INFO SHEET

Veterinary Services

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Monitoring U.S. Milk Quality Using Bulk Tank Somatic Cell Counts, 1997

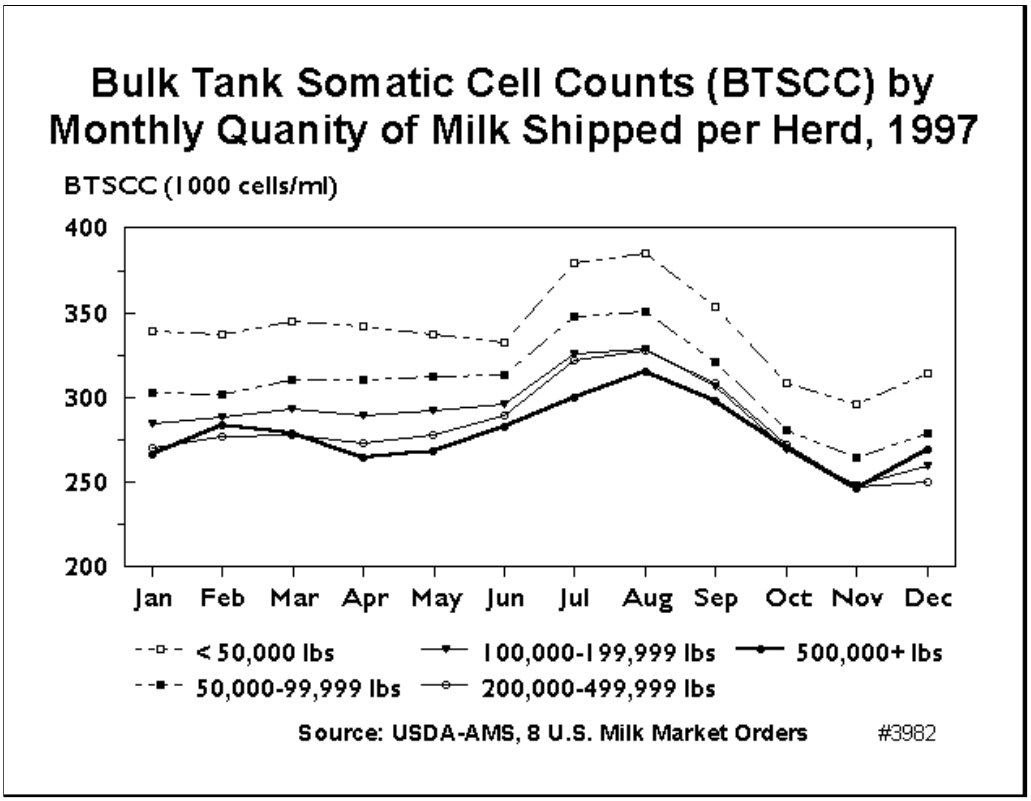
U.S. milk quality, as measured by bulk tank somatic cell counts (BTSCC), improves with increasing herd size and is lowest in dry regions and in the traditional dairy belt. Warm, humid areas produced milk with the highest BTSCC in 1997.

Bulk tank somatic cell counts is a measure of the number of white blood cells per ml of raw milk. BTSCC reflect the level of infection and resultant inflammation in the mammary gland of dairy cows associated with mastitis. Based on the USDA's National Animal Health Monitoring System Dairy '96 Study, when averaged across all herds, BTSCC in excess of 200,000 cell/ml lowered national milk production potential by 4 percent in 1995. BTSCC is also an indicator of milk quality as shelf life is reduced for high BTSCC milk and the processing quality and yield of some milk products from raw milk is reduced when somatic cell counts increase. While BTSCC are not a public health concern, reasons to monitor BTSCC include domestic consumer demand for high quality, milk processor need for high quality raw milk, to help improve cow udder health, and potential pressure from international markets for documentation of our dairy products' quality.

