B-1362
June 1981

The Texas Dairy Industry: Trends and Issues

The Texas A&M University System, The Texas Agricultural Experiment Station,
The Texas Agricultural Extension Service, College Station, Texas

[Blank Page in Original Bulletin]

THE TEXAS DAIRY INDUSTRY:

TRENDS AND ISSUES

Ronald D. Knutson,

Charles A. Hunter, Jr.

and

Robert B. Schwart, Jr.*

*Respectively, professor, Marketing Policy, and research associate, Agricultural Economics, the Texas Agricultural Experiment Station, and economist, Dairy-Marketing, the Texas Agricultural Extension Service, (Department of Agricultural Economics) College Station, Texas.

TABLE OF CONTENTS

THE TEXAS DAIRY INDUSTRY:

TRENDS AND ISSUES

by

Ronald D. Knutson, Charles A. Hunter, Jr., and Robert B. Schwart, Jr.

This publication surveys major economic trends and issues confronting the Texas dairy industry. It addresses production and consumption trends, production costs and returns, and trends in processing and distribution of dairy products. Policy issues are summarized in the final chapter.

TEXAS MILK PRODUCTION

Texas ranks ninth in milk production in the U.S. (Table 1). In 1979 Texas produced 3.4 billion pounds of milk -- 2.8 percent of the nation's milk production. In 1979 milk production generated $450.3 million in gross receipts for Texas dairy farmers, making it the third largest source of cash receipts among agricultural commodities, behind cattle and cotton.

Milk Production Trends

Milk production in Texas expanded by 12 percent in the past decade (Table 2). This compares with a 2 percent growth rate in the 1960s. The Texas share of United States milk production increased from 2.4 percent in the 1960s to 2.8 percent in 1972, and has remained fairly constant at 2.8 percent.

Texas milk cow numbers increased slightly from 1970 to 1973, but then declined until 1980 when an increase once again occurred (Table 3). This contrasts with a persistent decline in U.S. cow numbers.

Production Per Cow

Texas milk production per cow has made significant strides since 1960 in catching up with U.S. production per cow. From 1960 to 1979, Texas production per cow more than doubled from 5,090 pounds to 11,051 (Table 4).

The 1979 average output per cow in Texas nearly equaled the U.S. average of 11,471 pounds. Much of the credit for this increase in the output per cow is attributable to better breeding and improved management. This is illustrated by the increase in the percentage of cows under Texas Dairy Herd Improvement Association (TDHIA) testing (Table 5). The percentage of the total number of dairy cows in Texas under TDHIA testing more than doubled from 7 percent in 1970 to almost 17 percent in 1979.

Table 1. Leading states in milk production, 1979[12]

State	Production	Percent of total
	million pounds	percent
1. Wisconsin	21,950	17.8
2. California	12,549	10.2
3. New York	10,679	8.6
4. Minnesota	9,145	7.4
5. Pennsylvania	8,084	6.5
6. Michigan	4,830	3.9
7. Ohio	4,265	3.5
8. Iowa	3,920	3.2
9. TEXAS	3,437	2.8
10. Missouri	2,747	2.2
Others	42,017	33.9
United States	123,623	100.0

Table 2. Total milk production, Texas and U.S., 1960-79[11]

Year	Texas	U.S.	Texas as a percentage of U.S. production
	----------million pounds	---------	percent
1960	2,927	123,109	2.4
1965	2,973	124,180	2.4
1970	3,065	117,007	2.6
1971	3,239	118,566	2.7
1972	3,340	120,025	2.8
1973	3,280	115,491	2.8
1974	3,380	115,586	2.9
1975	3,208	115,334	2.8
1976	3,309	120,269	2.7
1977	3,372	122,698	2.7
1978	3,433	121,609	2.8
1979 1/	3,437	123,623	2.8

1/ Preliminary.

Table 3. Number of milk cows on farms, Texas and U.S., January 1, 1970-80[14]

Year	Milk cows that have calved		Percentage change from previous year	
	Texas	U.S.	Texas	U.S.
	--------1,000--------		-----percent---	
1970	354	12,091	----	----
1971	355	11,909	0.3	-1.5
1972	355	11,776	0.0	-1.1
1973	360	11,622	1.4	-1.3
1974	350	11,297	-2.7	-2.8
1975	345	11,220	-1.4	-0.7
1976	320	11,087	-7.2	-1.2
1977	318	11,035	-0.6	-0.5
1978	314	10,939	-1.3	-0.9
1979	310	10,839	-1.3	-0.9
1980[1/]	315	10,810	1.6	-0.3

[1/] Preliminary.

Table 4. Annual average production per cow, Texas and U.S., 1960-79[15]

Year	Production per cow		Texas production to U.S. production per cow
	Texas	U.S.	
	-------pounds--------		percent
1960	5,090	7,029	72.4
1965	6,930	8,305	83.4
1970	8,634	9,751	88.5
1971	9,124	10,015	91.1
1972	9,330	10,259	90.9
1973	9,239	10,119	91.3
1974	9,685	10,293	94.3
1975	9,634	10,350	93.1
1976	10,341	10,879	95.0
1977	10,705	11,181	95.7
1978	11,039	11,218	98.2
1979	11,051	11,471	96.3

Table 5. Participation in Texas Dairy Herd Improvement Association (TDHIA) testing program, 1965-79[26]

Year	Herds	Cow years	Production per cow	Percentage of total milk cows under TDHIA
	number	number	pounds	percent
1965	207	17,110	10,882	----
1970	270	26,304	12,068	7.4
1971	279	28,180	12,672	7.9
1972	283	30,154	12,553	8.4
1973	263	29,045	12,631	8.0
1974	288	32,593	12,764	9.3
1975	282	32,789	12,905	9.5
1976	307	35,713	13,364	11.1
1977	388	47,057	13,540	14.7
1978	383	46,832	13,817	14.9
1979	432	52,484	13,820	16.9

Summary

Texas dairymen have made significant progress in responding to the increased demand for milk. Total milk production has increased steadily since 1970, even though the total milking herd in the state has declined steadily over the same period. Production per cow in Texas is nearly equal to the U.S. average, much to the credit of the Texas Dairy Herd Improvement Association.

MILK CONSUMPTION

For the U.S. as a whole, the aggregate consumption of milk and its products on a milk equivalent (fat solids) basis has declined .3 percent, from 562 pounds in 1970 to 560 pounds in 1979 (Table 6). Both per capita whole milk and butter consumption declined, but lowfat milk and cheese consumption increased. The demand for ice cream has remained about constant.

Factors Influencing Consumption

Significant factors influencing the demand for milk and related products are changes in population, changes in the price of dairy products and substitutes, changes in consumer income, and changes in preferences.

Population

A population increase has had the greatest influence on the demand for milk in Texas. U.S. census population estimates for 1980 indicate that the Texas population grew 26.4 percent in the past decade. Rapid expansion in population has been an important factor in the increasingly high level of fluid utilization in Texas (Table 7). From 1971 to 1979, Texas fluid utilization increased from 72 to 81 percent. The result has been assurance of higher producer returns in Texas compared to other areas of the country where production increased faster than fluid demand.

Price

Consumers respond more to real price changes than to nominal price changes. That is, if dairy product prices increase at about the same rate that all other prices increase, one would not expect much change in consumer demand for dairy products.

Since 1960 dairy product prices, measured in an aggregate index, increased less rapidly than either the consumer price index or the price index for all food items. From 1960 to 1979 the price of all consumer goods increased by 145 percent and the price of all food increased by 166 percent, but the price of dairy products increased by only 134 percent (Table 8). Despite a substantial increase in dairy product prices, the overall price of dairy products declined relative to other prices.

There has been considerable study recently of the impact of price changes on the demand for milk and related products. Price responsiveness differs for each dairy product. Fluid milk studies generally agree that relative to a one percent change in fluid milk price, the percentage change in the quantity of fluid milk purchased is less than one percent. In economic terms, this relationship between price and quantity purchased is inelastic. For fluid milk, an average of the results of various studies renders a price elasticity estimate of about -.34.[4/]

Table 6. Trends in consumption of dairy products, U.S., 1970-79[12]

Year	Milk equivalent					Cheese		
	Fat solids basis	Calcium content basis	Fluid whole milk	Lowfat milk 2/	Butter	Whole and part skim milk 3/ American	Other	Ice Cream
	pounds per capita							
1970	562	486	214	51.3	4.4	6.8	4.4	17.9
1971	557	490	207	56.5	4.3	7.0	4.7	17.8
1972	561	479	204	62.5	4.1	7.6	5.3	17.7
1973	555	477	195	67.9	4.0	7.9	5.7	17.7
1974	544	471	184	70.9	4.3	8.4	6.0	17.8
1975	546	469	181	78.5	4.4	8.0	6.2	18.8
1976	548	486	174	83.3	4.3	8.9	6.7	18.3
1977	551	482	166	88.4	4.0	8.8	6.9	18.0
1978	558	473	161	91.7	4.1	9.4	7.5	17.9
1979 1/	560	479	157	94.8	4.2	9.6	7.9	18.1

1/ Preliminary.
2/ Includes skim milk, buttermilk, flavored milk drinks, and yogurt.
3/ Excludes cottage cheese.

Table 7. Fluid utilization in Texas milk markets compared with the nation as a whole, 1970-79[19]

Year	Texas Federal orders fluid utilization[1/]	U.S. order system fluid utilization
	------percent------	
1970	77	64
1971	72	59
1972	73	59
1973	76	61
1974	71	58
1975	73	57
1976	74	56
1977	75	53
1978	78	53
1979	81	52

1/ Includes a weighted average of the Texas Panhandle, Lubbock-Plainview and Texas orders or their resulting combinations.

Table 8. Changes in the price level for dairy products relative to the general price level and the price of all food, 1960-79[12]

Year	Consumer price	All foods	Dairy products
		1967 = 100	
1960	88.7	88.0	88.4
1965	94.5	94.4	90.0
1970	116.3	114.9	111.8
1971	121.3	118.4	115.3
1972	125.3	123.5	117.1
1973	133.1	141.5	127.9
1974	147.7	161.7	151.9
1975	161.2	175.4	156.6
1976	170.5	180.8	169.3
1977	181.5	192.2	173.9
1978	195.4	211.4	185.6
1979[1/]	217.4	234.5	207.1

1/ Preliminary.

The demand for manufactured dairy products, though still inelastic, is more responsive to price changes than the demand for fluid milk. For cheese the average value is -.67 and for butter -.75. Frozen dairy products have a price elasticity of about -.52.[4/]

The price of products that are alternatives to or substitutes for milk products can greatly affect the demand for milk products. For example, the relatively cheaper price for margarine has contributed to the declining consumption of butter. These effects will be discussed later in the chapter.

Income

Income is one of the prime factors influencing the demand for dairy products. When consumers have more purchasing power, the demand for dairy products increases. A study of the demand for fluid milk indicates that a 1 percent increase in real income results in a .2 percent increase in demand. Cheese, butter, and frozen dairy products are more income elastic than fluid milk with elasticities of .25, .32 and .33, respectively.[21/]

The vitality of the Texas economy over the last decade makes the income effect more important to the Texas dairy industry than in many other parts of the U.S. Per capita income has increased more rapidly in Texas than an average for the nation (Table 9). The rapid increase in income results primarily from a robust Texas economy. Government programs also supplement income.

The number of Texans participating in the food stamp program increased 397 percent between 1970 and 1978 with expenditures increasing by 1,691 percent. Over this period the program injected an additional $1.5 billion into the hands of low income consumers. Studies indicate that these consumers spend a larger share of increases in income on certain dairy products than average income consumers. One study found that food stamp participants spend 5.4 percent of expenditures for all food consumed at home on fluid milk while nonparticipants spend only 4.7 percent.[31/] Another study found that an increase in bonus stamps increased the demand for dairy products more than for poultry, pork, and fruit.[27/]

Another government program influencing the demand for dairy products is the school lunch program. Dairy products are the largest single commodity purchased for the program, making the dairy industry the primary beneficiary. A 1976 study found that dairy products received about 75 percent of the benefits among food items from this program.[24/] Though the demand for dairy products is increased by the school lunch program, some of the government demand simply displaces demand that would have ocurred without the program. That is, the net increase in demand is not as great as total government purchases.

Preferences

Preferences also influence per capita consumption. A basic change in preference influencing the demand for dairy products has been an increased aversion to animal fats. Regardless of the merits of the relation between animal fats and health, this is likely to continue to influence consumption in the 1980s. Consumer concerns and medical research developments could further encourage

Table 9. Per capita personal income, U.S. and Texas, 1960-78[25]

	Income per capita				Percent change in real income	
	U.S.		Texas			
Year	Nominal	Real 1/	Nominal	Real 1/	U.S.	Texas
	-------dollars-------		------dollars----		----percent-----	
1960	2,201	2,481	1,894	2,135	----	----
1965	2,750	2,910	2,363	2,501	17.3	17.1
1970	3,893	3,347	3,507	3,015	15.0	20.6
1971	4,132	3,406	3,700	3,050	1.8	1.2
1972	4,493	3,586	4,053	3,235	5.3	6.1
1973	4,981	3,742	4,525	3,400	4.4	5.1
1974	5,428	3,675	5,041	3,413	-1.8	0.4
1975	5,861	3,636	5,583	3,463	-1.1	1.5
1976	6,401	3,754	6,175	3,622	3.2	4.6
1977	7,043	3,880	6,908	3,806	3.4	5.1
1978	7,854	4,019	7,776	3,980	3.6	4.6
1979	8,773	4,035	8,788	4,042	0.4	1.6

1/ Adjusted with the consumer price index in Table 8.

the substitution of vegetable fats for animal fats in products like cheese and fluid milk or fluid milk substitutes. Research to identify and clarify any factors in animal fats that are detrimental to human health and the possible breeding, production, or processing techniques for eliminating such factors, if they exist, would appear to be particularly important to the long run health of the industry. The greatest need at this time is for visionary leadership throughout the livestock industry on this issue.

Product Demand Issues

This report does not examine the demand for individual dairy products in depth. Instead, it focuses on a few select issues concerning the major products.

