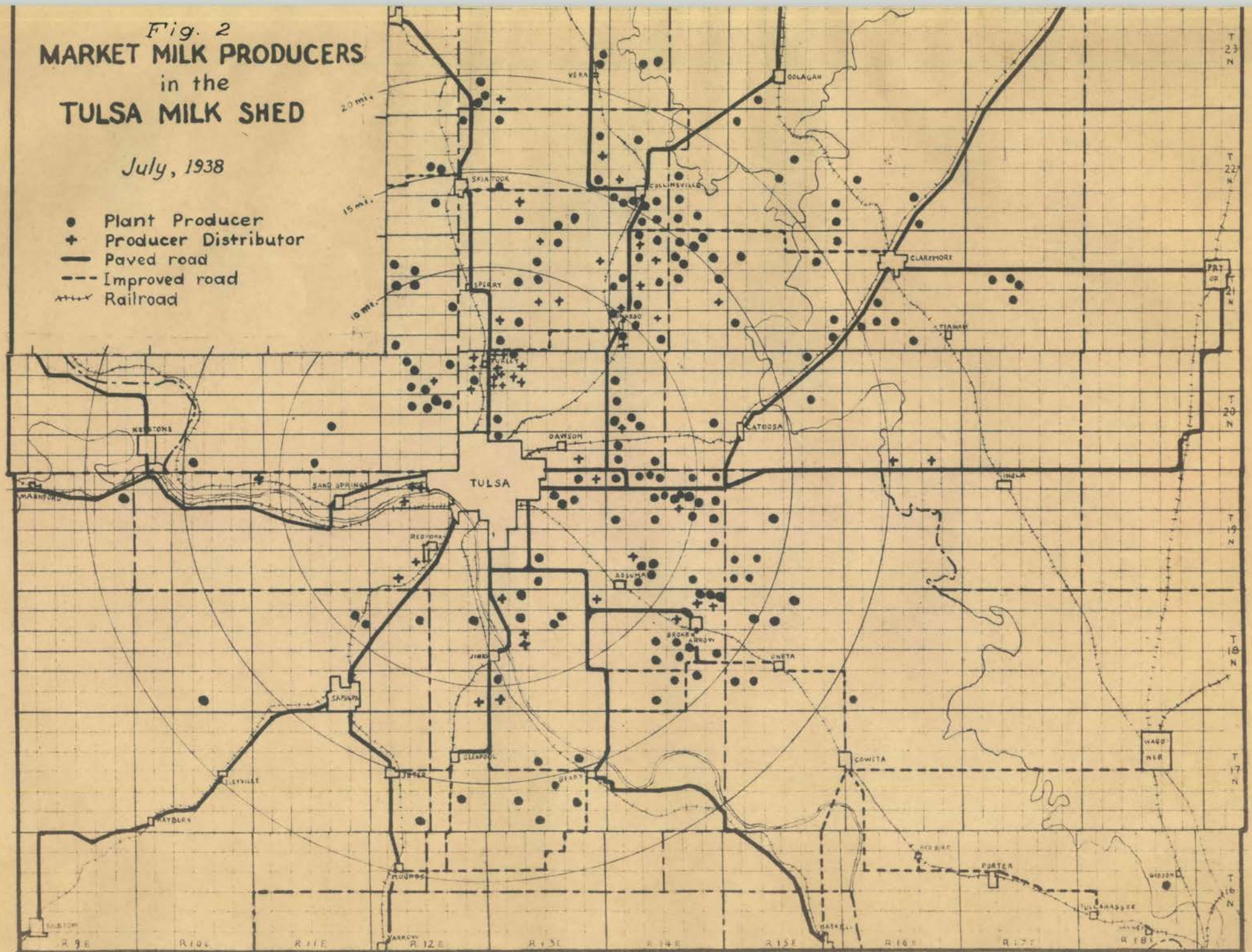


Table 1. Pounds of Fluid Milk Sold Daily by 221^{1/} Producers Located
Varying Distances from Tulsa, January to June, 1938

Miles From Tulsa	Plant Producers				Producer-Distributors			
	Num- ber of Pro- ducers	Per- cent of Total	Lbs. Milk Sold Daily	Per- cent of Total	Num- ber of Pro- ducers	Per- cent of Total	Lbs. Milk Sold Daily	Per- cent of Total
Zone 1 0 - 10	57	34	38,343	41	32	61	17,683	57
Zone 2 10 - 15	51	30	26,846	28	15	29	8,774	28
Zone 3 15 - 20	40	24	19,126	20	4	8	3,417	11
Zone 4 20 and over	21	12	10,699	11	1	2	1,290	4
Total	169	100	95,014	100	52	100	31,164	100

^{1/} Only those producers were used on which data were most complete. Since the 15 producers not included were scattered evenly throughout the area, the same relationship should hold true for the total producers.

Source of data: Tulsa Department of Health.

Table 2. Size of Dairy Herds in Tulsa Fluid Milk
Supply Area, 1937

Number of Dairy Cattle Per Farm	Plant Producers			Bottle Producers		
	Total Number of Herds	Total Number of Dairy Cattle	Average Size of Herd	Total Number of Herds	Total Number of Dairy Cattle	Average Size of Herd
25 or less	56	1,035	18	12	211	18
26 - 50	77	2,816	37	24	907	38
51 - 75	28	1,728	62	8	451	56
76 - 100	18	1,526	85	4	369	92
101 - 125	5	552	110	2	237	119
126 - 150	2	266	133	2	277	139
151 - 175	-	-	-	-	-	-
176 - 200	1	190	190	-	-	-
Total	187	8,113	43	52	2,452	47

Source of data: Tulsa Department of Health.

Table 3. Average Size of Herds, Number of Cows Producing, and Amount of Whole Milk Sold Daily for 221 Producers Located Varying Distances from Tulsa, January to July, 1938

Miles From Tulsa	Plant Producers			Producer Distributors		
	Average	Average	Average Amount	Average	Average	Average Amount
	Number of	Number of	Sold Daily	Number of	Number of	Sold Daily
	Cows in	Cows	Per Producer	Cows in	Cows	Per Producer
	Herds	Producing	(Pounds)	Herds	Producing	(Pounds)
Zone 1 0 - 10	47	32	673	44	30	553
Zone 2 10 - 15	41	27	526	44	29	585
Zone 3 15 - 20	38	26	490	61	40	854
Zone 4 20 and Over	41	26	510	73	51	1,290
Average of Area	42	28	566	45	31	599

In Zone 1, plant producers have on the average larger herds and more cows producing and sell a larger number of pounds of milk daily than those in the 10 and 15, and 15 to 20 milk zones. However, the few producer-distributor herds located in the 10 and 15, and over 20 mile zones are larger than the average for herds located nearer town.