Methodology

The USDA's Centers for Epidemiology and Animal Health (CEAH), in a cooperative project with USDA's Agricultural Marketing Service (AMS) and the National Mastitis Council's Milk Quality Monitoring Committee, received data from seven federal milk marketing orders in 1997. Participating federal milk marketing orders collected milk quality data from dairy operations through dairy cooperatives as part of multiple component pricing. The participating orders provided the following monthly data electronically for each dairy producer: total pounds shipped, BTSCC, and percentages of protein, fat, and solids non-fat (SNF). BTSCC, protein, fat, and SNF each were averaged per month.

Fig. 1



Dairy producers in the seven orders comprised 43 percent of U.S. dairy producers with permits to ship milk. They shipped a total of 55.2 billion pounds of milk in 1997, equal to 35 percent of U.S. milk produced (Table 1). Over one-half of the milk produced in the traditional dairy belt (from New York to Minnesota, Figure 1) was shipped to a study-participating federal milk marketing order. The majority of this milk came from Minnesota, Wisconsin, Michigan, and Ohio. Over 90 percent of the monitored order milk for the Southern states came from Texas which had 96 percent of its milk shipped to a participating federal milk marketing order. No state dominated in the Northern Plains region which stretched from North Dakota southward to Kansas. Two-fifths of the milk from the Northern Plains was marketed through a participating federal milk marketing order. New Mexico, due to its dry climate and number of large dry lot herds, was classified as a separate region, and 89 percent of its milk production was marketed through cooperating milk marketing orders.[1]

Table 1. Milk Producers and Total Milk Production in the BTSCC Monitoring System, 1997

	Milk Producers			Milk Production		
Region/State	BTSCC Monitoring Program[1]	With Permits to Ship Grade A or B Milk[2]	Producers monitored	BTSCC Monitoring Program	Total	Milk Monitored
	(Number)		(Percent)	(Million Pounds)		(Percent)
			Traditional dairy belt			
IL	726	1,854	39.2	924	2,307	40
IN	1,662	2,757	60.3	1,742	2,189	79.6
IA	2,051	3,949	51.9	2,477	3,987	62.1
MI	2,713	4,039	67.2	4,955	5,410	91.6
MN	7,151	10,085	70.9	7,507	9,210	81.5
MO	169	2,861	5.9	187	2,365	7.9
NY	283	8,426	3.4	346	11,547	3
OH	3,425	5,160	66.4	3,946	4,415	89.4
PA	1,823	11,300	16.1	1,546	10,742	14.4
WI	18,890	23,890	79.1	20,059	22,368	89.7

	subtotal	38,893	74,321	52.3	43,689	74,540	58.6
				Northern Plains			
KS		330	858	38.5	339	1,285	26.4
NE		564	884	63.8	629	1,040	60.5
ND		297	950	31.3	275	702	39.2
SD		415	1,404	29.6	629	1,384	45.4
	subtotal	1,606	4,096	32.9	1,872	4,411	42.4
				Southern states			
KY		394	2,377	16.6	280	1,815	15.4
MD		75	897	8.4	51	1,332	3.8
TN		12	1,315	0.9	14	1,594	0.9
TX		1,455	1,518	95.8	5,551	5,768	96.2
VA		18	11,140	1.6	9	266	0.5
WV		144	195	73.8	141	266	53
	subtotal	2,098	7,442	28.2	6,046	12,634	47.9
							Western states
NM		142	154	92.2	3,570	4,011	89
BTSCC states		42,739	86,013	49.7	55,176	95,596	57.7
Other states		--	13,400	--	--	61,006	--
	Total[3]	42,739	99,413	43	55,176	165,602	35.2

1. [1] Number of producers shipping milk in July.