Fluid Milk

Nationally, whole milk consumption has declined from 214 pounds per capita in 1970 to 157 pounds in 1979, a decrease of 57 pounds (Table 10). Lowfat milk consumption has offset a substantial part of this decline in fluid milk consumption by increasing from 51 to 95 pounds per capita, an increase of 44 pounds. The result is still a decrease in total fluid consumption of 13 pounds per capita.

Texas consumption patterns indicate a less abrupt shift in preferences from whole milk to lowfat milk. From 1970 to 1979, per capita demand for whole milk declined by only 10 pounds, while consumption of lowfat milk increased by only seven pounds. The result was a three pound decrease in per capita fluid milk consumption as opposed to a 13 pound decrease in the U.S. as a whole. This disparity in trends could reflect differences in the rate of change in preferences and could also reflect more rapid growth in per capita income in Texas than for the nation as a whole.

Butter

Butter consumption declined precipitously from 1950 to 1974. It has since leveled off at about 4.5 pounds per capita (Table 11). It is important to note that while butter demand has declined, total per capita fat consumption has increased. This indicates that Americans are not averse to all fats, they are just substituting vegetable for animal fats.

Cheese

Increased cheese consumption has been a major bright spot for the dairy industry. From 1970 to 1979, per capita consumption of cheese has increased 56 percent from 11.2 to 17.5 pounds (Table 6.) Cheese fits well into the snack, fast-food, and away-from-home orientation of today's consumers.

Table 10. Per capita consumption of whole and lowfat milk, Texas[1/] and U.S., 1970-79[13]

Year	Whole milk		Lowfat milk		Total fluid milk	
	Texas	U.S.	Texas	U.S.	Texas	U.S.
	pounds per capita					
1970	184	214	49	51	233	265
1971	184	207	51	57	235	264
1972	187	204	52	63	239	267
1973	182	195	54	68	236	263
1974	174	184	56	71	230	255
1975	171	181	57	79	228	260
1976	173	174	56	83	229	257
1977	173	166	57	88	230	254
1978	172	161	55	92	227	253
1979	174	157	56	95	230	252

1/ Texas per capita data were determined by dividing total sales by total population in the Texas market order.

Table 11. Changes in consumer preferences for animal and vegetable sources of fats and oils by product, 1970-79[1/]

Year	Total food fats and oil consumption[1/]	Butter	Margarine[2/]	Lard	Vegetable Oils	Others
	pounds per capita					
1970	53.0	5.3	11.0	4.7	15.5	19.7
1971	52.2	5.1	11.1	4.3	15.7	19.1
1972	54.3	4.9	11.3	3.8	17.0	20.5
1973	54.3	4.8	11.3	3.4	18.0	20.1
1974	53.2	4.6	11.3	3.2	18.4	18.9
1975	53.4	4.8	11.2	3.0	18.2	19.4
1976	56.0	4.4	12.2	2.7	19.9	20.2
1977	54.0	4.3	11.6	2.3	19.4	19.4
1978	55.6	4.5	11.4	2.2	20.5	20.3
1979	57.7	4.6	11.5	2.6	21.4	20.6

1/ Fat and oil consumption in individual categories does not sum to total consumption due to components in butter and margarine which are not fat or oil.

2/ Vegetable oils constitute about 96 percent of the fats and oils used in margarine.

The greatest threat to continued increases in cheese consumption is posed by imitation products. Evaluation of more progressive strategies utilizing combinations of non-dairy ingredients with skim milk might be an alternative.

Concluding Remarks on Consumption

Consumption of dairy products in the country declined about .3 percent from 1970 to 1979. The decline was mostly in the consumption of fluid whole milk. Part of the decline was partially offset by an increase in lowfat milk consumption. For all fluid milk, whole and lowfat, Texas consumption dropped by only three pounds from 1970 to 1979 compared to a 13 pound decrease in the U.S. as a whole. Butter consumption in the U.S. as a whole has stabilized at about 4.5 pounds per capita, but cheese consumption increased 6.3 pounds per capita.

Population, prices, income, and tastes are important factors influencing per capita consumption. Population growth has been great in Texas over the past decade and will continue to increase. Dairy product prices have increased at a slower rate than all consumer prices and all food prices. Real income in Texas increased more rapidly than the national average. Basic tastes seem to be changing with consumers switching from animal to vegetable fats.

Overall the outlook for consumption of dairy products and continued growth of the Texas dairy industry appears bright. Progressive leadership will, however, be required in dealing with some of the trouble spots. These issues will likely be resolved on a national basis. Hopefully, Texas will be in a leadership position in pointing the appropriate direction for change.

COSTS OF PRODUCTION, PRICES, AND RETURNS

This chapter discusses average producer costs and returns from producing milk in Texas. The discussion is based upon the USDA cost of production studies authorized in the 1973 farm bill. The USDA cost data is not without controversy, but it does provide a basis for comparing Texas and U.S. costs and returns. The breakdown of these costs provides an indication of unique aspects of the Texas dairy industry and its competitive position in the U.S. dairy industry.

One of the shortcomings of Texas cost data is that it is available for only one major production region. The study area, in Central and Northeast Texas, covers the following counties: Comanche, Cooke, Erath, Franklin, Hopkins, Johnson, Parker, Tarrant, Wise, and Wood (Figure 1). In 1979 these counties produced 47 percent of Texas milk production. While these costs provide an indication of the relative status of the Texas dairy industry, they are not necessarily representative of any other production region in Texas. Also, as an average, there could be wide variation in costs from farm to farm within the region covered.

Total Milk Production Costs

USDA cost of production studies break down total costs into direct and indirect costs. Direct costs are those that are associated with the daily operation of a dairy farm. They are basically out-of-pocket or variable expenses. As output increases these costs will also tend to increase. Direct costs are feed, hired labor, machinery and equipment repairs, energy, interest on operating capital, veterinary expenses, artificial insemination, milk hauling, and other miscellaneous expenses. Texas direct costs in 1980 are expected to be about 40 percent higher than for the nation as a whole (Table 12). This is primarily due to the larger amount of nonfamily labor employed and the higher cost of feed. From 1977 to 1980, Texas direct costs have risen 17 percent while nationally direct costs have risen only 8 percent. A larger increase in the price of feed in Texas reflects most of this difference.

Indirect costs are largely fixed costs. They include replacement reserves, taxes, insurance, interest on fixed investments, operator and family labor, and management. Indirect costs for Texas are about 70 cents per hundredweight less than U.S. costs even though these costs increased by 70 percent from 1977 to 1980 for Texas and by 54 percent for the U.S.

Income to the dairy farmers comes in two forms -- from milk produced and from livestock sold. Income in Texas from dairy livestock sold is approximately the same as for the entire nation. The doubling of income from livestock sales during the 1977 to 1980 period reflects increased beef and replacement dairy stock prices. Producer milk prices in Texas are higher than the national average. Despite the higher milk prices, Table 12 reveals that net income per hundredweight of milk in Texas is substantially less than the U.S. average.

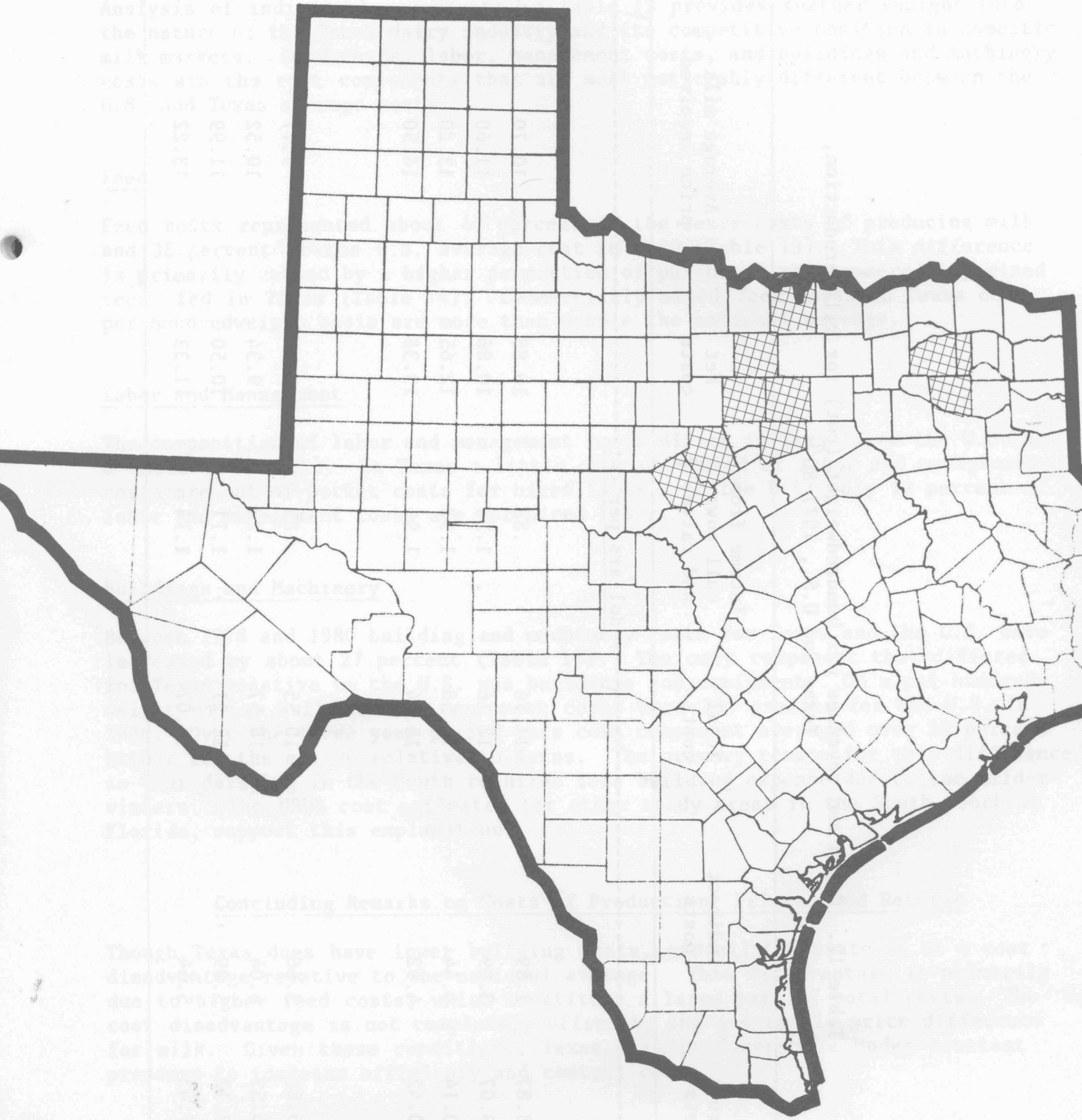


Figure 1. The USDA cost of production study included Cooke, Wise, Parker, Tarrant, Johnson, Erath, Comanche, Wood, Hopkins, and Franklin Counties.

Table 12. Costs and revenues per hundredweight (cwt) for milk production, Texas and U.S., 1977-80[7]

Year	Direct costs	Indirect costs	Total costs	Income from cull cows and calves	Net costs	Average milk price received	Net income
	dollars per cwt						
Texas							
1977	8.87	2.89	11.76	.88	10.88	10.70	- .18
1978	9.07	3.09	12.16	1.30	10.86	11.60	.74
1979	10.14	4.44	14.58	1.93	12.65	13.20	.55
1980	10.42	4.92	15.34	1.96	13.38	14.50	1.22
U.S.							
1977	6.89	3.66	10.55	.85	9.70	9.77	.07
1978	6.53	4.04	10.57	1.23	9.34	10.52	1.18
1979	7.12	5.09	12.21	1.71	10.50	11.99	1.49
1980	7.43	5.64	13.07	1.74	11.33	13.22	1.89

Cost Components

Analysis of individual components in Table 13 provides further insight into the nature of the Texas dairy industry and its competitive position in domestic milk markets. Feed costs, labor, management costs, and buildings and machinery costs are the cost components that are most noticeably different between the U.S. and Texas average costs.

Feed

Feed costs represented about 47 percent of the Texas costs of producing milk and 38 percent of the U.S. average cost in 1980 (Table 13). This difference is primarily caused by a higher proportion of purchased and commercially mixed feeds fed in Texas (Table 14). Commercially mixed feed costs in Texas on a per hundredweight basis are more than double the national average.

Labor and Management

The composition of labor and management costs differ in Texas from the U.S. as a whole (Table 15). In Texas a little over one-third of labor and management costs are out-of-pocket costs for hired labor. In the U.S. only 12 percent of labor and management costs are for hired labor.

Buildings and Machinery

Between 1978 and 1980 building and machinery costs for Texas and the U.S. have increased by about 27 percent (Table 16). The only component that differed for Texas relative to the U.S. was buildings and equipment. On a per hundredweight basis, building and equipment costs were 29¢ greater for the U.S. in 1980. Over the three year period this cost component averaged over 30 percent higher for the nation relative to Texas. The primary reason for this difference is that dairying in the South requires less building expense due to the milder winters. The USDA cost estimates for other study areas in the South, such as Florida, support this explanation.

Concluding Remarks on Costs of Production, Prices, and Returns

Though Texas does have lower building costs, overall the state is at a cost disadvantage relative to the national average. This disadvantage is primarily due to higher feed costs, which constitute a large part of total costs. The cost disadvantage is not completely offset by the geographic price difference for milk. Given these conditions, Texas milk producers are under constant pressure to increase efficiency and control costs.