Source of data: Tulsa Department of Health.

the raw state. Health requirements applied to raw milk producers are more rigid, especially regarding barn and milk house construction than for plant producers. It is also necessary usually to employ one or more men the year round to keep the place clean, handle the cooling and bottling, and make deliveries.

Plant producers on the other hand in many cases combine dairy production with several other farm enterprises. However, this is more true of those living some distance from town. Since producers located nearer Tulsa have larger herds (Table 3), and furnish a more than proportionate share of the total supply of plant producer milk (Table 1), it is probable that they obtain a larger share of their cash income from that source. In the zero to 10 mile zone, 34 percent of the total plant producers supply over 40 percent of the milk used daily by pasteurizing plants. Producers in zones 2 and 3, combined represent 54 percent of the total number of plant producers, yet furnish only 48 percent of the milk.

The situation seems to be reversed in the case of the few producer-distributors living 15 miles or more from Tulsa. They represent 10 percent of the total producer-distributors and furnish 15 percent of the milk. This would naturally be expected, since their costs are higher than for producer-distributors living in closer proximity to the market, and a large volume of business would be needed to make expenses.

THE PRODUCTION OF FLUID MILK FROM 1935 TO 1937

The number of herds supplying Tulsa with fluid milk increased from 228 in 1935 to 240 in 1937. The number dropped to 236 for the first five months of 1938. (Table 4). However, the total number of dairy

Table 4. Estimated* Number of Herds and Number of Dairy Cows Supplying Tulsa With Fluid Milk, 1935 - 1937

Year	Number of Herds	Number of Dairy Cows
1938	236	10,087
1937	240	10,565
1936	231	11,340
1935	228	10,965

* Interpolations were made where data was not recorded for that month.

Source of Data: Monthly Dairy Inspection Sheets of the Tulsa Department of Health.

cows was smaller in both 1937 and 1938. The severe drouth during 1936 together with milk prices that were relatively lower than the prices for other agricultural commodities were possibly factors that contributed to this decrease. Indications are that considerable land that was formerly in pasture was put into wheat that year.

Each year from 1935 to 1937 the total pounds of fluid milk sold annually increased. During 1937 fluid milk sales amounted to an estimated 45,000,000 pounds, while in 1935 they were less than 37,000,000. (Table 5). It could not be determined definitely whether or not consumption had also increased, but it is safe to say that much of the increased production was used as surplus milk for dairy manufacturing purposes. Although the number of cows in herds and the average number producing were both

Table 5. Estimated Fluid Milk Production* For The
Tulsa Market, 1935 - 1937

Year	: Number : of Herds	: Average Number : of Cows Producing	: Pounds of Whole Milk Sold : (000)
1937	240	6,810	44,917
1936	231	6,891	41,585
1935	228	6,552	36,782

* The figure on the monthly report was the average number of gallons sold daily that month. This was multiplied by 8.60215 to convert to pounds, and then by 30 to put on a monthly basis. Interpolations were made where no figure was recorded.

Source of data: Monthly Inspection Sheets of the Tulsa Department of Health.

greater in 1936 than in 1937; production for 1937 was about 4,000,000 pounds greater than in 1936. This can be explained mainly by the severe drouth in 1936, and fairly good producing conditions in 1937.

Seasonal Variation in Fluid Milk Production. Figures obtained from the records of the Tulsa Health Department were used to work out seasonal variations for the number of cows producing and for daily sales of market milk producers. (Table 6). Since figures were not recorded every month for all the producers, it was necessary to use only those on which data were most complete. The number used varied from 16 to 20 for producer-distributors, and 30 to 40 for plant producers during different years.

The largest amount of milk comes on the market during the spring and early summer months. Pastures then are good and also, even though special herd management practices are followed, it is difficult to keep a larger proportion of the herd from freshening at this time of the year than in other periods.

1/
Table 6. Indexes of Seasonal Variation in Daily Fluid Milk Production and in Number of Cows Producing for the Tulsa Market 1935 - 1937