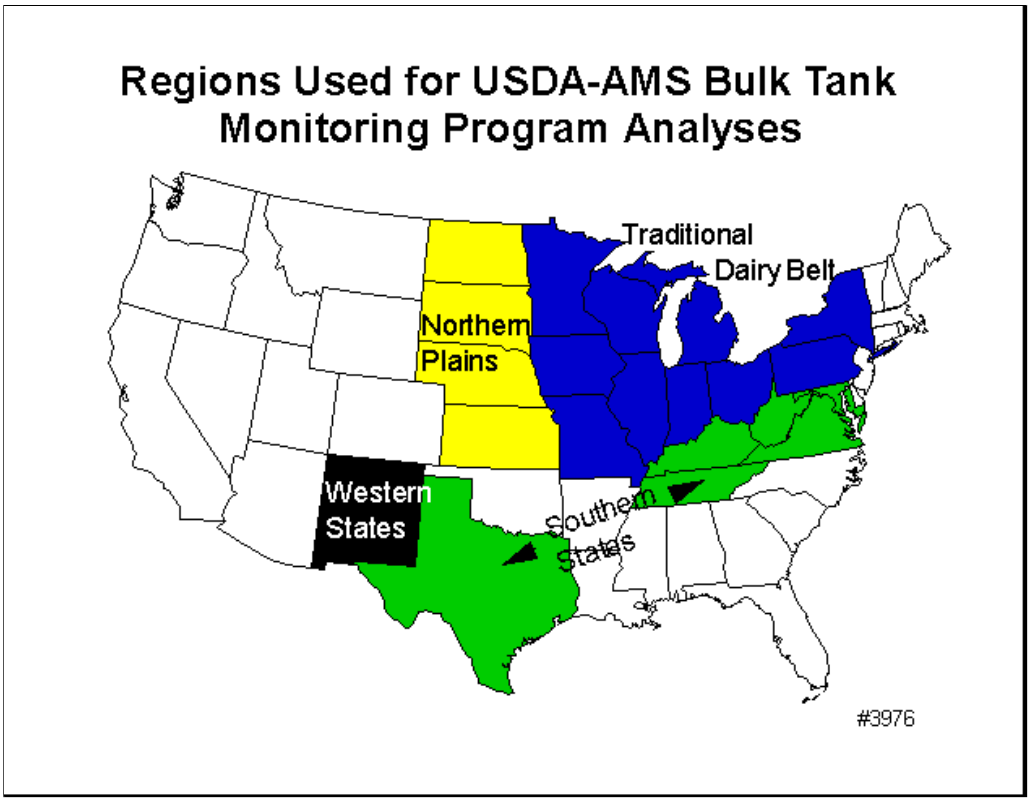
[2] Source: Olson, K. E. 1997. Dairy farm numbers drop 6.3 percent to 99,413. Hoard's Dairyman, October 25.

2. [3] Sum of parts may not equal totals due to rounding.

Seasonal and Yearly Trends

BTSCC peak during the summer months from June to September in participating market order regions with the the highest values in August (Figure 2). Average BTSCC from 1994 to 1997 was 297,000 cells/ml, while the month of August had an average BTSCC of 343,000 cells/ml or 15 percent above the 4-year mean. November had the lowest average BTSCC of 265,000 cells/ml, or 11 percent below the 4-year mean.

Fig. 2



Stress in general is thought to cause elevated somatic cell counts. University of Florida scientists[2] suggest heat stress and high humidity as reasons for somatic cell counts to increase during the summer months. First, heat stress may amplify the cow's susceptibility to infection by decreasing her resistance to mastitis-causing pathogens. Secondly, warm, humid weather favors the growth of mastitis-causing pathogens which increases the chances of pathogens entering the cow's udder.

Another way to measure seasonal trend is to compare percentages of herds and milk with BTSCC below 400,000 cells/ml. The European Union's upper limit of BTSCC is 400,000 cell/ml (geometric mean smoothed) while the United States' is 750,000 cells/ml (arithmetic mean). The European standard could become the international standard, and if so, the U.S. would have to meet it for milk products exported. The vast majority (over 70 percent each) of U.S. producers and milk are meeting the European standard, though these percentages decline during July and August when only 60 percent of our milk has BTSCC of 400,000 cells/ml or less (Figure 3). The best month is November when over 75 percent of the milk meets the European standard.