Table 13. Costs per hundredweight (cwt) of producing milk by components, Texas and U.S., 1977-80

Cost component and year	Costs: Texas	Costs: U.S.	Percentage of total costs: Texas	Percentage of total costs: U.S.
	--------$/cwt--------		--------percent-------	
Feed:				
1977	6.41	5.07	54.5	48.1
1978	6.53	4.62	53.7	43.7
1979	7.24	4.95	49.7	40.5
1980	7.14	4.97	46.5	38.0
Hired labor, operator and family labor, management:				
1977	2.41	2.48	20.5	23.5
1978	2.45	2.57	20.1	24.3
1979	2.79	2.83	19.1	23.2
1980	2.98	3.02	19.4	23.1
Buildings and equipment, machinery, machinery repairs, overhead:				
1977	.96	1.23	8.2	11.7
1978	1.00	1.30	8.2	12.3
1979	1.14	1.49	7.8	12.2
1980	1.27	1.67	8.3	12.6
Livestock:				
1977	.70	.63	5.9	6.0
1978	.85	.89	7.0	8.4
1979	1.82	1.53	12.5	12.5
1980	2.07	1.75	13.5	13.4
Veterinary and medicine, artificial insemination, milk hauling, miscellaneous expenses:				
1977	.86	.69	7.3	6.5
1978	.89	.71	7.3	6.7
1979	1.02	.81	7.0	6.6
1980	1.18	.93	7.7	7.1
Energy:				
1977	.23	.24	2.0	2.3
1978	.23	.25	1.9	2.4
1979	.29	.30	2.0	2.5
1980	.38	.39	2.5	3.0
Interest and taxes:				
1977	.19	.21	1.6	2.0
1978	.21	.23	1.7	2.2
1979	.28	.30	1.9	2.5
1980	.32	.36	2.1	2.8

Table 14. Feed costs per hundredweight (cwt) of milk, Texas and U.S., 1978-80[6]

Year and cost component	Costs: Texas	Costs: U.S.	Percentage of total feed costs: Texas	Percentage of total feed costs: U.S.
	$/cwt		percent	
1978				
Grains	.90	.87	14	19
Commercially mixed feeds	3.82	1.56	58	34
Silage	.06	1.05	1	22
Hay	1.44	1.01	22	22
Pasture and miscellaneous forages	.31	.13	5	3
	6.53	4.62	100	100
1979				
Grains	.98	.99	13	20
Commercially mixed feeds	4.36	1.78	60	36
Silage	.07	1.01	1	20
Hay	1.50	1.04	21	21
Pasture and miscellaneous forages	.33	.13	5	3
	7.24	4.95	100	100
1980				
Grains	.96	.96	13	19
Commercially mixed feeds	4.18	1.72	59	35
Silage	.07	1.06	1	21
Hay	1.59	1.09	22	22
Pasture and miscellaneous forages	.34	.14	5	3
	7.14	4.97	100	100

Table 15. Management, operator and family labor, and hired labor costs per hundredweight (cwt) of milk, Texas and U.S., 1978-80[a]

Year and cost component	Costs		Percentage of total management and labor costs	
	Texas	U.S.	Texas	U.S.
	---------$/cwt---------		---------percent---------	
1978				
Management	.80	.69	33	27
Operator and family labor	.81	1.57	33	61
Hired labor	.84	.31	34	12
	2.45	2.58	100	100
1979				
Management	.95	.80	34	28
Operator and family labor	.90	1.70	32	60
Hired labor	.94	.33	34	12
	2.79	2.83	100	100
1980				
Management	1.00	.86	33	28
Operator and family labor	.97	1.81	33	60
Hired labor	1.01	.35	34	12
	2.98	3.02	100	100

Table 16. Machinery, machinery and equipment repairs, buildings and equipment, and overhead costs per hundredweight (cwt) of milk, Texas and U.S., 1978-80[6]

Year and cost component	Costs: Texas	Costs: U.S.	Percentage of total machinery, etc., costs: Texas	Percentage of total machinery, etc., costs: U.S.
	----------$/cwt----------		----------percent----------	
1978				
Machinery	.12	.11	12	8
Machinery and equipment repairs	.12	.16	12	12
Buildings and equipment	.40	.63	40	49
Overhead	.36	.40	36	31
	1.14	1.30	100	100
1979				
Machinery	.14	.13	12	8
Machinery and equipment repairs	.13	.18	12	12
Buildings and equipment	.49	.74	43	50
Overhead	.38	.44	33	30
	1.14	1.49	100	100
1980				
Machinery	.16	.14	13	8
Machinery and equipment repairs	.14	.19	11	12
Buildings and equipment	.56	.85	44	52
Overhead	.41	.47	32	28
	1.27	1.65	100	100

TRENDS IN MILK PRODUCTION AND FARM STRUCTURE

As in agriculture as a whole, the trend is toward fewer but larger operations. Dairy farms having more than 200 milk cows are typical of the West where farms with more than 500 cows might appropriately be considered large. In the Upper Midwest, farms with more than 200 milk cows are relatively uncommon.

In Texas, dairy farm size varies substantially. In 1974 over 98 percent of the dairy cows in El Paso County were located on farms having more than 100 cows. In Hopkins County, only 53 percent of the dairy cows were on farms with more than 100 cows. While the trend toward fewer but larger farms is apparent, it is not clear how far and how fast this trend is proceeding.

Aggregate Trends

The total number of dairy farms in Texas with more than $2,500 in sales declined 43 percent from 4,821 farms in 1964 to 2,767 in 1974, the last year for which census data are available. The decline was most pronounced in the period 1969 to 1974 when the number of farms declined from 4,126 to 2,767, a 33 percent reduction. Nationally, dairy farms declined 44 percent, from 349,244 farms in 1964 to 196,057 in 1974.

The Census of Agriculture provides data on the number of milk cows on farms with over $2,500 in sales. Data for farms with as many as 100 cows and more are presented for the U.S. and Texas in Tables 17 and 18. These data indicate that for the U.S., farms with more than 50 milk cows have increased in number while farms with less than 50 cows have declined. The greatest percentage increase occurred in farms having more than 100 cows.

For Texas, an increase in farms with milk cows occurred only in herds with more than 100 cows. Farms with 50 to 99 cows declined by 43 percent between 1964 and 1974, while smaller size farms experienced an even greater decline.

These trends indicate that for the U.S., farms having more than 50 cows have the best chance of survival, but for Texas it takes larger farms with more than 100 cows. It is important to note that for the U.S. as well as for Texas, the data indicate a continuing trend toward larger scale farms. Data for 1974, for example, indicate that there were 661 farms in the U.S. with more than 500 milk cows; of these, 30 were located in Texas.

Factors Influencing Trends

The trend toward fewer but larger dairy farms is influenced by a number of factors. The relative importance of these factors appears to differ geographically. Specifically, the trend toward large scale dairy farming has progressed further in the South and West. A recent study by Matulich found that of the dairy herds having 200 or more cows in 1974, 51 percent were located in the West and 31 percent in the South.[22]

Table 17. Farms with sales of $2,500 and over, U.S., 1964, 1969 and 1974[2]

Year	Milk cows on farms:	1 to 19	20 to 49	50 to 99	100 and over	Total
1964	Number of farms	473,936	214,655	37,345	8,697	734,633
1969	Number of farms	247,312	157,334	38,467	9,854[1/]	452,967
1974	Number of farms	153,276	118,618	46,128	14,348[2/]	332,370

1/ In 1969 there were 7,368 farms with herds of 100 to 199 cows and 2,486 farms with herds of 200 cows and over.

2/ In 1974 there were 10,726 farms with herds of 100 to 199 cows, 2,961 farms with herds of 200 to 499 cows and 661 farms with herds of 500 cows and over.

Table 18. Farms with sales of $2,500 and over, Texas 1964, 1969 and 1974[2]

Year	Milk cows on farms:	1 to 19	20 to 49	50 to 99	100 and over	Total
1964	Number of farms	16,205	1,878	2,005	679	20,767
1969	Number of farms	10,348	1,265	1,586	781[1/]	13,980
1974	Number of farms	6,031	623	1,133	912[2/]	8,699

1/ In 1969 there were 613 farms with herds of 100 to 199 cows and 168 farms with herds of 200 cows and over.

2/ In 1974 there were 692 farms with herds of 100 to 199 cows, 190 farms with herds of 200 to 499 cows and 30 farms with herds of 500 cows and over.

Regional differences in the growth of dairy farms suggest the three primary factors influencing the trend toward fewer and larger farms are 1) economies of size and limits of growth, 2) weather, and 3) degree of dependence on family labor.

Weather

The California study area had the benefit of nearly ideal weather conditions for milk production. Low rainfall, low humidity, and warm temperatures are associated with 1) less investment in facilities and equipment, 2) fewer herd health problems, 3) less energy expense for maintenance of animal body temperature, and 4) less labor for herd care. The California study area is supplied with irrigation water and has fair soils for production of roughages.

These conditions are duplicated in few parts of the country. More rainfall, higher humidity, colder temperatures, and poorer soil, or soil moisture conditions, limit the extent of the economies associated with large scale dairying. Yet these limits are more relative than absolute. For example, large scale dairying is common in the Pacific Northwest where the disadvantage of higher rainfall in some areas is offset by nearly ideal roughage production conditions. Also, in several milk producing counties of Texas, the number of herds with more than 500 milk cows is increasing despite less favorable soil conditions or limited access to low cost irrigation water.

Family Labor

The role of the farm family as a component of the milk production process differs substantially on a regional basis. In the Upper Midwest and Northeast, milk production is typically a family enterprise. As a family enterprise, the husband plays the dual role of manager and laborer; the wife keeps the books and sees that the milk meets health and cleanliness standards; and the children supply much of the labor.

In the South and West, this family relationship to the dairy enterprise is becoming less common. More of the husband's time is spent as a business manager, a supervisor of hired farm labor, and a procurement specialist for purchased inputs. In such situations, the wife is less frequently involved in the day-to-day milk production operations. Also, hired labor is substituted for the labor of the children in the farm operation.

Such changes are, in part, associated with the increasing size and complexity of dairy enterprises. As size and complexity increases, the demands on management multiply. Opportunities for specialization increase with size, making it possible to substitute hired labor, to increase mechanization, and to use outside services, such as accounting, for functions traditionally performed by the wife and children.

It is interesting to note that the USDA has traditionally defined a family farm as one where the farm family including the husband, wife, and children supply over half of the labor used in the farm operation. Specifically, the USDA suggests that a farm with over 1.5 man years of hired labor does not qualify as a family farm. We do not know how many dairy farms in Texas would meet this criterion. We suspect that, using this definition, well over half of the milk production in Texas is not produced on a family farm. As dairy enterprises are released from constraints associated with the availability of family labor, we suspect there exists a greater tendency to grow in size. If this is true, the process of industrialization of milk production should accelerate with reductions in its dependence on the farm family.

Economies of Size and Limits on Growth

In dairying, economies of size come in two primary forms: technical economies and input economies. Technical economies arise from the relationship between size and efficiency of production. Input economies are available to farms that can purchase inputs in quantities that offer lower costs per unit.

The California study by Matulich suggests that under ideal weather and highly industrialized conditions, cost of production tends to fall up to herd sizes of at least 1,200 cows. The most pronounced reductions in cost occur up to about 750 cows. Beyond this herd size, cost per hundredweight begins to level out.

Technical economies of the magnitude indicated by Matulich arise from a number of sources. Investments required in dairy farming increase as size increases, but not proportionately. A 200 cow dairy does not require twice the investment of a 100 cow dairy. Likewise, a large dairy farm will support a better manager and more specialized labor. In essence, large dairy farms utilize the existing supply of labor and management more efficiently. There is a tendency for larger dairy farms to specialize more in milk production as opposed to crop production. Least cost feed formulation procedures are more common on larger dairy farms.

Less is known about the precise magnitude of input economies, but opportunities which reduce costs of inputs, such as larger volume purchases of feed, are apparent.

The limits to growth are not well defined and are constantly being pushed to higher levels by producers, equipment manufacturers, veterinarians, breeders, animal scientists, and management specialists.

Economic theory suggests that while the size of a dairy farm increases, costs of production per hundredweight tend to decline, but at some size, costs begin to rise. Available studies, several of which have been conducted in the past 5 years, suggest that substantial variation exists in the size at which that limit is reached. The California study mentioned earlier suggests that significant economies of size are recognized in herds of 375 to 1,200 cows. By analyzing milking, feeding, and housing systems in the Chino Valley, the study determined that over 60 percent of the decline in average cost per cow occurred in herd expansion from 375 to 450 cows. For 375 cow herds, the average annual cost was $1,056 per cow. For 450 cow herds, the average was $1,015. Herds of 750 cows had costs of $999, declining slightly to $990 for herds of 1,200 cows. The study did not find a general upswing in costs per cow.

In contrast, a study of dairy farms operating in New York did not find large herds so clearly associated with lower production costs.[23] Large herds of over 200 cows were much less common in New York than in California, with herds of 50 to 99 cows most prevalent. The study found labor costs per cow were lowest for herds of 55 to 65 cows. Machinery costs were lowest for herds of 70 to 99 cows. Feed costs, the primary component of total costs, were lowest for herds with less than 55 cows. Overall, the study found no strong indication of economies or diseconomies of scale associated with herd size.

The New York study indicated important constraints to growth as seen by producers. One constraint concerned land. Dairy farmers in that area of the country typically produce most of the roughage they feed to their herds. With land costs higher than in some other areas of the country, expansion would incur higher average costs. Waste disposal is another problem of expansion. The cold climate makes disposal difficult, and herd expansion could exacerbate the problem.

Another study of Arkansas dairy farms looked at costs relative to herd size.[1/] Herds were categorized as small if herd size was less than 50 cows, medium if herd size was 50 to 99 cows, and large if herd size was over 100 cows. Average costs per hundredweight of milk produced was lowest for the medium herd size with average costs for large herds only slightly higher. Small herds had considerably higher average costs than the other two categories. In terms of costs per cow, large herds had the lowest average costs, but the differences between the three categories was slight. As in New York, Arkansas producers raise most of the roughage they feed. Because of this practice larger herd sizes are not strongly associated with significant reductions in per unit average costs.

The environment for and techniques of milk production in Texas could be classified somewhere between the Arkansas or New York type of operation and the California type of operation. Inclement weather is not a limitation on growth as in New York. To an individual producer in Texas, the most important limitations on growth are management, capital availability, and willingness to become purchased-inputs oriented.

Quality management is probably the scarcest resource in the world. Large variation exists in the size of operation individuals can manage. When that size limit is exceeded, serious problems result. A farmer is better off limiting expansion of his dairy operation to a size that he or she can comfortably manage.