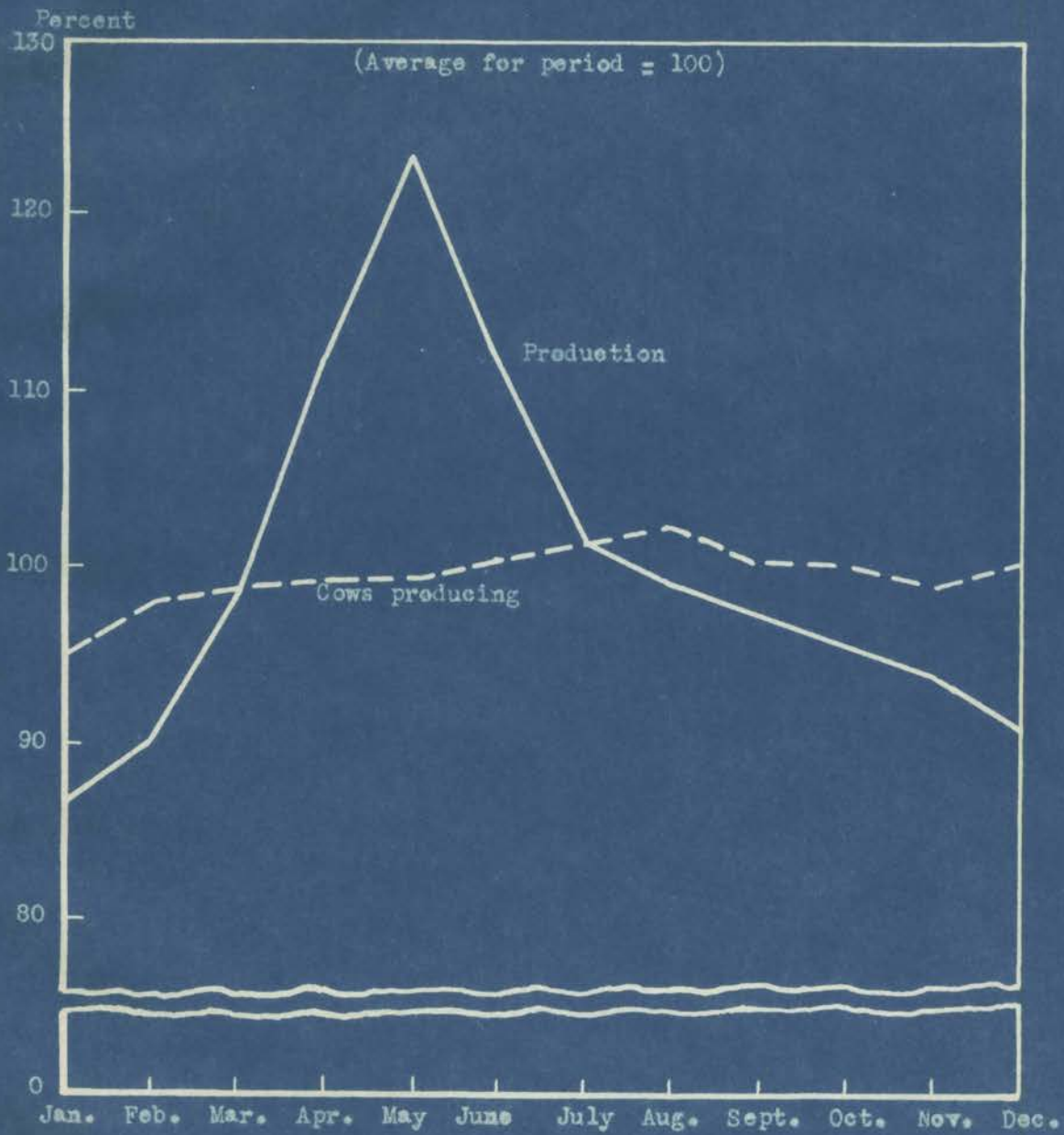
Month	: Producer-Distributors ::		Plant Producers	
	: Cows	: Milk Sold	: Cows	: Milk Sold
	: Producing	: Daily	: Producing	: Daily
January	95.2	85.8	96.1	86.3
February	96.3	91.3	96.8	89.6
March	97.2	94.7	99.4	99.2
April	98.9	102.6	99.4	112.0
May	99.2	111.5	101.0	123.0
June	101.5	109.7	102.6	111.9
July	104.7	106.3	102.6	101.9
August	104.7	106.8	102.6	99.5
September	101.3	102.0	99.0	99.7
October	101.0	96.1	101.6	95.2
November	99.2	97.4	101.0	93.1
December	100.7	95.7	99.7	90.7

1/ Average for period - 100.

Source of data: Monthly Inspection Sheets of Tulsa Department of Health.

Fig. 3.

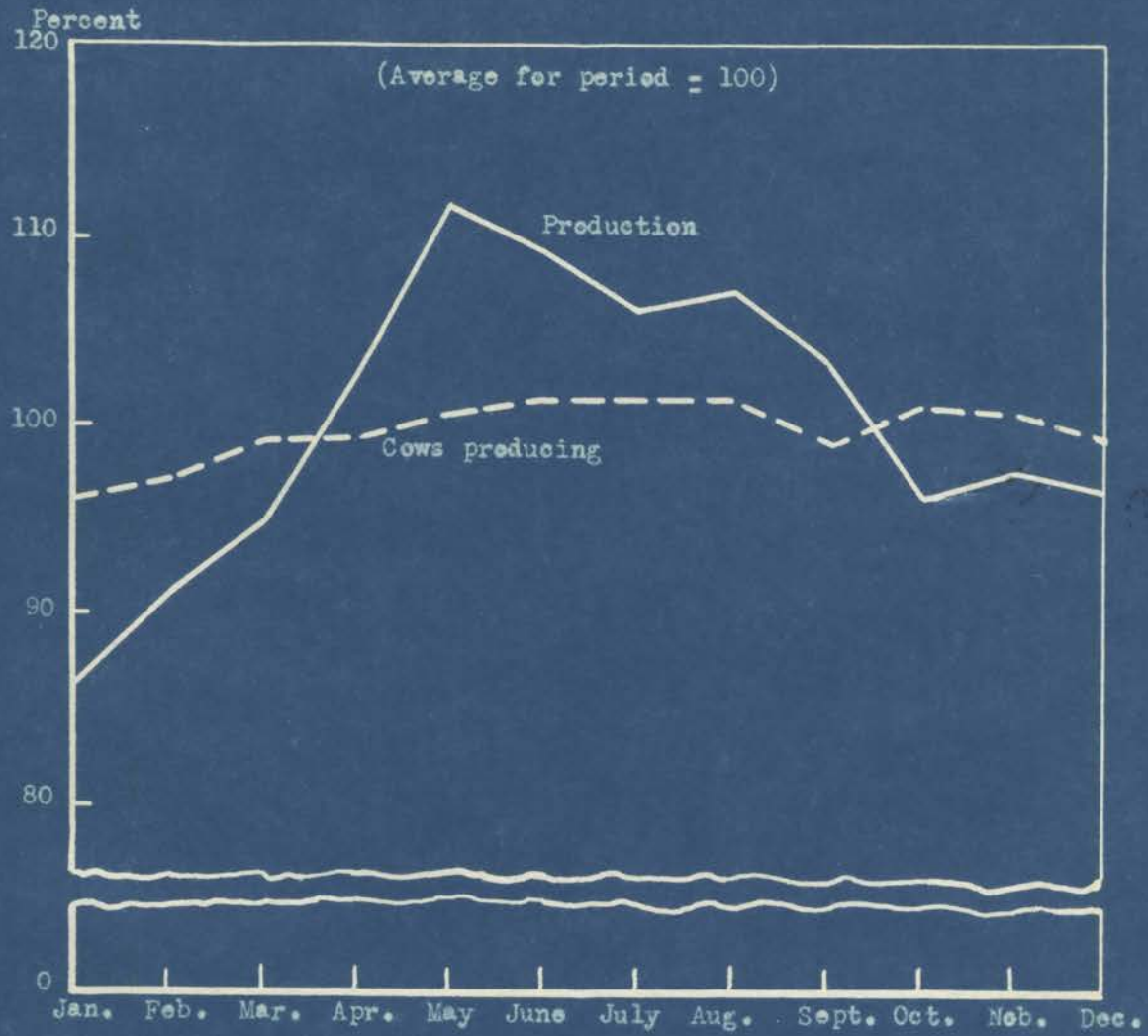
Seasonal Variation in Fluid Milk Production and in Number
of Cows Producing For Plant Producer Herds,
1935 - 1937



Source: Tulsa Department of Health.

Fig. 4.