Fig. 3

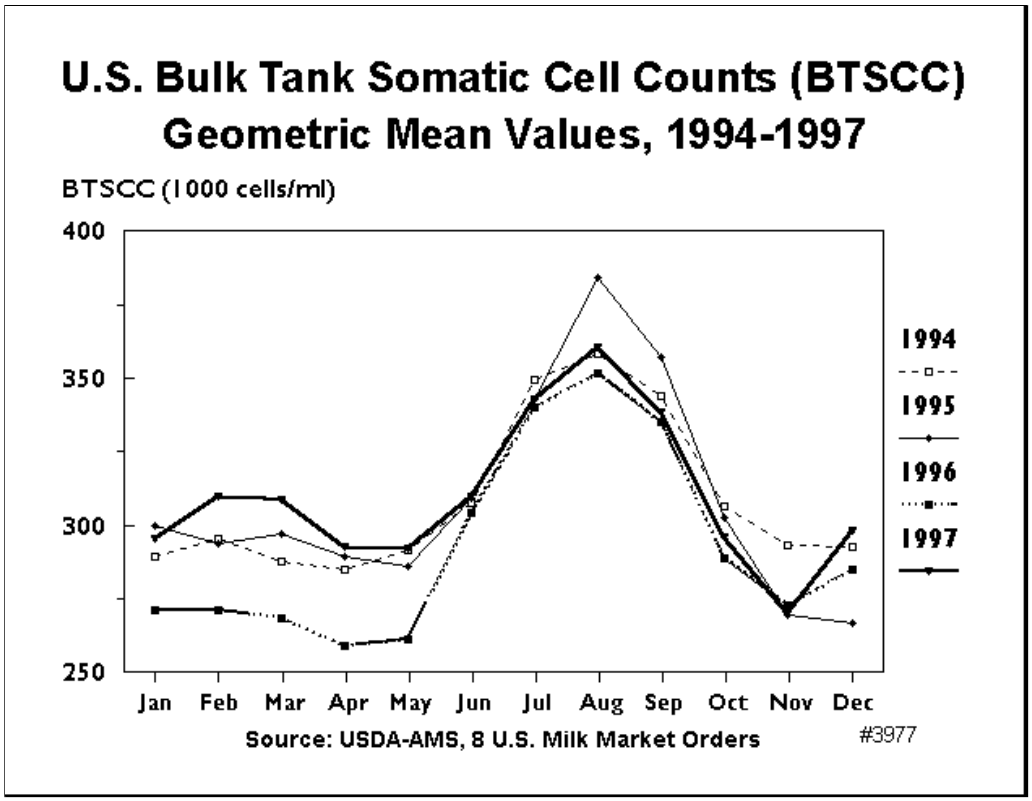
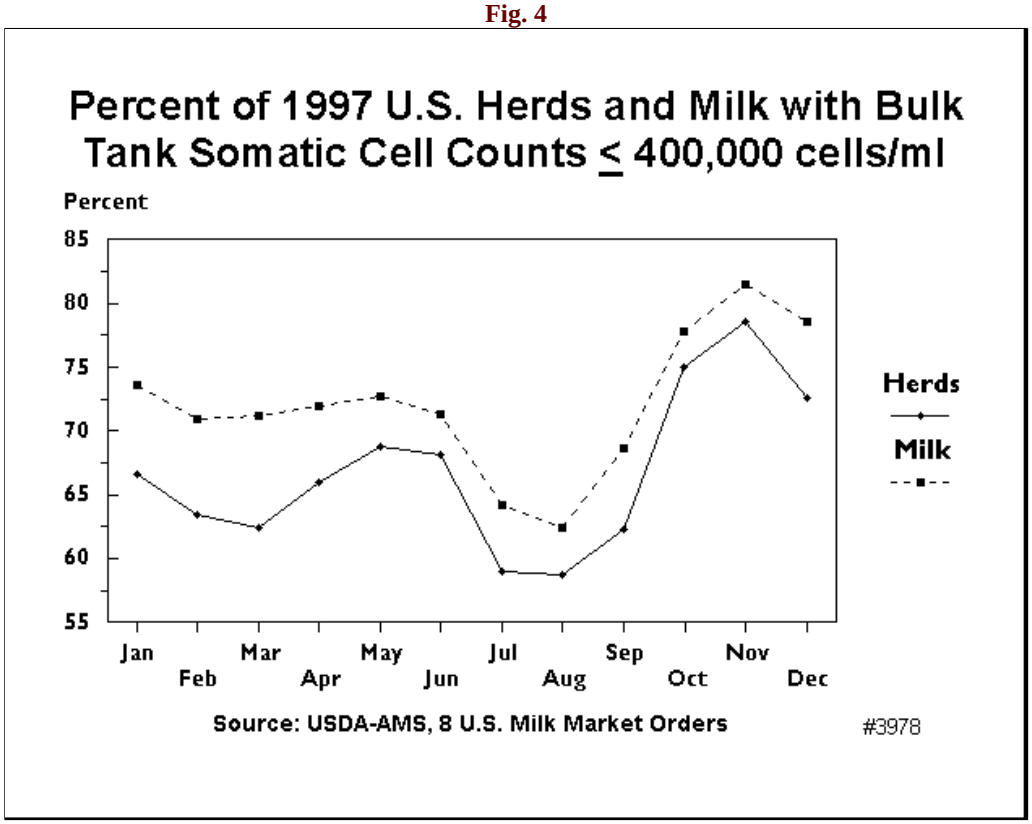