In many respects the capital availability limit is self-explanatory. For a profitable dairy operation it is less of a constraint as the number of years of successful operation increases and thus the equity base expands. It is important to recognize that recent increases in the cost of borrowed capital require a higher rate of return from milk production than has been typical in the past. Higher borrowing costs may decrease the relative profitability of dairying in years to come.

The willingness to become purchased-inputs oriented is not as much of a factor in Texas as in other parts of the country. Yet it is still important and there are some producers who insist that they need to grow all, or nearly all, of their feed inputs. Such a position may place a limit on expansion of the size of the dairy herd.

County Trends in Milk Production and Farm Structure

As indicated previously, milk production in Texas is highly concentrated in certain areas of the state. Seven counties were selected to illustrate differences and trends in milk production and farm structure. The counties include Hopkins, Erath, Grimes, Bexar, Jim Wells, El Paso, and Randall (Figure 2). These counties accounted for 32 percent of Texas milk production in 1979.

Hopkins County

Hopkins County is located 80 miles northeast of Dallas. For many years this county has been the leading producer of milk in the state, contributing around 15 percent of total production. Milk production in the county was 540 million pounds in 1979, and the number of milk cows at the beginning of 1979 was around 47,800 (Table 19). Though the use of these numbers leads to a crude estimate of production per cow, the estimates are helpful for comparison. Average production per cow was 11,297 pounds for the county compared with the Texas average of 11,051 pounds and the national average of 11,471 pounds.

Hopkins County milk production has increased 63 percent since 1970. An interruption in growth in 1975 was followed by a sharp recovery in milk production the following year. Most of the farms with milk cows in Hopkins County have over 50 cows (Table 20). Farms with less than 100 cows are decreasing in number. Those with over 100 cows are increasing. In 1974 there were 10 farms in Hopkins County with 200-499 cows and five farms with over 500 cows. In that year the average herd size in the county was 105 milk cows. This average is estimated to have grown to 110 milk cows in 1979. Herd numbers have expanded since 1974 to about 490 in 1979.

In 1974, Hopkins County ranked 31st nationally for the value of dairy products sold from farms with sales of $2,500 and over. In 1969 the county ranked 42nd nationally. Milk sales in the county amounted to roughly $60 million in 1979 with total dairy influence estimated at $100 million.

The county has an annual rainfall of about 45 inches with drainage flowing northward to the South Sulfur River. The soils are generally sandy to sandy loam with some heavy soils offering good conditions for crop growth and a 238 day growing season.

Hopkins County has aggressively developed a community infrastructure to support milk production and marketing, including facilities to process milk not needed in fluid markets. There are organizations offering feed manufacturing, dairy equipment, credit, veterinarian and breeding services, and Extension education services. Dairying in Hopkins County appears to have a bright future.

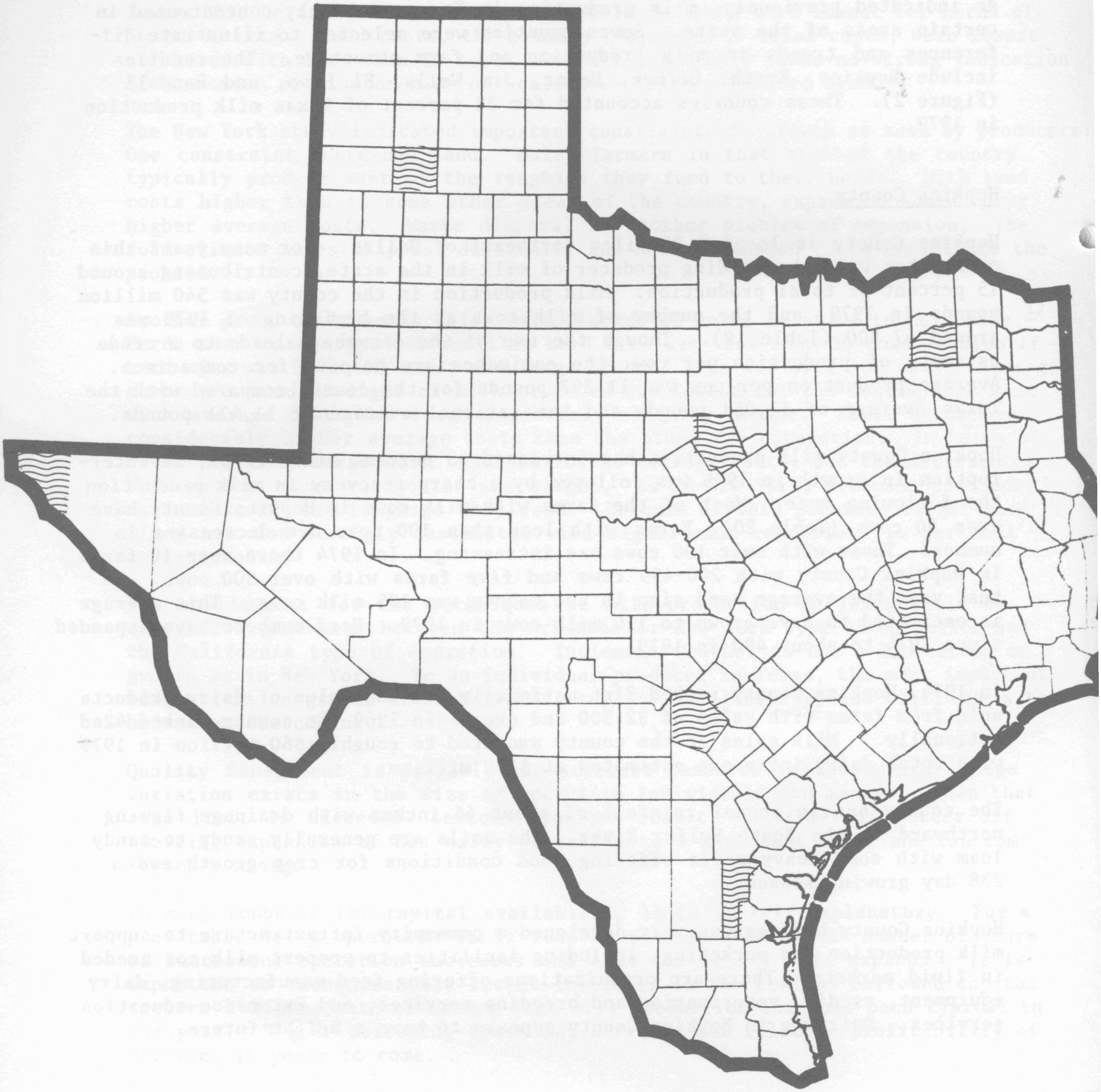


Figure 2. Seven counties -- Hopkins, Erath, Grimes, Bexar, Jim Wells, El Paso, and Randall -- selected for illustration.

Table 19. Milk cows and production, Hopkins County, Texas, 1970-79[28]

Year	Milk cows that have calved	Milk production
	number[1/]	million pounds
1970	36,600	331.1
1971	37,700	407.1
1972	38,700	457.5
1973	43,200	459.3
1974	43,700	498.0
1975	48,000	460.0
1976	40,000	496.0
1977	42,000	538.0
1978	48,000	514.0
1979	47,800	540.0

1/ Number on January 1.

Table 20. Farm size by milk cow numbers, Hopkins County, Texas, 1969 and 1974[1/3]

Year	Farms with:	1 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 and over	Total
1969	Number of farms	47	95	242	83[2/]	---	---	467
1974	Number of farms	19	57	212	113	10	4	415

[1/]Farms with sales of $2,500 and over.

[2/]100 cows and over.

Erath County

Erath County, located in North Central Texas, is the second largest milk producing county in Texas. Its total milk production in 1979 was 323 million pounds, 9 percent of the state total. With 22,000 milk cows in Erath County, the average milk production per cow was among the highest in Texas at 14,682 pounds (Table 21).

In 1974, Erath County had 192 farms, down from 263 in 1969. Like Hopkins County, the number of farms having less than 100 cows decreased while the number of farms having over 100 cows increased (Table 22). In 1974, Erath County had two farms with over 500 cows and 12 farms with 200 to 499 cows. The average herd size per farm was 83 cows.

Erath County is much more hilly than Hopkins County. Annual rainfall is approximately 31 inches, allowing producers to use both dry lots and pasture to maintain their herds. The county is characterized by both clay loam and sandy loam soils.

Like Hopkins County, there is a great deal of support for agriculture from local business. Lending institutions cater to the agricultural sector with a particular emphasis on dairying. Also, the availability of locally grown feed promotes milk production. The 130 percent growth in milk production since 1970 reflects the dedication of the entire community to dairying.

El Paso County

Production from El Paso County's 5,000 milk cows totaled 84 million pounds in 1979, accounting for about 2.5 percent of the state total (Table 23). The average production per cow was 16,800 pounds, substantially above both the state and national averages.

Production methods in El Paso County resemble large scale operations in certain areas of California. In 1974 there were 20 farms with 6,200 milk cows (Table 24). This results in an average herd size of about 310. There were four farms with 100 to 199 cows and four farms with over 500 cows. These highly industrialized farms purchase the majority of their feed inputs. Still, both milk production and farms have declined over time.

Declining milk production in El Paso County suggests that an increasing proportion of El Paso's milk supply is coming from neighboring counties in New Mexico. In fact, the number of milk cows on farms in Dona Ana County, New Mexico, rose steadily from 3,600 on January 1, 1970, to 8,600 on January 1, 1980.

The growing number of producers in New Mexico may be partially explained by the financing arrangements some of these producers have with lending institutions. Some producers are moving just across the state line to take advantage of financing from California lenders. These lenders use revolving credit financing similiar to credit card financing. Though an upper limit is set on credit availability, dairymen can use the credit as needed, accruing interest on the money as it is used. The use of these credit terms indicates that producers find it advantagous despite the fact that the lender can hold a lien on

Table 21. Milk cows and production, Erath County, Texas, 1970-79[28]

Year	Milk cows that have calved	Milk production
	number[1/]	million pounds
1970	14,500	140.3
1971	14,000	161.0
1972	16,500	155.6
1973	15,900	164.9
1974	16,000	231.0
1975	21,400	229.0
1976	21,000	267.0
1977	20,000	297.0
1978	24,000	315.0
1979	22,000	323.0

1/ Number on January 1.

Table 22. Farm size by milk cow numbers, Erath County, Texas, 1969 and 1974[1/3]

Year	Farms with:	1 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 and over	Total
1969	Number of farms	106	35	90	32[2/]	---	---	263
1974	Number of farms	71	14	54	39	12	2	192

[1/] Farms with sales of $2,500 and over.

[2/] 100 cows and over.

Table 23. Milk cows and production, El Paso County, Texas, 1970-79[28]

Year	Milk cows that have calved	Milk production
	number[1/]	million pounds
1970	6,750	90.8
1971	7,600	84.4
1972	6,300	82.1
1973	6,300	65.2
1974	6,200	67.5
1975	6,600	73.2
1976	5,700	74.3
1977	5,700	74.6
1978	5,400	79.4
1979	5,000	84.0

[1/]Number on January 1.

Table 24. Farm size by milk cow numbers, El Paso County, Texas, 1969 and 1974[1/3]

Year	Farms with:	1 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 and over	Total
1969	Number of farms	13	2	0	10[2/]	---	---	25
1974	Number of farms	9	0	3	4	0	4	20

[1/] Farms with sales of $2,500 and over.

[2/] 100 cows and over.

the entire dairy operation. Texas usury and homestead laws have been given as reasons for seeking credit outside Texas. Another reason for the decline in milk production and farms in El Paso County is urbanization.

Jim Wells County

Jim Wells County is located in South Texas. Though milk production is relatively low, the county is the leading producer in the southern semi-tropical section of the state. Milk production in 1979 was 27 million pounds, less than one percent of the state total (Table 25). The number of milk cows in 1979 was 5,100. This yields an annual average milk production of only 5,300 pounds per cow. This average is down from the 1970 level which could be explained by the growth in importance of Jersey herds in the county.

Most milk produced in Jim Wells County moves to plants in Corpus Christi and the Rio Grande Valley. Total milk production increased from 1970 to 1972 and then persistently declined by 55 percent through 1979. A larger percentage of the dairy farms in Jim Wells County have over 100 milk cows than is typical of most counties in Texas (Table 26). In fact, the structure resembles that of El Paso County. Considering this structure, future milk production is dependen on the ability of these larger farms to operate efficiently and earn a profit at prevailing prices.

Grimes County

Grimes County, located in southeastern Texas, is the state's eighth largest milk producing county -- down from fourth in 1970. Its production in 1979 was 75.2 million pounds from 9,800 cows (Table 27). This yields an output per cow of only 7,673 pounds, substantially below the state and national average. Growth in Grimes County milk production up to 1973 has been followed by a persistent decline. The number of farms declined 22 percent between 1969 and 1974 (Table 28).

Grimes County agriculture benefits from the rich soils along the Brazos and Navasota Rivers combined with adjacent rolling grasslands. Its average annual rainfall of 41 inches results in abundant forage production. The county also benefits from its proximity to the rapidly growing metropolitan area of Housto

These advantages should assist in the expansion of the Grimes County dairy industry. However, competition from other agricultural and industrial enterprises, including oil and coal development, appears to be having an opposite and overriding effect. Future development of the Houston metropolitan area may also discourage agricultural development.

Bexar County

Bexar County produced 40 million pounds of milk in 1979, around one percent of the state total. With 4,800 milk cows, the average production per cow is 8,333 pounds (Table 29). A persistent decline in milk production has occurred in Bexar County with milk production in 1979 half of what it was 10 years earlier. This decline in milk production has been accompanied by a reduction in farms of all sizes up to 200 cows (Table 30).

Table 25. Milk cows and production, Jim Wells County, Texas, 1970-79[28]

Year	Milk cows that have calved	Milk production
	number[1/]	million pounds
1970	7,450	48.1
1971	7,400	49.8
1972	7,300	60.5
1973	7,400	47.7
1974	6,800	39.0
1975	5,500	38.5
1976	5,000	31.0
1977	5,000	29.3
1978	4,800	28.7
1979	5,100	27.0

1/ Number on January 1.