Seasonal Variation in Fluid Milk Production and in Number of Cows Producing For Producer Distributor Herds, 1935 - 1937



Source: Tulsa Department of Health.

The number of cows producing is greatest during June, July, and August. (Table 3). Since a lower price is paid on surplus milk, that is on all milk above that needed for fluid consumption, than for fluid milk some of the large producers try to manage their breeding practices so as to have an equal number of cows freshening each month. Others try to have a larger number freshen during the late summer and fall months when production is low.

Producer-distributors seem to maintain their production more uniformly throughout the year than do plant producers. The variation between high and low months for both number of cows producing, and daily milk sales is less. Also sales do not go as high during May when production is ordinarily the highest, and their volume remains on a higher level for the remainder of the summer months. It seems that many of the plant producers simply allow their cows to follow the natural tendency to freshen in the spring.

It would greatly stabilize the market if all producers could be persuaded to manage their herds so as to have production more nearly even throughout the year. Even though the surplus in April and May could not be eliminated, much of it could be spread more uniformly throughout the remaining months. In some milksheds, producer organizations have through cooperative efforts of their members attempted to adjust seasonal production somewhat near consumption throughout the year.^{2/}

^{2/} Bartlett, R. W., "St. Louis Milk Problems With Suggested Solutions", Illinois Agricultural Experiment Station Bulletin 412, April, 1935, p. 135.

QUALITY AND SANITARY REGULATIONS

Milk is one of our most important and at the same time most perishable foods. If it is not produced and handled under the most sanitary conditions it can easily become a menace to public health. In order to safeguard public health most cities have adopted standards to control the quality of market milk.

Milk sold in Tulsa for fluid consumption must meet the standards set up by the American Medical Milk Commission. The Tulsa Ordinance provides that market milk shall contain not less than 3.3 percent milk fat nor less than 8.5 percent of solids not fats. A physical examination and tuberculosis test must be made at least once every 12 months of all cows from which milk is sold for fluid consumption. All cows found to have tuberculosis must be removed from the herd at once. Every person connected with a dairy, or milk plant, whose work brings him in contact with the handling of the milk must have passed a medical examination made by the City Health Officer. In addition stringent requirements are made as to the construction of dairy barns and milk houses, the handling of utensils, the cooling of the milk, and the care of the cows.

Four grades of raw and four grades of pasteurized milk are set up in the Ordinance.^{3/} However, no milk or cream can be sold to retailers or consumers except Grade "A" pasteurized and Grade "A" raw milk. This section is not constructed as forbidding the sale of lower grades of milk and cream during temporary periods of degrading^{4/} not exceeding 30 days.

^{3/} See Appendix.

^{4/} If a producer's milk falls below the standard required for Grade "A" pasteurized, or Grade "A" raw milk he is given 30 days in which to bring the milk back up to standard.

Sanitary requirements are more stringent on farms producing milk that is to be sold in the raw state than on those where milk is produced to be sold to pasteurizing plants. This has, in the opinion of the City Milk and Dairy Inspector, ^{5/} caused a decline in the amount of raw milk sold. Since there is always a chance that some harmful bacteria have not been eliminated from raw milk, even though produced and handled under the best of sanitary conditions, this decline is desirable.

5/ Dr. H. G. Ross.

DISTRIBUTION OF MARKET MILK IN TULSA

Channels of Distribution. The proportion of milk sold in bottles direct to retailers and consumers by producer-distributors has decreased from 30 percent of the total in 1935 to 24 percent in 1937. (Table 7).

Table 7. Proportion of Market Milk Sold Annually By Plant Producers and By Producer-Distributors, 1935 - 1937

Year	: Pounds of Whole : : Milk Sold	Percent Sold By:	
		: Producer-Distributors	: Plant Producers
1937	44,917	24	76
1936	41,585	27	73
1935	36,782	30	70

Source of data: Tulsa Department of Health.

None of the producers have facilities for pasteurizing their milk on the farm. The milk sold by producer-distributors is sold as raw milk. At least two factors are operating to bring about a decline in the amount of raw milk sold. One is the more rigid sanitary regulations applied to raw milk producers. The greater cost involved in dairy barn and milk house construction and the additional facilities and time required for handling in order to meet the health department requirements make the original investment and fixed costs higher. Also the demand is becoming greater for pasteurized milk because it is commonly believed to be more pure.

From a brief survey of 20 grocery stores in various sections of Tulsa, it was found that those stores in the poor sections of town sold very little, if any, pasteurized milk. In medium and high class

residential sections, about five quarts of pasteurized milk were sold to one of raw. However, several of the stores in the more exclusive sections sold large amounts of pure Jersey milk that came direct from the producers in the raw state. Special grades of milk, such as Pure Jersey and Homogenized, sold usually for a price two cents higher than that received for pasteurized milk. Raw milk was priced at one cent less than pasteurized milk at the time of the survey.

Of the nine pasteurizing plants located in Tulsa, three handle over 60 percent of the fluid milk supply taken in by plants. It is suspected, however, that these three plants use a larger proportion of the fluid milk supply for manufacturing purposes than do the remaining plants. It could not be determined what proportion of the pasteurized milk sold went through the hands of the retailers and what amount was delivered direct to the consumer. Neither could the amount of raw milk going through retailers' hands and the amount sold direct be ascertained. Yet, although no data can be cited, personal observation seems to warrant a belief that a major portion of that milk sold by pasteurizing plants goes to retailers, while most of that sold by producer-distributors goes direct to the consumer's door.

Transportation. The producers located near to population centers have a great advantage over those located at some distance in the transportation of fluid milk, since transportation costs tend to increase with distance. However, good all-weather roads tend to equalize these advantages to a certain extent within a 30 to 45 minute driving distance of the city. Most parts of the Tulsa milkshed where production is heaviest have either paved, black top, or gravel roads. (Figure 1). Except on the two main highways, the roads west of Tulsa are usually

rather poor. This is perhaps one of the reasons why there are not more dairies in this section.

It was pointed out earlier that, a larger proportion of the producer-distributors than of the plant producers, are located a short distance from town. This is to be expected since these producers must distribute their milk daily within the city.

The milk received at pasteurizing plants is usually brought to the plant by the producer himself. In some cases one producer will, for a fee, pick up the milk of several of the producers in a vicinity and take it to the plant along with his own. Substantial savings could probably be effected by a much larger number of plant producers if they would follow this practice.