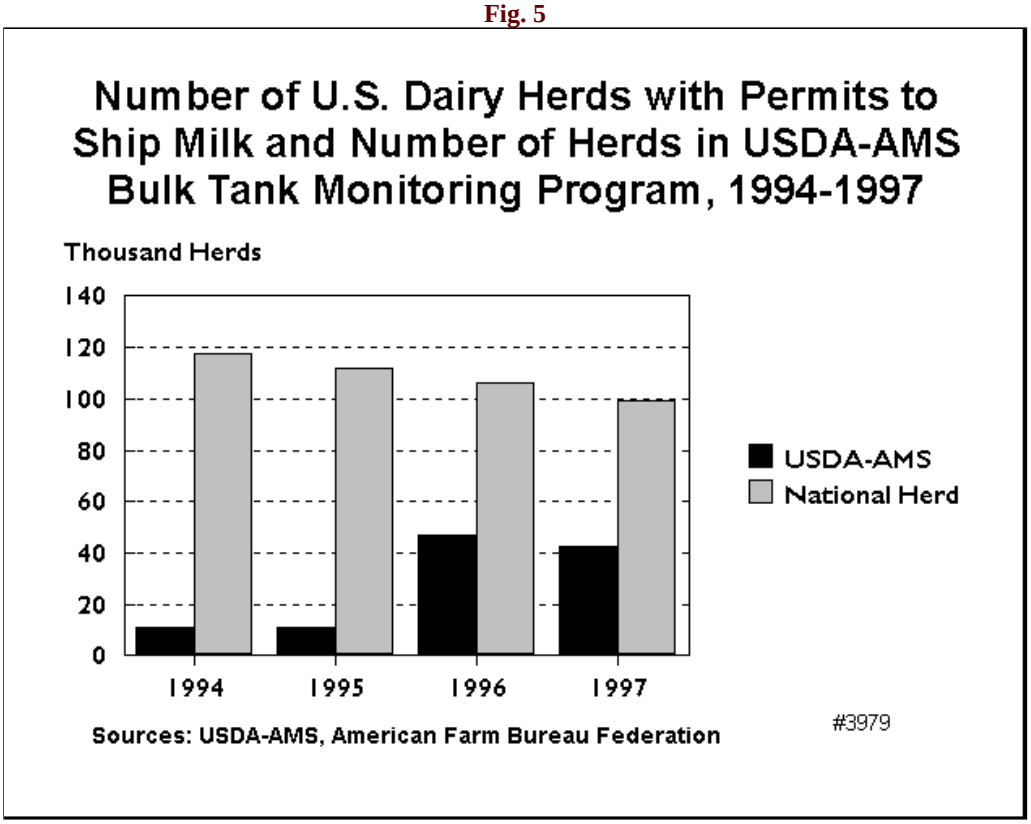
Fig. 4



Comparing across years to discern trends is difficult due to the large increase in number of farms and quantity of milk monitored in 1996 (Figures 4 and 5). In 1996, the number of participating orders increased from five to eight to include producers from the major milk-producing states of Michigan, Minnesota, and Wisconsin. As demonstrated in Figure 2, 1996 and 1997 had lower average BTSCC than 1994 and 1995, primarily due to the differences that occurred from July through December. BTSCC for 1996 and 1997 averaged 13,000 cells/ml less than for 1994 and 1995, and the difference was statistically significant. This difference could have been due in part to the additional milk being monitored. When the comparison is based on the nine states