Table 26. Farm size by milk cow numbers, Jim Wells County, Texas, 1969 and 1974[1/]

Year	Farms with:	1 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 and over	Total
1969	Number of farms	23	8	10	15[2/]	---	---	56
1974	Number of farms	13	2	7	9	3	2	36

[1/] Farms with sales of $2,500 and over.

[2/] 100 cows and over.

Table 27. Milk cows and production, Grimes County, Texas, 1970-79[28]

Year	Milk cows that have calved	Milk production
	number[1/]	million pounds
1970	8,000	77.8
1971	9,200	95.7
1972	10,200	112.7
1973	11,500	83.2
1974	10,500	94.0
1975	10,200	89.0
1976	10,200	97.2
1977	10,700	93.5
1978	9,900	85.1
1979	9,800	75.2

[1/]Number on January 1.

Table 28. Farm size by milk cow numbers, Grimes County, Texas, 1969 and 1974[1/]

Year	Farms with:	1 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 and over	Total
1969	Number of farms	44	28	46	26[2/]	---	---	144
1974	Number of farms	24	25	34	23	6	1	113

[1/]Farms with sales of $2,500 and over.

[2/]100 cows and over.

Table 29. Milk cows and production, Bexar County, Texas, 1970-79[28]

Year	Milk cows that have calved	Milk production
	number[1/]	million pounds
1970	8,800	80.3
1971	8,700	83.5
1972	8,000	74.7
1973	6,900	51.5
1974	6,700	57.4
1975	6,600	54.4
1976	6,200	52.5
1977	6,100	46.5
1978	5,200	48.0
1979	4,800	40.0

[1/] Number on January 1.

Table 30. Farm size by milk cow numbers, Bexar County, Texas, 1969 and 1974[1/3]

Year	Farms with:	1 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 and over	Total
1969	Number of farms	84	28	29	25[2/]	---	---	166
1974	Number of farms	54	9	13	12	4	1	93

[1/] Farms with sales of $2,500 and over.

[2/] 100 cows and over.

Increased competition from urban expansion and industrial development has encouraged this decline. To supply the needs of the rapidly growing city of San Antonio, increasing quantities of milk are moving into the county, in both raw fluid and processed form, primarily from Central and North Texas.

Randall County

Randall County is representative of the High Plains dairy industry. In 1979 milk production totaled 17 million pounds from 1,200 cows (Table 31). This is an average of 14,200 pounds per cow, well above the state and national average. Production levels for the county exhibit no major trend. A decline of production in the mid-1970s, concurrent with low prices and incomes, was followed by a return in 1978 and 1979 to production levels that approximated the early 1970s.

Farm numbers in all size categories declined in Randall County between 1969 and 1974 (Table 32). Due to the importance of cattle trading in the area, the number of farms with milk cows shown in this table could be overstated. The largest declines were in farms having less than 100 cows.

Randall County has an annual rainfall of only 20 inches, making irrigation necessary for forage and feed grain production during much of the growing season. It is estimated that half of the dairies in the county buy all their feed. Temperatures range from very hot to very cold with frequent strong winds in the county.

Table 31. Milk cows and production, Randall County, Texas, 1970-79[28]

Year	Milk cows that have calved	Milk production
	number[1/]	million pounds
1970	2,050	19.0
1971	2,100	17.4
1972	1,900	18.0
1973	2,100	16.2
1974	1,900	16.8
1975	1,700	12.7
1976	1,200	16.7
1977	1,500	15.5
1978	1,600	17.5
1979	1,200	17.0

[1/] Number on January 1.

Table 32. Farm size by milk cow numbers, Randall County, Texas, 1969 and 1974[1/]

Year	Farms with:	1 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 and over	Total
1969	Number of farms	41	7	7	7[2/]	---	---	62
1974	Number of farms	23	3	4	2	4	0	36

[1/] Farms with sales of $2,500 and over.

[2/] 100 cows and over.

MILK PROCESSING AND DISTRIBUTION IN TEXAS

About three-fourths of the milk sold to plants and dealers in Texas is used for fluid purposes (Table 33). More than 90 percent of the Texas milk supply is used to make fluid milk products, ice cream, and cottage cheese.

In 1978, Texas dairy products were manufactured in 83 plants. This represents a 26 percent decline in the number of plants since 1970 (Table 34). As a result, the average size of plant has increased from 26 million pounds annually in 1970 to 40.6 million pounds in 1978.

This trend toward fewer but larger processing plants has been typical of the milk industry since the 1930s. It reflects the lower unit costs experienced by larger scale plants. It also reflects the fact that there are fewer but larger wholesale buyers of processed dairy products. Increasingly fluid milk, ice cream, and cottage cheese are purchased centrally on a regional basis by supermarkets and convenience stores. Often such purchases are of a private retailer brand package.

Over time as retailers have found centralized private label purchasing advantageous, they have frequently limited the number of brands that are allowed shelf space in the dairy case or frozen food counter. The combination of regional buying and limited shelf space has frequently meant that only the larger milk and ice cream processors have supermarket and convenience store outlets for their products. Others have been forced out of business.

Complicating the problems of the independent milk processor has been the increasing entry by supermarkets into milk processing and distribution. Such integrated retailers generally manufacture a limited line of products and deliver them directly to their own stores, avoiding middlemen. The result for some integrated retailers has been substantial savings along with control over milk processing and distribution systems. As integrated retailers increase the volume of fluid milk products processed, some expand product lines into cultured and frozen products. Such innovations will continue to affect the future structure of the Texas milk processing and distribution industry.

Fluid Milk Processing

From 1970 to 1978, the number of fluid milk plants in Texas declined nearly 30 percent from 72 to 51 plants (Table 35). The decline occurred in all size groups -- including plants having over 100 employees. Plants having less than 50 employees declined 52 percent, those having 50 to 99 employees declined 24 percent, and those having over 100 employees declined 12 percent.

Texas Federal Milk Marketing Order Administration data indicate that the largest number of plants received from two to five million pounds of milk per month (Table 36). However, the majority of the milk was processed by 11 plants which received over ten million pounds of milk per month. Five plants receiving more than 15 million pounds per month processed slightly over 31 percent of the milk regulated by Federal milk marketing orders in Texas. These plants averaged nearly 19 million pounds of milk received per month.

Table 33. Total milk marketed and the percentage used in fluid and manufactured dairy products on a whole milk equivalent basis, Texas, 1970-79[10]

Year	Milk sold to plants and dealers	Milk used in manufactured products	Percentage used: Fluid products	Percentage used: Manufactured products
	------million pounds-------		-----percent-----	
1970	2,915	720	75	25
1971	3,100	790	75	25
1972	3,203	764	76	24
1973	3,137	772	75	25
1974	3,235	726	78	22
1975	3,090	751	76	24
1976	3,215	846	74	26
1977	3,280	878	73	27
1978	3,370	741	78	22
1979	3,370	733	78	22

Table 34. Average number of pounds of milk received by processors, Texas, 1970-78[29]

Year	Milk sold to plants and dealers	Plants processing one or more dairy products	Average milk received per plant
	million pounds	number	million pounds
1970	2,915	112	26.0
1971	3,100	115	26.9
1972	3,203	108	29.6
1973	3,137	97	32.3
1974	3,235	103	31.4
1975	3,090	93	33.2
1976	3,215	92	34.9
1977	3,280	88	37.2
1978	3,370	83	40.6

Table 35. Number of fluid milk plants by number of employees, Texas, 1970-78[8]

Year	Under 20		20 to 49		50 to 99		100 or more		Total	
	number	percent	number	percent	number	percent	number	percent	number	percent
1970	18	25	7	10	21	30	26	36	72	100
1971	14	19	13	18	20	27	27	36	74	100
1972	12	18	10	15	20	29	26	38	68	100
1973	11	17	9	14	18	28	26	41	64	100
1974	11	19	6	10	21	36	20	34	58	100
1975	9	17	2	3	21	40	21	40	53	100
1976	10	19	1	2	17	33	24	46	52	100
1977	9	18	4	8	15	29	23	45	51	100
1978	9	18	3	6	16	31	23	45	51	100

Table 36. Fluid milk processing plants in Texas according to pounds of bulk milk receipts in October 1979[1/]

Size of milk receipts	Plants	Total Milk receipts	Average milk receipts	Percentage of total milk receipts
million pounds	number	----------pounds----------		percent
Less than 2.0	4	5,547,108	1,386,777	1.8
Over 2.0 but less than 5.0	22	81,175,320	3,689,787	26.9
Over 5.0 but less than 10.0	7	49,646,162	7,092,309	16.5
Over 10.0 but less than 15.0	6	70,367,398	11,727,900	23.4
Over 15.0	5	94,595,429	18,919,086	31.4
	44	301,331,417	6,848,441	100.0

1/ Includes fluid milk plants located in Texas that are regulated by the Texas, Lubbock-Plainview, Texas Panhandle and Rio Grande Federal Milk Marketing orders; plus two plants at Texarkana, Texas, that are partially regulated by the Texas Order.

Ice Cream and Frozen Desserts

In 1979, Texas was the sixth largest ice cream producing state. Texas plants produced 60.1 million gallons of frozen desserts including 38.7 million gallons of ice cream, 11.6 million gallons of ice milk, and 2.7 million gallons of sherbet.

Production of ice cream in Texas increased from 28.8 million gallons in 1970 to 38.7 million gallons in 1979. This 34 percent increase in Texas production compares with only a 7 percent increase nationally (Table 37).

The number of plants manufacturing ice cream in Texas has declined from 62 in 1970 to 31 in 1978. The 50 percent decline in the number of Texas plants exceeded the 35 percent decline experienced nationally. The average Texas plant manufactured 464 thousand gallons of ice cream in 1970 and 1.2 million gallons in 1978.

Cottage Cheese

Since 1971, Texas cottage cheese production has stabilized at about 27 million pounds (Table 38). Meanwhile U.S. production has declined 4.2 percent.

The total production of cottage cheese can be divided into lowfat and creamed types (Table 39). While lowfat production in Texas has increased only slightly, U.S. production has increased considerably -- 6.3 compared to 160 percent. In contrast, the production of creamed cottage cheese has increased 5.7 percent since 1970 in Texas and decreased 14.4 percent nationally. These trends in production can be partially explained by the fact that Texans appear to be less milkfat conscious than the nation as a whole, as noted earlier.

Butter and Cheese

Butter and cheese production is the residual use for Texas milk production. As such, considerable month to month and year to year variation exists in butter and cheese production depending upon the difference between the quantity of milk produced and the quantity used for fluid milk, ice cream, and cottage cheese. Year to year variation is particularly noticeable in the variable quantity of cheese produced (Table 40). Within year variation of production in Texas, butter and cheese typically follows a spring flush and then a sharp decline in production in the fall.

The data contained in Table 40 indicate that cheese production is increasing as a residual use for Texas milk while butter production is decreasing.

Expected Future Developments in Processing and Distribution

Rapid population growth with more modest expansion of production in Texas will lead to a continued high proportion of milk used for fluid milk, ice cream, and cottage cheese. Production of butter and powder will expand only when production increases outrun use in fluid and frozen dairy products, such as in late 1979 and 1980.

Table 37. Hard ice cream plants and production, Texas and U.S., 1970-79[9]

Year	Texas		U.S.	
	Plants	Production	Plants	Production
	number	1,000 gallons	number	1,000 gallons
1970	62	28,780	1,628	736,741
1971	59	30,141	1,520	738,382
1972	53	31,229	1,451	742,895
1973	49	31,173	1,330	748,814
1974	44	32,468	1,239	755,700
1975	39	35,439	1,167	803,494
1976	38	34,762	1,124	783,021
1977	32	36,668	1,095	784,093
1978	31	37,403	1,062	791,851
1979	1/	38,707	1/	785,949

1/ Not Available

Table 38. Cottage cheese production, Texas and U.S., 1970-79[9]

Year	Texas production	U.S. production
	1,000 pounds	
1970	25,465	1,038,581
1971	28,360	1,088,889
1972	28,514	1,115,092
1973	29,851	1,086,222
1974	26,303	977,623
1975	27,458	990,985
1976	28,766	1,009,969
1977	28,704	1,016,985
1978	28,990	1,023,668
1979	26,937	994,361

Table 39. Lowfat[1/] and creamed[2/] cottage cheese production, Texas and U.S., 1970-79[9]

Year	Texas		U.S.	
	Lowfat	Creamed	Lowfat	Creamed
	-----1,000 pounds-----		-------1,000 pounds-------	
1970	3,822	21,643	60,129	978,452
1971	4,015	24,345	85,237	1,003,652
1972	5,021	23,493	102,411	1,012,681
1973	5,349	24,502	128,019	958,203
1974	4,386	21,917	121,941	855,682
1975	4,347	23,111	129,316	861,669
1976	4,854	23,912	135,364	874,605
1977	4,539	24,165	139,007	877,978
1978	4,520	24,470	153,159	870,529
1979	4,064	22,873	156,590	837,771

1/ Milkfat content of less than 4.0 percent.

2/ Milkfat content of 4.0 percent or more.

Table 40. Butter and cheese production, Texas, 1970-79[9]

Year	Butter production	Cheese production
	----------1,000 pounds----------	
1970	4,195	11,124
1971	3,709	13,522
1972	3,321	1/
1973	3,805	7,408
1974	2,014	10,061
1975	2,168	5,552
1976	3,895	11,661
1977	2,667	17,751
1978	1/	12,177
1979	1/	1/

1/ Data not recorded to avoid individual plant disclosure.

Structural and technological changes within the dairy processing industry will continue to put pressure on smaller plants to either grow, merge, or exit from the industry. Further chain store integration into fluid milk processing as well as expansion into frozen products and cottage cheese can be expected.

Recently, increasing energy costs have offset some of the advantages enjoyed by large plants. Large plants normally move milk longer distances. As energy costs rise, these plants experience larger unit cost increases relative to plants with a more limited distribution territory. Such relative cost increases may not be as large for integrated chain operations, which move milk to stores in combination with other grocery products. In any event, the relative cost increases, though expected to continue, are not likely to be great enough to offset incentives of plants to expand and merge with other plants.