Plant Facilities. Information was obtained from most of the plants regarding the amount of their equipment and facilities for handling fluid milk. Since this information could not be secured for all the plants, it was impossible to show the results in a table. Yet, it seems safe to say that physical facilities for handling Tulsa's present supply of fluid milk are adequate. If necessary, a considerably larger volume probably could be handled with very little additional plant equipment.

FLUID MILK PRICES

Fluid milk prices are relatively stable as compared to commodity prices. However, there appears to be a great variation among cities in the level of prices paid to producers. It can be seen (Figure 5) that the dealer's buying price for market milk has been consistently higher in St. Louis, Wichita, and Kansas City, than in Tulsa, since April 1936. Also fluctuations are greater and more numerous than in any of the other cities shown.

Since the milksheds of most cities are more or less isolated, the factors that determine price in that particular milk market are for the most part local in character. Market conditions may remain unstable year after year, due to maladjustments of production to consumption or because of domination over the market by either distributors or producers. Milk wars have sometimes been the result of such maladjustments in the past.

A lower price level in one city than in another to which it is compared is not in itself conclusive evidence that that level is not in line with the local conditions. More rigid sanitary requirements in one area may be an important reason for higher buying prices in that area. In another, feed for cattle may have to be imported, or for some other reason the area may not be suitable for dairy production. It would be necessary for dairymen in such areas to be paid higher prices than dairymen in areas where feed is more plentiful and dairy conditions more favorable.^{6/}

Production conditions in the Tulsa milkshed are possibly not as favorable to milk production as the conditions found in most of the

^{6/} Tinley, J. M., and Blank, Martin H., "An Analysis of The East Bay Milk Market". Agricultural Experiment Station Bulletin 534, University of California, June 1932, p. 59.

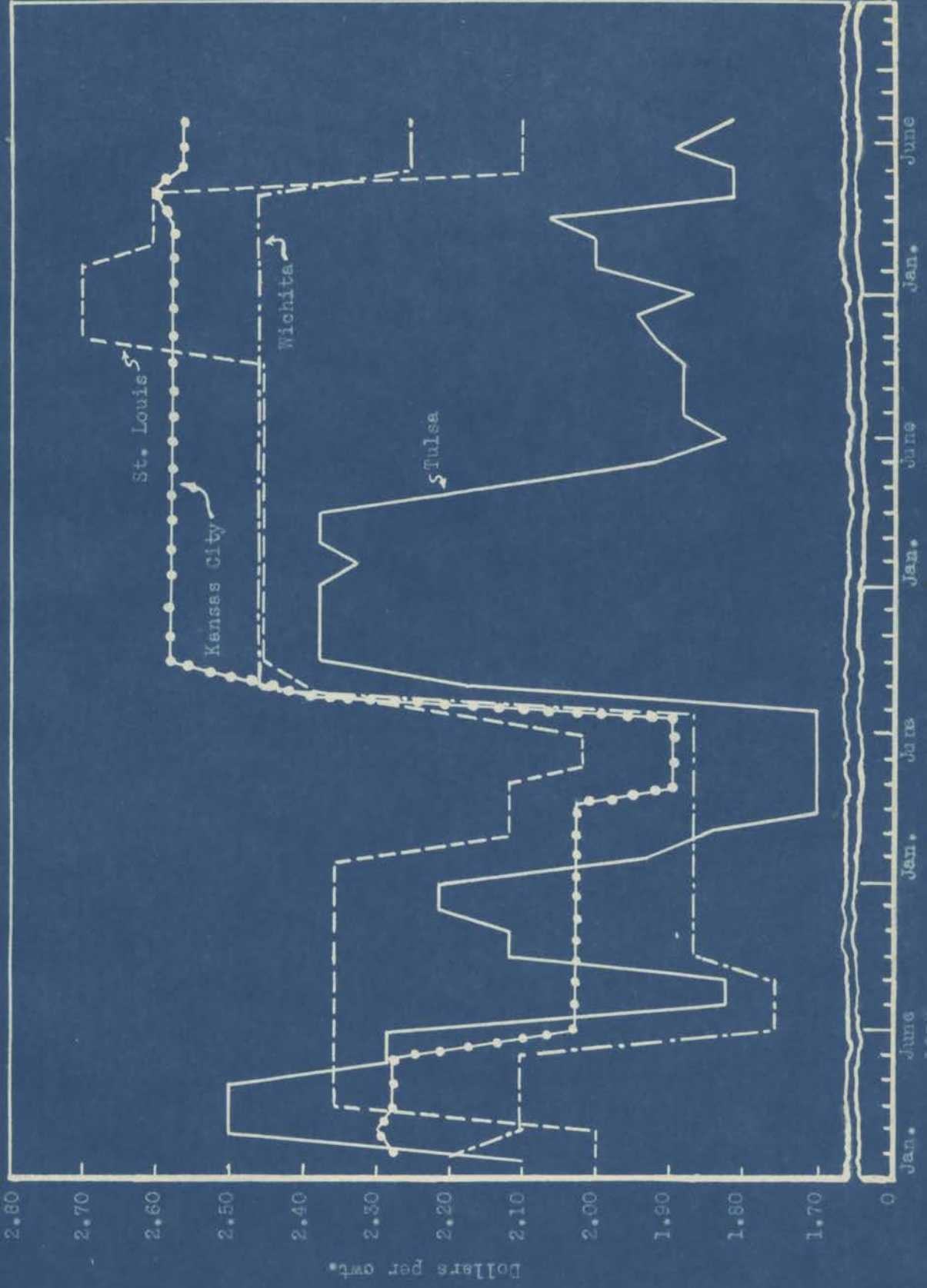
cities in northern and eastern United States where lower temperatures and fairly abundant rainfall throughout the year greatly increase efficiency of production. This disadvantage tends to increase production costs in the Tulsa milkshed. However, a factor that probably makes total cost of production greater in the large eastern milksheds is the increased cost of distribution. The supply must come from an area several times as large as the Tulsa supply area. Distribution within the city is difficult and takes more time. Dairy plants usually have a greater capital investment and pay higher rentals.

It should be pointed out also that the mere fact that buying prices fluctuate seasonally in one market, while they remain practically the same in another, is not an indication itself of unstability in the former market. The buying price in some markets fluctuates seasonably with the wholesale price of butter. It is probable that if the buying price of market milk is carefully adjusted to the annual level of prices of milk fat in manufacturing milk the return to producers would be much the same, regardless of whether prices were changed monthly, or remained unchanged for a period of a year or more.^{7/}

It seems that the buying price for market milk in Tulsa, in general, fluctuates with wholesale butter quotations. (Figure 6). In the last half of 1937, however, the dealer's buying price remained much lower proportionately, than the wholesale butter price, which was due largely to the unusually large production of fluid milk in Tulsa that year. The relationship between the retail price and the price paid to the producer remained practically the same, throughout the period January 1935 to July 1938. Although the retail price did not change as often, it usually rose or fell from one to two cents with any appreciable change in the dealer's

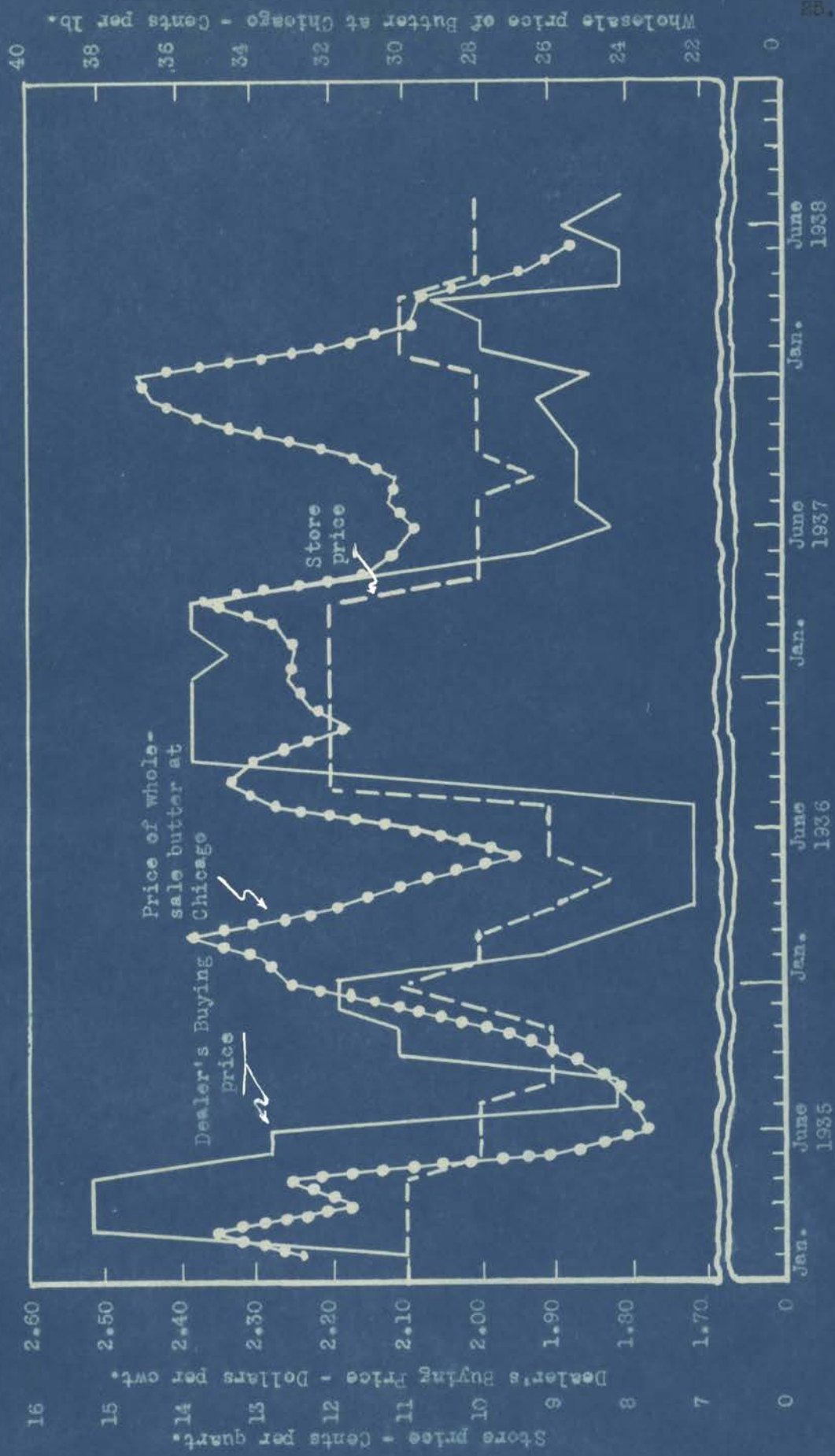
^{7/} Op. cit. p. 46.

Fig. 5
Dealer's Buying Prices For Market Milk in Different Markets
January 1935 - July 1938



Source: Monthly Fluid Milk Market Reports of the Market News Service, B. A. T., U. S. D., A.

Fig. 6
 Dealer's Buying Prices and Store Prices For Market Milk in Tulsa
 and Daily Average Price of 92 Score Butter at Chicago ^{1/}
 January 1935 - July 1938



Sources: ^{1/} Monthly Fluid Milk Market Reports, Market News Service of the B. A. E., U. S. D. A.
^{2/} Domestic Dairy Market Review, Market News Service of the B. A. E., U. S. D. A.

buying price.

The lower level and the greater and more numerous fluctuations in prices paid to producers are perhaps due partially to lower production costs and the policy of basing prices on the price of wholesale butter. Yet, it seems probable that the level of prices paid to producers could be raised and the market made more stable if greater efforts were made toward adjusting production to demand, both from month to month, and from one year to the next.

Much of the surplus production coming during the spring months could be spread more evenly throughout the year if all producers would cooperate in following breeding practices that would make production more nearly uniform. Total production, at least for the last two years, seems to have been greater than local demand conditions warrant.

It seems possible, also, that since the producers are unorganized while distribution is largely in the hands of a few large plants the distributors are able in a measure to dominate the market.

In some cities, groups have been organized representing producers, distributors, and consumers to determine how and in what volume milk shall be produced and what the marketing service shall be. In St. Louis conditions were more or less stabilized in 1935 by the activities of organized groups representing producers, distributors, and consumers. Preceding 1929, the policies followed in the production and marketing of milk in St. Louis milkshed were determined by milk distributors. In 1929 a group known as the Sanitary Milk Producers was organized among producers in order to bargain collectively with distributors. In 1930 the Consumers Milk Commission was established to represent consumer interests. In 1935 the control of the major policies in the

St. Louis dairy district had become more nearly representative of all
interests concerned.^{8/}

^{8/} Bartlett, R. W., "St. Louis Milk Problems with Suggested Solutions".
Illinois Agricultural Experiment Station Bulletin 412, April 1935,
p. 135.