COOPERATIVE MARKETING OF MILK IN TEXAS

Due to a relatively high fluid utilization, the primary role of milk cooperatives in Texas involves milk procurement and balancing milk supplies. This is in contrast to several major cooperatives in other parts of the country which also are heavily involved in processing.

Milk Procurement

Producers have two basic options for marketing their milk. They can market directly to a fluid milk processor, or they can market through a cooperative. Producers that market directly to a fluid milk processor are referred to as independent producers. The term "independent" is somewhat misleading since any producer of a highly perishable product like milk has to have an assured outlet for his product. An independent producer's milk normally goes directly from the farm bulk tank to the processing plant.

Milk is usually hauled from the dairy farm to the processor by an independent hauler. Such haulers may be under contract with either a milk processor or a cooperative. Sometimes haulers having milk destined for particular plants will pick up milk from both independent and cooperative producers. An increasing number of legal restrictions have been placed upon cooperative contract haulers concerning the legality of picking up independent producers' milk.

Cooperative producers are typically required to sign a marketing agreement or contract with their cooperative. This marketing agreement commits the producer to market his or her milk through the cooperative for a specified time period -- normally one year. Independent producers may or may not be required to sign a marketing contract.

As a general rule, however, cooperative producers have less control over where their milk is ultimately processed than do independent producers. That is, in a cooperative, the producers turn over the job of marketing to cooperative management. This is more often the case for large cooperatives such as Associated Milk Producers, Inc. (AMPI) which serves the needs of a large number of processors than it is of cooperatives such as Vanguard Milk Producers Cooperative which serves only a few processors in Texas.

Balancing

The balancing function has always been essential to a smoothly operating milk market. Milk is produced continuously, yet the same quantity of milk is not produced every day of the year. Milk production is typically higher in the spring than it is in the fall of the year. In fact, during the fall a substantial quantity of milk is trucked into Texas from out-of-state to meet the needs of processors and consumers. In the spring, on the other hand, more milk is normally produced in Texas than is needed for fluid, soft, and frozen dairy products.

The balancing function can best be described as one of getting the milk or cream to where it is needed for processing fluid, soft, and frozen dairy products, and then utilizing the residual milk that is not needed for these purposes. The means of utilizing the residual milk is normally to manufacture it into butter, nonfat dry milk, cheese, or condensed milk. In the spring, manufacturing plants may be running near capacity, in the fall, they may be virtually shut down.

Complicating the job of balancing is the fact that large fluid milk processing plants typically do not package milk 7 days a week. During the days when plants are closed, such as Sunday, the milk picked up from the farm must be stored.

This combination of conditions makes the job of balancing milk supplies both complex and costly. Due to the high costs, processors cannot typically make money performing the balancing function. As a result, the job tends to fall on the cooperatives. While all cooperatives in Texas perform some aspect of the balancing function, such as allocating milk supplies among fluid milk processing plants, the major burden for balancing falls on the largest cooperative, AMPI, and to a much lesser extent on Mid-America Dairymen, Inc. (Mid-Am). These are the only cooperatives that have access to manufacturing plants in or close to Texas that can handle residual milk supplies.

Since balancing is costly, cooperatives normally receive premiums over Federal market order prices to perform the balancing function. The existence and size of these premiums have been highly controversial. Some argue that premiums are set at levels which exceed the cost of balancing. Evaluating the soundness of his argument is beyond the scope of this paper. Let us simply recognize that the balancing function has to be performed and, as an aggregate producers and processors benefit from it.

It has from time to time been suggested that Federal market order prices should include remuneration for services performed in balancing. However, the USDA has tried to maintain the existing level of regulation. Therefore, the USDA has not supported integrating service charges into Federal marketing orders, even when advocated by large regional milk cooperatives.

The cost of balancing and premiums will continue to be debated within the industry. A need exists for closer analysis of costs incurred in balancing. Such analysis would provide a basis for evaluating the charges and countercharges that have been made.

Texas Milk Cooperatives

Between 1977 and 1980, cooperatives had between 82.2 and 85 percent of the raw fluid milk sales in the Texas Federal milk marketing order (Table 41). Stated another way, independent producers accounted for 15 to 17.8 percent of Texas milk sales.

In April 1980, Texas cooperative milk sales were shared by five cooperatives -- AMPI, Mid-Am, Southern Milk Sales, Inc., South Texas Independent Milk Producers Association (STIMPA), and Vanguard Milk Producers Cooperative of Texas. These five cooperatives had approximately 2,277 Texas producer members and marketed 257 million pounds of milk (Table 42).

Table 41. Cooperative share of the Texas Federal milk marketing order sales, 1977-80[30]

Month	1977	1978	1979	1980
	Year			
	percent			
January	85.0	84.9	82.4	82.9
July	85.0	82.8	82.2	-

Table 42. Estimated membership and volume of milk produced by Texas dairy farmers by cooperative affiliation, April 1980[16]

Cooperative	Number of Texas producers	Volume of milk
	number	million pounds
AMPI	1,750	202
Southern Milk	250	30
Mid-America	190	17
STIMPA	60	6
Vanguard	27	2
TOTAL	2,277	257

Associated Milk Producers, Inc.

Since the 1960s, the dominant force in Texas cooperatives has been Associated Milk Producer, Inc. AMPI is the largest of the regional milk cooperatives. In 1979 it marketed 14 billion pounds of milk produced on 26,474 member farms. AMPI is divided into three regions. The North Central Region includes producers located in the states of Minnesota, Wisconsin, Iowa, North and South Dakota, Nebraska, and Missouri. This region is heavily involved in the production of butter, nonfat powder, and cheese. It also has substantial fluid milk sales. The Mid-States Region includes producers located in Wisconsin, Illinois, Indiana, Iowa, Michigan, and Ohio. It serves the fluid needs of Chicago and surrounding markets. In addition to Texas, the Southern Region of AMPI includes producers located in New Mexico, Oklahoma, Kansas, Arkansas, Nebraska, Colorado, Mississippi, Tennessee, Kentucky, and Missouri.

In April 1980, approximately 1,750 Texas producers belonged to AMPI. About 80 percent of these producers were located in the eastern half of the state which serves the major metropolitan centers of Dallas-Fort Worth, Houston, and San Antonio. Since Texas produces less milk than is needed to satisfy its needs throughout the year, milk from other states within the Southern Region is regularly moved into Texas by AMPI. Such movements are an integral part of the balancing function referred to previously.

AMPI serves the fluid needs of processors throughout the state. It bears the primary responsibility for seeing that the milk needs of processors are met and that excess supplies are converted to manufactured dairy products. It performs the latter function through manufacturing plants located in Sulphur Springs, El Paso, and Muenster, Texas.

Southern Milk Sales, Inc.

Southern Milk Sales was formed in 1979. As the second largest cooperative in Texas, it handled about 30 million pounds of milk in April 1980. Its membership consisted of about 250 Texas producers. Most of these producers are located in eastern Texas, central Texas, and the Stephenville area. Sales are made primarily to plants in Dallas, San Antonio, Corpus Christi, and Abilene.

Southern Milk also has substantial sales outside Texas in south central and southeastern United States. Its total U.S. milk sales were about 100 million pounds in April 1980. Southern Milk has no manufacturing facilities.

Mid-American Dairymen, Inc.

Like AMPI, Mid-Am is a regional cooperative. Its primary base of operation includes the states of Kansas, Missouri, Iowa, and Minnesota. Its major markets include Kansas City, St. Louis, Des Moines, and Minneapolis-St. Paul. Mid-Am is an important manufacturer of hard dairy products and by-products.

Mid-Am had 190 Texas producers as members that shipped 17 million pounds of milk in April 1980. Most of Mid-Am's members are located in Hopkins County and surrounding counties. Milk from this area is shipped to both Houston and Dallas. Mid-Am operates a by-products plant at Schulenburg, Texas.

The need of Texas processors and cooperatives to reach into other states for milk supplies could make Mid-Am a more important factor in the Texas market in the future. Increasing quantities of milk processed in Texas has its origin in the Ozarks region of southwestern Missouri -- an area of traditional Mid-Am producer membership.

South Texas Independent Milk Producers Association

STIMPA was formed about 15 years ago. It has 60 producer members located in southern Texas and the Waco-Dallas area. It handled about six million pounds of milk in April 1980. Most of this milk production goes to processors located in Corpus Christi, Dallas, and San Antonio.

Vanguard Milk Producers Cooperative

Vanguard Milk Producers Cooperative was recently organized as a spinoff from a Missouri cooperative of the same name. It had about 27 producers located in Grimes, Brazos, Washington, and Karnes counties in April 1980. It shipped about two million pounds of milk in that month. Most of this milk went to Corpus Christi and Houston.

Expected Future Cooperative Developments

Increases in the size of processors combined with the limited number of days processors operate have made the cooperative's role in procurement and balancing of milk supplies more important. These trends are not likely to be reversed, which suggests an increasingly important role for cooperatives in Texas. Yet, the history of Texas milk cooperatives has tended to be one of cyclical rise and fall of influence. This likely reflects the combination of the traditional independence of many Texas producers and processors who desire not to become too closely tied to a single cooperative organization.

The future role of milk cooperatives in Texas rests primarily on two factors: (1) the relative importance of out-of-state milk supplied, and (2) decisions regarding integration into fluid milk processing. As a state's ability to supply its own milk needs declines, the importance of large regional cooperatives increases. Regional cooperatives have better access to supplies of milk in surplus producing areas to the north. Given that the increasing number of large fluid milk processing plants find it important to have an assured supply of milk, regional cooperatives could provide this service.

The second factor affecting the future of cooperatives in Texas relates to decisions regarding integration into fluid milk processing. Regional cooperatives in several areas of the U.S. operate a substantial number of fluid milk and ice cream processing facilities. The trend appears to be in the direction of more cooperative processing.

Texas cooperatives have not become extensively involved in processing. In the past, some Texas cooperatives have processed milk. These plants were either acquired through mergers of cooperatives processing milk or by cooperative takeover of a processor that defaulted on milk payments. Most of these plants were inefficient and unprofitable, so the cooperatives closed or sold the processing operation.

Texas cooperatives have had a policy of not antagonizing raw milk customers by direct competition in fluid milk or ice cream, nor do their members want to invest the large amounts required to acquire or build an efficient processing plant. Consequently, Texas cooperatives have decided not to become involved in processing. The recent acquisition of an El Paso fluid milk processing plant by a southeastern regional dairy cooperative should motivate Texas cooperatives to consider more closely their role in processing milk.

REGULATION OF MILK MARKETS

The dairy industry is one of the most regulated industries in the nation. Dairy regulation has evolved over the last half century with the objectives of increasing producer income, maintaining price stability, and assuring consumers of an adequate supply of fluid milk. The costs and benefits of dairy regulation are subjects of much debate.

The perishability of fluid milk has always influenced milk marketing methods and dairy legislation. This characteristic was particularly important in shaping market structure before 1900. At that time, milk was either consumed where it was produced or it was sold to nearby neighbors. With the acceptance of pasteurization around the turn of the century, milk marketing took on a new dimension. Pasteurization not only reduced the danger of milk-borne diseases, it also reduced the problem of spoilage. Furthermore, producing and processing milk began to evolve as separate functions allowing for specialization.

Cooperative Formation

As producers and processors began to operate as distinct enterprises, marketing problems arose between the two. In some cases, producers had only one outlet for their milk so that processors were in a position to manipulate producer milk supplies and prices. Some producers organized into cooperatives to counteract the advantages of processors, doing so under the protection of Section 6 of the Clayton Act and the Capper-Volstead Act.

Classified Pricing

Acting as a bargaining association for member producers, cooperatives promoted a system of classified pricing to increase producer income. Classified pricing was a system in which different prices were applied to a product according to its ultimate use. A higher price was paid for fluid grade milk used in fluid form, and a lower price was paid for fluid grade milk used for manufactured products. Classified pricing existed at the retail dealer level before cooperatives became involved in marketing as a result of the nature of demand for dairy products. The demand for fluid milk was not very responsive to an increase or decrease in its price or, in economic terms, it had a highly inelastic demand. The demand for manufactured products, such as cheese or butter, was more responsive to price changes. Though manufactured products did not have an elastic demand, their demand elasticity was greater than that of fluid milk.

The differences in demand led to increased gross revenues if a two price system was applied. A higher price could be specified for fluid milk to increase gross revenues while a lower price for manufactured products maintained demand for these products. With classified pricing, there was an incentive for processors to pay more for milk to meet fluid demand than for milk to meet manufactured demand. Therefore, the classified pricing system was not objectionable to all processors.

Some processors were willing to adhere to a rigid two-price system as long as there was assurance that all processors in the same fluid milk market were paying the same price. The agreement between cooperatives and dominant processors stipulated that processors would pay for the milk they received according to how they used it. For example, if a processor used 80 percent of the milk he received in fluid form and 20 percent went to manufactured uses, the processor would pay the higher price for 80 percent of the total and the lower price for the remainder. Cooperatives would collect these payments and distribute them, after deducting for services rendered, among member producers at a blend price. The blend price was a weighted average of the higher and lower prices. All members received the same price for their milk regardless of its ultimate use.

Despite the support from processors and cooperatives, milk prices were still vulnerable to wide fluctuations. The price system offered incentives for producers who were not members of cooperatives to sell their fluid grade milk at a price less than the higher fluid price, but greater than the blend price received by member producers. If total output expanded, more milk would go into manufactured uses due to the limited demand of fluid milk. The increased milk available for manufactured use would drive down the lower manufactured price thereby reducing the blend price and offering increased incentive for avoiding cooperative membership. Therefore, cooperative power to police the classified pricing system was hindered. Farmers and their cooperatives were also at a disadvantage concerning the weighing and quality measurements of milk sold to processors.

During the 1920s, instability permeated the dairy industry. Cooperatives would sometimes cut off milk supplies to processors buying milk from nonmembers. At the same time, processors would sometimes "lock out" milk from cooperatives if cheaper milk could be acquired. The instability during this period took the form of violence with strikes and sabotage. Pricing problems were exacerbated by the general economic depression in the 1930s. In 1932, the milk price at the farm level declined to a level almost half of the 1929 price. As demand declined, classified pricing became even more difficult to apply. This motivated organized producers to turn to the government for help.