FLUID MILK CONSUMPTION IN TULSA

Not a great deal of information can be given at this time regarding consumption of fluid milk in Tulsa. Although the amount consumed is fairly even throughout the year, the amount produced varies greatly from month to month. (Figures 4 and 5). A substantial amount of the milk received by pasteurizing plants during certain months is not needed to satisfy the fluid demand and is used as manufacturing milk. Just how much of the total year's supply is surplus milk, could not be definitely determined. It was estimated by those familiar with the dairy industry that sometimes as much as 30 percent goes for purposes other than fluid consumption during the latter part of April, the month of May, and the first part of June. Again during the fall a fairly large amount is surplus milk.

There was an increase in the total fluid milk supply of from less than 37 million pounds in 1935 to over 44 million in 1937. Production in 1937 was unusually large. Although the fluid milk supply was almost 4 million pounds larger than in 1936, the total number of dairy cattle, as already pointed out, was larger during the latter year. Even though the drouth during the summer of 1936 was responsible for the greatly reduced production it seems reasonable that the amount of milk consumed in the fluid form in 1937 would not be greater than the total fluid supply in 1936.

The amount of surplus milk used in 1937 is estimated to be close to six and one-half million pounds.^{9/} The number of pounds of market

^{9/} Figure 5 indicates a wide fluctuation in fluid milk production during the year. The amount consumed during any one month is believed to be not larger than 3,250,000 pounds, which was the total production during the lightest producing month in 1937. All milk, about 3,000,000 pounds any month in 1937, was taken as surplus milk. On this basis the total surplus for 1937 is estimated to be around 6,500,000.

milk consumed, therefore, is around $38\frac{1}{2}$ million. Daily per capita consumption is calculated to be .630 pints.

Total supply of fluid milk in 1937 (pounds).....	44,917,933
Less estimated surplus.....	6,500,000
Consumption of market milk in 1937 (pounds).....	38,417,933
Daily consumption (pounds).....	105,255
Daily consumption (pints).....	97,888
Daily per capita consumption (pint).....	.630

The figure for market milk consumption in 1937 could vary more than one million pounds above ^{10/} or below the figure used with a change in per capita consumption of only .01 of a pint. It seems probable, therefore, that if there is an error in the estimate made it is within a range of .02 of a pint above or below the calculated figure.

Figures were available on the per capita consumption of milk in the 14 largest milk sales areas in the United States, all having populations of more than 500,000 in May 1934. For purposes of comparison this information is shown in Table 8, with the per capita consumption for Tulsa in 1938. Six of the cities shown have a larger daily consumption per person, while eight rank below Tulsa in per capita consumption. Low store prices in Boston and New York, and low wagon prices in Minneapolis account for the high consumption in those cities. It St. Louis low income and high milk prices caused low sales. ^{11/}

^{10/} It is not likely that consumption for 1937 was greater than $38\frac{1}{2}$ million pounds, because the amount consumed during any one month will probably be not greater than the amount produced during the lightest producing month.

^{11/} Bartlett, R. W., "St. Louis Milk Problems with Suggested Solutions". Illinois Agricultural Experiment Station Bulletin 412, April 1935, p. 99.

Per capita consumption in Tulsa is considerably above the average of .59 pint for the 15 cities used in Table 8. This can be explained mainly by the relatively large proportion of high income families in Tulsa, together with low milk prices.

A large number of persons in Tulsa are either connected with, or are in businesses directly related to oil. An industry which has paid, in the past, relatively high wages. For that reason, it seems possible that the number of better than average income families is higher than in most larger cities.

Retail prices of milk in St. Louis from January 1935 to July 1938 were usually from one to two cents higher than in Tulsa. As was pointed out previously, low incomes, together with high milk prices are responsible for St. Louis' low per capita consumption. It is probable that Tulsa milk prices are in general lower than those in most of the larger eastern cities. Even though total incomes may be higher, wages, the cost of living, and the cost of distributing milk would also be higher than in Tulsa. Prices in Tulsa were all the way from one to three cents lower than the Boston prices where per capita consumption was the greatest.^{12/}

One reason perhaps, why some of the larger cities rank higher than Tulsa in consumption is the fact that intensive educational programs have been carried on in many of those cities. Educational material in the form of leaflets and circulars, window posters, and bill board advertisements have been placed before the consumer in such a way as to popularize the use of milk. Better health is always the appeal used. Public schools have been responsible for large increases in some places

^{12/} Op. cit. p. 94.

Table 8. Daily Consumption of Milk in Tulsa in 1938 Compared To That in the Fourteen Largest Milk Sales Areas in the United States - 1934

Area	: Amount of Milk : Sold Daily : (000 of Pints)	: Population : of : Area	: Daily Consump- : tion Per Per- : son (Pint)
Tulsa (1938)	98.1	155,412	.630
Boston	1,574.2	2,052,000	.767
Mimeapolis (1933)	372.2	516,000	.721
New York	7,173.9	10,275,400	.698
Los Angeles	1,163.9	2,485,000	.650
Milwaukee	490.8	761,800	.644
Cleveland	880.2	1,385,400	.635
Philadelphia	1,594.4	2,674,100	.596
Pittsburg	802.0	1,400,800	.573
Chicago	2,674.4	4,952,700	.540
Detroit	1,161.7	2,174,000	.534
San Francisco (1932)	339.4	645,700	.526
Buffalo	282.6	586,300	.482
Baltimore	448.0	1,074,500	.428
St. Louis	551.7	1,303,100	.423

Source of data: Figures, other than for Tulsa, from Illinois Agricultural Experiment Station Bulletin 412, Table 1, p. 96, and Table 18, p. 161. Population in Tulsa from Chamber of Commerce. Daily milk sales in Tulsa from Tulsa Department of Health.

by teaching the health giving properties of milk. Much propaganda has been spread in recent years regarding the health giving properties of some products. However, in the case of milk most of the appeals made have not been propaganda. The amount of milk generally considered as the minimum for the maintenance of good health is one pint daily for adults. Nutrition authorities recommend a quart a day for growing children.^{13/} All the cities fall considerably below this standard.

It follows therefore that although per capita consumption in Tulsa is already higher than in many cities there is still a need and ample opportunity to increase consumer demand. This could most likely be done through the organized action of certain public minded groups. The line of attack should not be, however, that of advocating lower prices. As has been shown, fluid milk prices in Tulsa are probably not higher than is necessary to cover production costs. Efforts should be instead along educational lines.

^{13/} Dr. D. I. Purdy, Head of the Department of Household Science, Oklahoma Agricultural and Mechanical College, Stillwater.

SUMMARY AND CONCLUSIONS

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Tulsa draws its market milk supply mainly from within a 20 mile radius of the city. The heaviest producing sections of the milkshed lie to the north, the east, and southeast of Tulsa where production conditions are most favorable. Southwest of the city, market milk production is not heavy.

Over 90 percent of the producer-distributors are within a 15 mile radius of the city while over half the plant producers are within a 10 to 20 mile radial distance. On the average, plant producers located nearer the city are more specialized, have larger herds, and furnish a larger proportion of the total supply of milk for the pasteurizers than those plant producers living a greater distance from the city. The few producer-distributors living a greater distance than 15 miles have larger herds and furnish a more than proportionate share of the producer-distributor milk supply than those living nearer town.

Total annual production increased from less than 37 million pounds in 1935 to more than 44 million in 1937. The number of producers increased from 228 in 1935 to 240 in 1937. However, the total number of dairy cows was less in 1937 than in the previous year.

Market milk production for the Tulsa market varies greatly from season to season. It seems that producer-distributors follow breeding practices that keep their production more uniform throughout the year than do plant producers. Seasonal variation in their production is not nearly so great and the drop following the flush season in the spring is not as pronounced.

The rigid regulations of the Tulsa Health Department greatly increase the costs both of producers and pasteurizing plants. The

resulting higher price is, however, by far outweighed by the protection and freedom from disease afforded the consuming public.

From 1935 to 1938 there has been an increase in the amount of pasteurized milk distributed by pasteurizing plants and a decrease in the amount of raw milk sold by producer-distributors. This is entirely desirable from a health standpoint. In general, those retailers located in the poorer sections of town sell a large proportion of raw milk while those in the exclusive sections sell mostly pasteurized milk. Some of the stores having a high class of trade sell large amounts of pure Jersey and Homogenized milk.

Although there are nine pasteurizing plants in Tulsa, three plants handle over 60 percent of the fluid milk supply. Much of this supply is, however, surplus milk used in the manufacture of dairy products.

Most milk received by pasteurizers is brought direct to the plant by each producer. In a few cases, substantial savings have been effected through one producer bringing the milk of several others to the plant along with his own.

Indications are that Tulsa's facilities for handling fluid milk are larger than are needed at present, or will be needed for some time in the future.

Market milk prices in Tulsa are somewhat below those in the cities to which its prices were compared. Also, fluctuations were greater and more numerous than in the other cities. This is due partially to lower production costs, and the policy plants have of basing their buying prices on the price of wholesale butter. However, it seems that excessive seasonal variations and over production during certain years may be a large factor. Also, the fact that producers are unorganized, while

distribution is largely in the hands of a few large plants, might make it possible for distributors to dominate the market.

Daily per capita consumption in Tulsa is calculated to be .630 of a pint. This is somewhat above the average of .59 for that in the 14 cities to which it was compared. However, six of the cities ranked higher in consumption than did Tulsa. The high figures for those cities were attributed to extremely low prices, higher than average family incomes, or to intensive educational programs.

In Tulsa, prices are at least not too high, and the average family income is as high or higher than the average city included in the comparison. However, efforts have not been directed toward stimulating consumer demand as has been done in some of the cities where daily per capita consumption was higher.

RECOMMENDATIONS

It would seem that, although consumer demand is better than in many cities, conditions in the Tulsa milk market are rather unstable. Prices to producers are perhaps lower and more unsteady than they would be if production were more nearly adjusted to consumer demand both from season to season, and from year to year. It is possible, since the producers are largely an unorganized group, that distributors are to a certain degree able to dominate the market. Improvements in the quality of milk could be beneficial both to producers and distributors.

An organization made up of all dairymen furnishing Tulsa with fluid milk could in all probability have a stabilizing influence and bring about certain improvements in the market. Such an organization should have for its main purposes the bringing about of herd management practices among producers that would more nearly smooth out seasonal production, a closer adjustment of production to consumer demand from year to year, collective bargaining with distributors, and the improvement of the quality of milk sold to the distributor.

Substantial savings could probably be made by certain producers living in the same vicinity and delivering to the same plant through cooperative efforts in transportation.

Consumer demand in Tulsa could, possibly, be stimulated through the organized action of certain public minded groups. They should not, however, advocate lower prices. Efforts should be, instead, along educational and advertising lines. Advertising by the industry as a whole would be more effective and less expensive in the long run than would competitive advertising by individual distributors.

APPEND IX

APPENDIX

Section of the Tulsa Milk Ordinance
Dealing With the Grading of Milk and Cream

Certified Milk. Milk which conforms with the current requirements of the American Medical Milk Commissions and is produced under the supervision of the Medical Milk Commission of the Medical Society of Tulsa County, and Board of Health.

Grade "A" Raw Milk. Milk, the average bacterial count of which does not exceed 50,000 per cubic centimeter, and which is produced upon dairy farms conforming with all the specified sanitary requirements in the Ordinance. Milk must be cooled within one hour after milking to 50° Fahrenheit or less and maintained at or below that temperature until delivered.

Grade "B" Raw Milk. Milk the average bacterial count of which at no time exceeds 200,000 per cubic centimeter and which is produced on dairy farms conforming with all the items of sanitation required for Grade "A" Raw Milk, except that the cooling temperature shall be changed to 70° Fahrenheit.

Grade "C" Raw Milk. Milk, the average bacterial count of which at no time prior to delivery exceeds 1,000,000 per cubic centimeter, which is produced on dairy farms conforming with all the items of sanitation required for Grade "B" Raw Milk.

Grade "D" Raw Milk. Raw milk which does not meet the requirement of Grade "C" Raw Milk.

Grade "A" Pasteurized Milk. Milk of Grade "A", or Grade "B" quality, pasteurized, cooled, and bottled in a milk plant conforming

to all the items of sanitation specified in the Ordinance and the average bacterial count of which at no time after pasteurization and until delivery exceeds 50,000 per cubic centimeter. All milk not pasteurized within two hours after being received at the plant must be immediately cooled to a temperature of 50° Fahrenheit or less and maintained there until pasteurized.

Grade "B" Pasteurized Milk. Grade "C" Raw Milk which has been pasteurized, cooled, and bottled in a milk plant conforming with all of the requirements for Grade "A" pasteurized milk.

Grade "C" Pastuerized Milk. Pasteurized milk which does not meet the requirements of Grade "B" pasteurized milk.

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