Marketing Orders

President Roosevelt and the Congress responded with the Agricultural Adjustment Act (AAA) in 1933. The Act authorized the establishment of Federal regulation of the milk industry. Marketing agreements between Federal regulators and fluid milk processors and licenses were the tools of regulation. Like the classified pricing system promoted by the cooperatives, regulatory pricing was based on a two-price system.

When the Supreme Court rejected the legality of parts of the AAA, the Agricultural Marketing Agreement Act (AMAA) of 1937 became the enabling legislation. The AMAA has changed little since its enactment, and remains the foundation for fluid milk marketing regulation today. The objectives of this Act are to increase producer income, to maintain equity between producers and processors, and to assure consumers of an adequate supply of fluid milk. Market orders are the mechanism for regulation. Only fluid grade processors are regulated by the order. Producer output is not restricted, and it may expand as long as there is a market for it. This Act allows producers to establish, after a hearing, Federal regulation of prices in a market area with a two-thirds majority vote in terms of either producer members or output. A market area is defined as the normal area from which a consumption center receives its milk supply.

Order Objectives

The market order system is designed to create equity among producers and processors in the milk market. The objective is more orderly marketing and milk price levels that are consistent with supply and demand forces in the market. To accomplish these objectives, the classified pricing system is used.

Fluid grade milk used for fluid purposes receives a higher price called Class I price, and the fluid grade milk that goes into manufacturing use receives a lower price called Class II or III price. Class I products are whole fluid milk and similar products such as skim milk, lowfat milk, and buttermilk. Class II products are "soft" products such as yogurt, cottage cheese, and ice cream. Class III products are "hard" products such as cheese, butter, and nonfat dry milk.

The Class I and II prices are based on the Class III price. This price is based on a price determined every month by the USDA called the Minnesota-Wisconsin (M-W) price. The Minnesota and Wisconsin area is the largest milk producing area in the country and approaches free competition among milk manufacturers. Class III prices around the country are uniform and set at a level equal to the M-W price because of the national market for manufactured products.

In order to assure an adequate supply of fluid milk for consumers and raise producer returns, the market order system establishes increasing Class I prices in market areas as the distance from Eau Claire, Wisconsin increases. The difference between the Class I and Class III prices is called the Class I differential. The differential reflects the cost of transporting fluid milk from the Wisconsin area to southern markets.

For example, the Class I price per hundredweight of 3.5 percent butterfat milk in May 1980 for milk sold in Houston was $14.27. The average Class III price was $11.66. The Class I price in Minneapolis for the same month was $12.71 and the Class III price was $11.66. Therefore, the differential between the Class I and III prices in Houston was $2.61, while in Minneapolis it was only $1.05. Theoretically, the difference between the Houston Class I price and the Minneapolis Class I price should equal the cost of transporting milk from Minneapolis to Houston. However, with rapidly raising transportation costs, this is no longer the case.

Order Administration

Though the ultimate authority over the program resides with the Secretary of Agriculture, a market administrator is in charge of each market area. The administrator and his staff audit the accounts of the regulated processors, collect and dispense funds from regulated processors, and generate data.

Auditing was authorized to determine if processors were using milk supplies as reported in order to determine the correct amount of payments required of processors.

Federal Regulation

Since 1933, the influence of Federal regulation has grown steadily. The number of market areas expanded from 29 in 1947 to a peak of 83 in 1962 . Since 1962, the number has declined primarily because of mergers. Technological advancements in areas such as refrigeration and trucking have altered what used to be "normal" market areas, and mergers have been necessary to reflect this change. Though there were only 47 market areas in 1979, the number of people within these areas was 159,481,088 -- well over half of the entire U.S. population. Almost all of the major cities are affected by Federal regulation except San Francisco and Los Angeles, which are regulated by a state order.

Eighty percent of all fluid grade milk was federally regulated in 1978. Federally regulated milk constituted 66 percent of both fluid grade and manufactured grade milk. These percentages have increased steadily over the years. For the nation, the number of producers selling their milk to regulated processors has declined since 1960. Regulated processors have followed the same trend as volumes of milk processed in each plant increased.

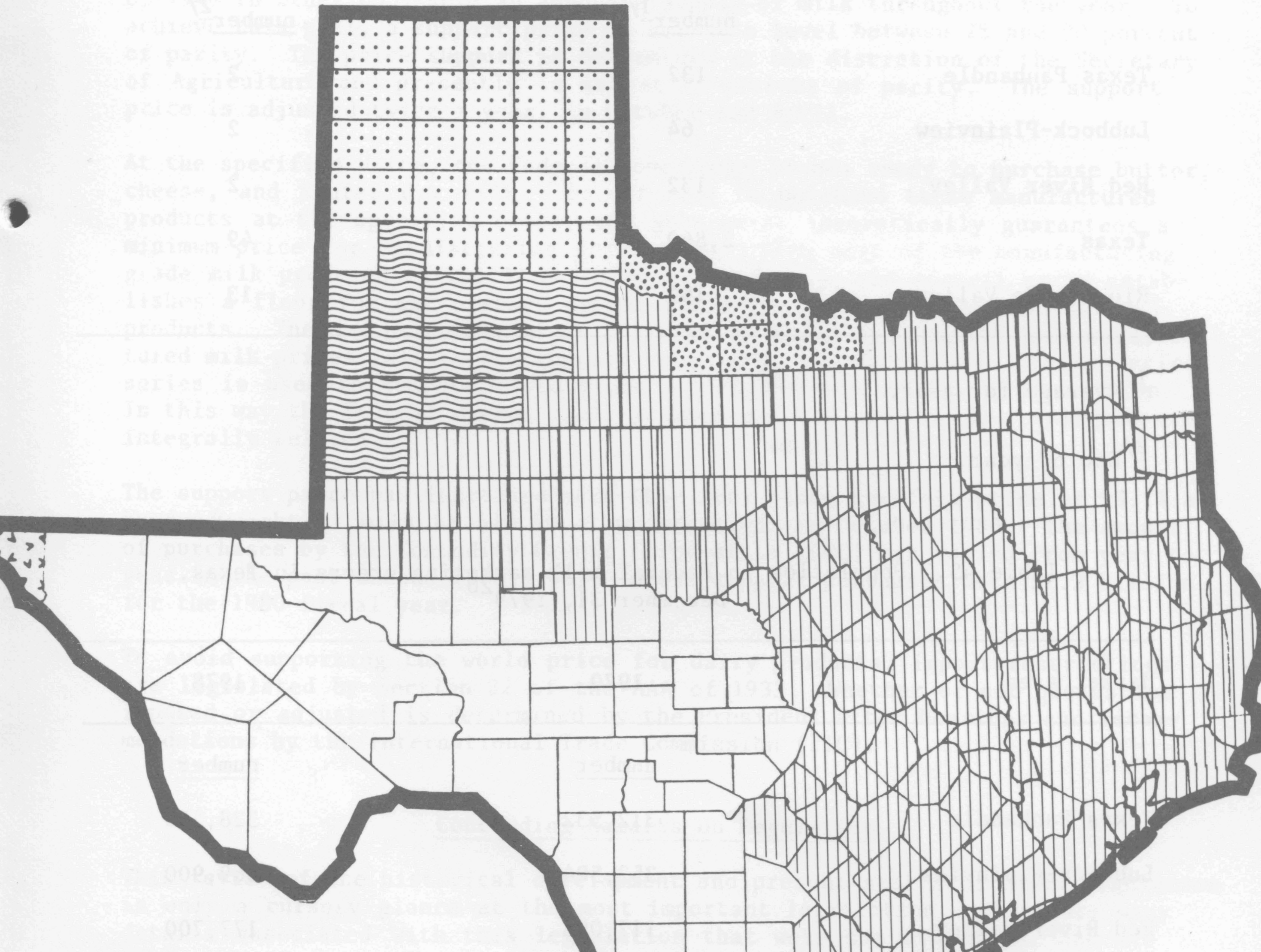
Federal Marketing Orders in Texas

Federal marketing orders were not established in Texas until the 1950s (Table 43). Though the original marketing orders defined the areas of competition among regulated handlers, competition areas began to overlap with time. As the number of processing plants declined in Texas, the remaining plants had to extend further for milk supplies. Their distribution areas also expanded. A proposal by AMPI to merge some market orders became a reality in 1975. In that year the oldest orders, those established between 1951 and 1955, merged with the South Texas order to create the Texas order.

This consolidated order covers almost all of eastern Texas from San Antonio to the coast, and from Brownsville to the northeastern border (Figure 3). A portion of this order extends to the New Mexico border. Of the five orders that regulate areas in Texas, the Texas order affects more producers, processors, and consumers than the other four orders combined (Tables 44 and 45). This fact is understandable because the largest cities in Texas -- Houston, Dallas, Fort Worth, San Antonio, and Corpus Christi -- are included in this market area. A total of 2,860 producers shipped to 49 regulated processors in the Texas order in 1979. In the other four orders, a total of 478 producers shipped to 19 regulated processors. Of these totals, some producers and processors operated in states bordering Texas.

Table 43. Federal milk marketing orders, Texas, 1980[20]

Market area	Date effective
Texas Panhandle	2-1-56
Lubbock-Plainview	7-1-62
Red River Valley	11-1-58
Texas	7-1-75
Merger of:	
Austin-Waco	2-1-55
Central West Texas	12-1-52
Corpus Christi	7-1-55
North Texas	10-1-51
San Antonio	7-1-52
South Texas	10-1-68
Rio Grande Valley	7-1-62



gure 3. Federal marketing orders in Texas:

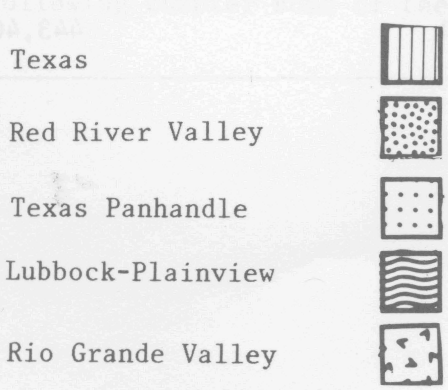


Table 44. Producers and processors in Federal milk marketing orders affecting Texas, 1979[20]

Market area	Producers	Processors
	number[1/]	number[2/]
Texas Panhandle	132	2
Lubbock-Plainview	64	2
Red River Valley	132	2
Texas	2,860	49
Rio Grande Valley	150	13

1/ Average for year.

2/ End of year.

Table 45. Population in Federal milk marketing orders in Texas, December 31, 1979[20]

Market area	1970	1978
	number	number
Texas Panhandle	312,532	328,500
Lubbock-Plainview	352,504	369,900
Red River Valley	117,098	177,700
Texas	9,467,722	11,105,200
Rio Grande Valley	359,291	443,400

Price Support Program

In addition to the Federal market orders, the dairy industry is affected by a price support program. This program was established by the Agricultural Act of 1949 in order to assure an adequate supply of milk throughout the year. To achieve this goal, a support price is set at a level between 75 and 90 percent of parity. The price support is determined at the discretion of the Secretary of Agriculture and presently is set at 80 percent of parity. The support price is adjusted twice a year, in October and April.

At the specified price, the Federal government stands ready to purchase butter, cheese, and nonfat dry milk. By offering to purchase these manufactured products at the specified price, the government theoretically guarantees a minimum price for manufacturing grade milk. With most of the manufacturing grade milk produced in the Minnesota-Wisconsin area, the support price establishes a floor for the average annual price for milk used in manufactured products. The M-W price series is affected by the price support when manufactured milk prices fall to the support level and, as noted above, the M-W price series is used to compute fluid grade prices throughout most of the nation. In this way the Federal market order program and the price support program are integrally related.

The support price has increased more than four times the 1949 price of $3.14 a hundredweight of milk to $12.80 a hundredweight in October 1980. The amount of purchases by the Commodity Credit Corporation (CCC) has varied from year to year in the past decade (Table 46). Gross support purchases were $1.3 billion for the 1980 fiscal year.

To avoid supporting the world price for dairy products, import restrictions are legislated by Section 22 of the AAA of 1933. Whether or not quotas are imposed or adjusted is determined by the President after hearings and recommendations by the International Trade Commission (ITC).

Concluding Remarks on Regulation

This review of the historical development and present status of dairy regulation is only a cursory glance at the most important legislation. There are many details associated with this legislation that were not discussed, but are essential to the operation of the market order system and the price support program. Some of these details are subject to a great deal of debate, and in the following chapter some of the issues will be examined.

Table 46. CCC purchases as a percentage of annual milk production and total net support purchases, 1970-79

Fiscal year[1/]	CCC purchases as a percentage of annual milk production[2/]	Net support purchases[3/]
	percent	million dollars
1970	4.9	168.6
1971	6.1	315.4
1972	4.4	267.0
1973	1.9	135.8
1974	1.1	31.4
1975	1.7	485.8
1976	1.0	69.6
1977	5.0	709.8
1978	2.2	446.4
1979	1.7	244.3

1/ From 1970 to 1976 the fiscal year is July 1 to June 30. From 1977 to 1979 the fiscal year is October 1 to September 30.

2/ Milk equivalent basis.

3/ CCC support purchases and related costs (for processing, packaging, transporting, and storing) of dairy products, less proceeds from sales to commercial buyers for domestic use and for export, U.S. military agencies, foreign government and private welfare agencies, and Section 32 programs.

ISSUES FACING THE TEXAS DAIRY INDUSTRY

Significant challenges face Texas milk producers. Most of these challenges are not unique to Texas producers, but all have significant implications for Texas producers. We will not attempt to cover all issues -- only those that appear to be most important at this time. The issues selected are too complex to be covered in depth in this chapter; therefore, we will briefly define the issue, indicate some of the main policy options that have been suggested, and discuss some possible implications for the Texas dairy industry. The specific issues we have chosen to discuss are:

1. Federal dairy price and income policy
2. Cooperative regulation
3. Dairy imports
4. Reconstituted milk

Federal Dairy Price and Income Policy

Over the past decade, public support for Federal dairy programs, including the price support and the Federal marketing order program, has deteriorated. The attack on these institutions has been led by government agencies, university economists, and consumer activists. Charges against dairy programs include increases in the price of milk above competitive levels, high government costs, and excessive control by dairy cooperatives. Dairy interests have replied to these charges by pointing out the price and production stabilizing effects of Federal programs, the fact that milk prices have risen less rapidly than general inflation, and the fact that Federal programs do not control the level of milk production.

The level of production has become a major issue in itself. An increasing number of people believe that the 80 percent of parity price support is stimulating excess production. With government purchases exceeding $1 billion this year, there is little argument that there is surplus production. Disagreement exists over whether this increase in production is temporary or permanent.

Those who argue that it is temporary propose that a supply-demand adjuster linked to the level of government purchases be added to the minimum 80 percent of parity price support. Those who argue that the increase in production is of a more permanent nature have suggested the following alternatives:

1. A reduction of the support price minimum to at least 75 percent of parity with a supply-demand adjustor based on the level of stocks.
2. A conversion of the parity concept to consider only costs factors directly related to milk production. Such a revised parity concept is generally referred to as "dairy parity."
3. Basing the level of dairy price support on the national average cost of producing milk.
4. Basing the level of dairy price support on an economic formula which includes factors that reflect milk production costs, consumer incomes, and manufactured product stocks.
5. Abandoning the milk price support program in favor of a target price concept similar to that which exists for major grains.

The nature and level of price supports will likely be a major issue in the 1981 farm bill debate.

The nature of Federal marketing order legislation is also under attack. The basic aspect of marketing orders being questioned is classified pricing. Advocates of change argue that charging a higher price for milk used for fluid purposes imposes on consumers and processors an unnecessarily high price. They also argue that cooperatives are large enough to take care of themselves without government support.

Defenders of the Federal marketing order program argue that classified pricing is a necessity to both secure sufficient fluid grade milk production and to provide economic stimulus for milk to move in an orderly manner from manufacturing plants to fluid milk markets.

It appears that the level of government price and income support for milk producers may decline in the next decade and the milk industry will become increasingly subject to the pressure of market forces. If this forecast is accurate, there will be increased pressure on milk producers, cooperatives, and processors to perform the market functions such as pricing and management of industry inventories that are now being performed by government.

Cooperative Regulation

As cooperatives are increasing their responsibility for how producers fare in the marketplace for milk, more questions are being raised about their potential for abusing their market power. These questions arose in the early to mid-1970s when antitrust suits were brought against AMPI, Mid-Am, and Dairymen, Inc. This antitrust litigation was resolved in the signing of consent decrees by AMPI and Mid-Am and in a favorable court decision toward Dairymen, Inc.

Despite the resolution of this litigation, milk cooperatives continue to be the brunt of public criticism including pressures within Congress to modify cooperatives' charter for existence, the Capper-Volstead Act. The Capper-Volstead Act gives producers and their cooperatives three basic rights:

1. The right to organize cooperatives and conduct pricing and marketing activities.
2. The right to coordinate pricing and marketing activities among cooperatives.
3. The right to merge with other cooperatives.

The Capper-Volstead Act is not a blanket exemption from the antitrust laws. It does not allow cooperatives to either combine with noncooperatives nor does it allow cooperatives to engage in predatory practices against other cooperatives, proprietary processors, or producers who are not members of cooperatives.

The main target of the advocates of Capper-Volstead reform is to take away the right of two or more cooperatives to coordinate their pricing and marketing activities, as well as the right to merge with other cooperatives. Some advocates of reform would also like to see further restrictions placed on cooperatives' ability to integrate vertically into processing and marketing activities -- particularly as it relates to fluid milk and ice cream. It is, however, important to note that cooperatives have no special right to purchase processing and distribution facilities from proprietary processors. Policy changes of this type would place severe restrictions on cooperatives to grow, consolidate, and bargain for premiums over Federal order prices.

Dairy Imports

Restrictions exist on the importation of manufactured dairy products including butter, powder, and cheese into the United States. While these restrictions were relaxed somewhat by the recently completed multilateral trade negotiations, they are still substantial.

Two main justifications exist for these import restrictions:

1. They preserve the soundness of the milk price support program which maintains U.S. prices above world prices. Without import restrictions, increased quantities of manufactured products would flow into the U.S. resulting in larger government purchases of these products, thus undermining the price support program.
2. Other surplus milk producing countries such as the European Economic Community (EEC) countries subsidize the export of dairy products. Without import controls the U.S. would become a dumping ground for these subsidized surplus products.

There are four main arguments for further relaxation or abandonment of dairy import controls. These arguments are:

1. Restricting dairy imports is inconsistent with the basic U.S. economic policy that supports free trade.
2. If we are going to export agricultural commodities such as grain and cotton, we have to be willing to import. Trade is a two way street.
3. The U.S. dairy farmer has been overly protected. Increased competition would make the whole industry more efficient and stronger.
4. In the long run, present import policies encourage the development and use of substitute dairy products such as imitation cheese, nondairy dips, margarine, and imitation milk.

There is no doubt that removing dairy import restrictions would initially result in a substantial decline in the price of milk to producers. There is more debate over how quickly the price would recover and the ability of U.S. producers to compete in the world market for dairy products. Some suggest that while milk prices would initially fall, increased imports would result in sharply increased government outlays for subsidies within the EEC. The result, they suggest, will be reduced willingness of the EEC governments to subsidize dairy exports. Others suggest the destruction of the U.S. industry would increase the demand for foreign dairy products and ultimately raise prices for these products. The soundness of such arguments will continue to be extensively debated. Pressures to negotiate reduced dairy import restrictions for a relaxation of import restrictions on U.S. products, such as feed grains going to the EEC, will likely continue.

Reconstituted Milk

Reconstituted milk is made by adding water to nonfat dry milk (use of dried whole milk could become more common). Presently, consumers can reconstitute milk by purchasing nonfat powder in the grocery store and adding water to it. The result is a lower priced milk product having the same nutritive value as fresh skim milk bought in the grocery store. This lower price results from the fact that processors purchase milk used to make manufactured products, such as nonfat powder, at a lower price than milk used to make fluid products. Many consumers have chosen not to buy nonfat milk powder and mix it at home because of a combination of inconvenience and the "cooked" taste associated with the product.

Were it not for certain provisions of Federal marketing orders, regulated milk processors could reconstitute milk, and likely sell it at a lower price than fresh milk. Under the existing regulation, the processor that reconstitutes milk is required to pay the milk market administrator the difference between Class I and Class III prices. When combined with the cost of reconstituting milk, this raises the price of reconstituted milk above that of fresh milk.

In 1979, a consumer group petitioned the Secretary of Agriculture to remove the required payment of the difference between the Class I and Class III price for milk that is reconstituted. Strong opposition to the proposal was expressed by milk producers and cooperatives. The proposal, if accepted, would allow reconstitution, which many felt would undermine the whole dairy program. In particular, there was concern that reconstituted milk would mean an end to classified pricing. In addition, there was concern that the quality of fluid milk would decline and consumption would fall. Conflict among government agencies has resulted in much delay on the decision to hold a hearing.

Texas producers have more reason to be concerned about the reconstitution issue than producers in the Upper Midwest. As explained earlier the transportation differential makes the difference between the Class I and Class III prices greater in Texas than in Minnesota and Wisconsin where much of the nonfat powder is produced. Thus, the price of reconstituted milk would be lower in Texas than the price of fresh milk and consumers would have an incentive to try reconstituted milk and potentially switch. Reconstituted milk consumed in Texas would displace Class I sales. Class I utilization would decline; therefore, the blend price would decline towards the Class III price. The result would be reduced income to Texas milk producers resulting eventually in reduced production. How much price and production would fall would depend on how many consumers switched to reconstituted milk beverages.

Many Minnesota and Wisconsin producers should not be opposed to reconstituted milk beverages. The reason is that as the demand for nonfat powder increases *to produce reconstituted milk beverages, the price of nonfat powder will rise.* The result is a net benefit to producers located in areas of substantial manufacturing milk utilization.

The controversy over the reconstitution issue will not likely end with the reconstitution of nonfat powder. New techniques for drawing water out of the milk supply without a change in milk flavor appear to be on the horizon. Such technological change will continue to place pressure on the industry for policy changes. The impact of such changes on higher production cost areas will invariably be greater than the impact on lower cost areas. In the long run, the only way to survive such changes is on a basis of efficiency. In other words, the Texas dairy industry must be as efficient as that of other states. This will be difficult to accomplish, but it must be a basic goal of Texas milk producers. If our cost of production is significantly higher than producers in other states, a reduction of the Texas dairy industry can be anticipated.

What is the potential for competing with milk producers in Minnesota and Wisconsin? Texas producers in areas such as Hopkins County and Erath County have demonstrated the ability to produce and even expand milk production in the face of extremely adverse market conditions such as those that existed in the early 1970s. California producers have demonstrated the ability to compete and expand milk production under climatic conditions that are not substantially different than some areas of Texas.

A Proposed Industry Strategy

Need exists for a total industry effort to determine what can be done to make the Texas dairy industry stronger. Producers, cooperatives, processors, agribusiness, bankers, community leaders, and universities will need to be involved. Careful assessment is required to determine:

1. How the Texas dairy industry would be affected by various policy changes.
2. What the principle barriers are to improved efficiency and expanded production.
3. Ways to overcome the barriers to improved efficiency and expanded production.
4. The potential as an industry to improve marketing strategies and increase milk consumption. Market promotion and product development programs, such as those conducted by the dairy industry in California, should be investigated. Such fundamental questions as how to sell consumers fresh milk and how to increase ice cream and other dairy product consumption need careful evaluation.

Without such an effort, the Texas dairy industry will face competitive problems. We are not suggesting that Texas will decline in significance as a milk producing state. We are suggesting that a total industry effort is needed to preserve our position as the ninth largest milk producing state, or better yet, to move up to seventh or eighth.

Literature Cited

1. Berry, C. R., Gary C. Burton, and Ralph D. May, Relative Cost of Producing Grade A Milk in Central Arkansas, University of Arkansas, Agricultural Experiment Station Bulletin 841, October 1979.

2. Census of Agriculture, 1964, 1969 and 1974, Bureau of the Census, U.S. Department of Commerce.

3. Census of Agriculture, 1969 and 1974, Bureau of the Census, U.S. Department of Commerce.

4. Cook, Hugh L., Leo Blakley, Robert Jacobson, Ronald Knutson, Robert Milligan, and Robert Strain, The Dairy Subsectors of American Agriculture: Organization and Vertical Coordination. North Central Regional Research Publication 257, November 1978.

5. Costs of Producing Milk in the United States - Final 1977, Preliminary 1978 and Projections for 1979, USDA/ESCS, August 20, 1979 and Costs of Producing Milk in the United States - Final 1978, Preliminary 1979, and Projections for 1980, USDA/ESCS, July 1980.

6. Costs of Producing Milk in the United States - Final 1978, Preliminary 1979, and Projections for 1980, USDA/ESCS, July 1980.

7. Costs of Producing Milk in the United States - Final 1978, Preliminary 1979 and Projections for 1980, USDA/ESCS, July 1980 and Cost of Producing Milk in the United States - Final 1977, Preliminary 1978, and Projections for 1979, USDA/ESCS, August 20, 1979.

8. County Business Patterns, Bureau of the Census, U.S. Department of Commerce, 1970-78.

9. Dairy Products Annual Summary, USDA/ESCS, 1975-79 and Production of Manufactured Dairy Products, USDA/SRS, 1970-74.

10. Dairy Products Annual Summary, USDA/ESCS, 1975-79; Production of Manufactured Dairy Products, USDA/SRS, 1970-74; and Texas Dairy Statistics, USDA/ESCS, 1977-79.

11. Dairy Situation, USDA/ESCS, February 1964, March 1970, 1975, 1979, and 1980.

12. Dairy Situation, USDA/ESCS, March 1980.

13. Dairy Situation, USDA/ESCS, March 1980, and Federal Milk Order Market Statistics, USDA/AMS, 1970-79.

14. Dairy Situation, USDA/ESCS, March 1980 and Texas Dairy Statistics, USDA/ESCS, 1975 and 1979.

15. Dairy Situation, USDA/ESCS, March 1980; Texas Milk Production, USDA/ESCS, February 1962 and January 1967; and Texas Dairy Statistics, USDA/ESCS, 1972, 1978, and 1979.

16. Data obtained from individual cooperatives.

17. Fats and Oils Situation, USDA/ESCS, July 1979.

18. Federal Milk Order Market Administration, Dallas, Texas.

19. Federal Milk Order Market Statistics, USDA/AMA, 1970-79.

20. Federal Milk Order Market Statistics, USDA/AMA, 1979.

21. George, P. S. and G. A. King, Consumer Demand for Food Commodities in the United States with Projections for 1980, Giannini Foundation Monograph No. 26, March 1971.

22. Matulich, Scott C., "Efficiencies in Large-Scale Dairying: Incentives for Structural Change," American Journal of Agricultural Economics, 60(4): 642-647.

23. McGuire, David P. and Bernard F. Stanton, Are There Limits to Herd Size in New York Dairy Farming? Department of Agricultural Economics, Cornell University, A. E. Res. 79-16, August 1979.

24. Nelson, Paul E. and John Perrin, "Economic Effect of Federal Contributions to the U.S. School Lunch Program," ERS/AER 350, September 1976.

25. Survey of Current Business, Bureau of Economic Analysis, August 1979 and August 1980.

26. TDHIA Involvement, Texas Agricultural Extension Service, 1978, and unpublished data.

27. Texas A&M University, unpublished study.

28. Texas Dairy Statistics, Texas Crop and Livestock Reporting Service, 1970-79.

29. Texas Dairy Statistics, USDA/ESCS 1977 and 1978 and County Business Patterns, Bureau of the Census, U.S. Department of Commerce, 1970-78.

30. Texas Federal Order Market Administrator.

31. West, Donald A., "Food Expenditures by Food Stamp Participants and Nonparticipants," National Food Review 3, USDA, June 1978.