(IN, KY, MD, NM, NY, OH, PA, TX, and WV) that had relatively consistent amount of milk monitored over the 4-year period, 1994, 1995, and 1997 had almost the same average BTSCC. The average BTSCC for 1996 was statistically lower than the other 3 years due to its lower scores during the first part of the year. Consequently, there doesn't seem to be a trend in BTSCC over the years.

Fig. 5



Regional and Herd Size Differences

Among the regions, New Mexico with its dry climate, had the lowest regional average BTSCC across all months, except for December, followed by the traditional dairy belt states and Northern Plains states (Figure 6). The Southern states, with their warmer and more humid climate, had the highest average BTSCC in 1997. Differences in BTSCC between regions were statistically significant.

Fig. 6

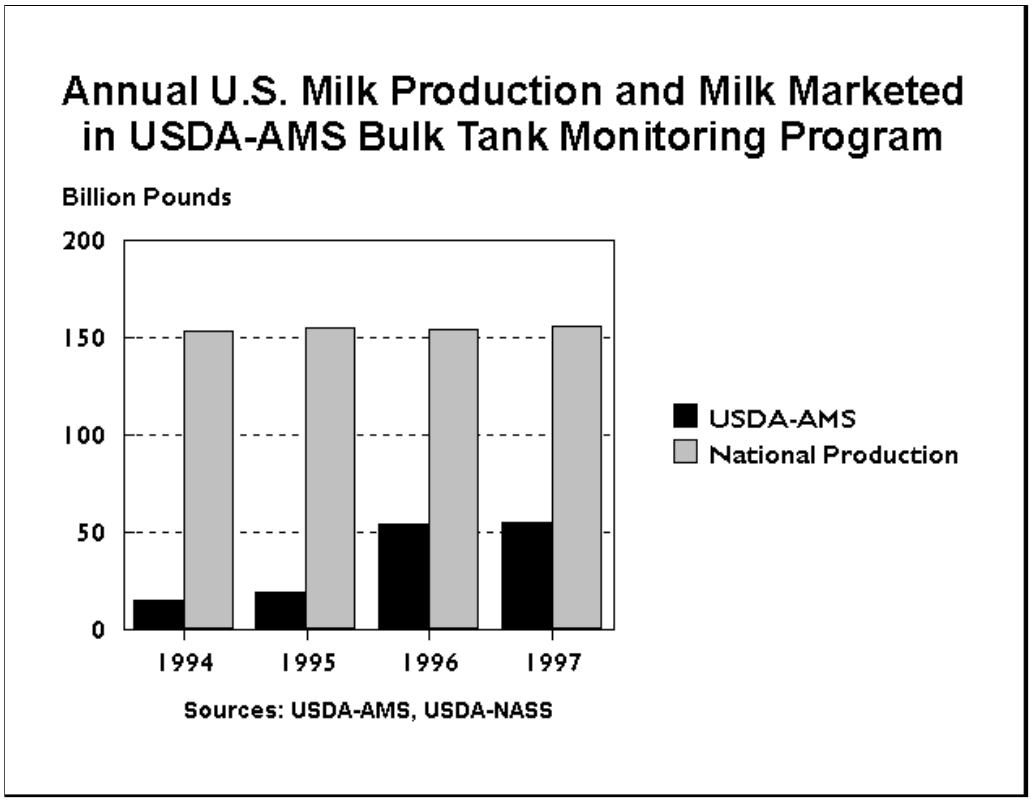
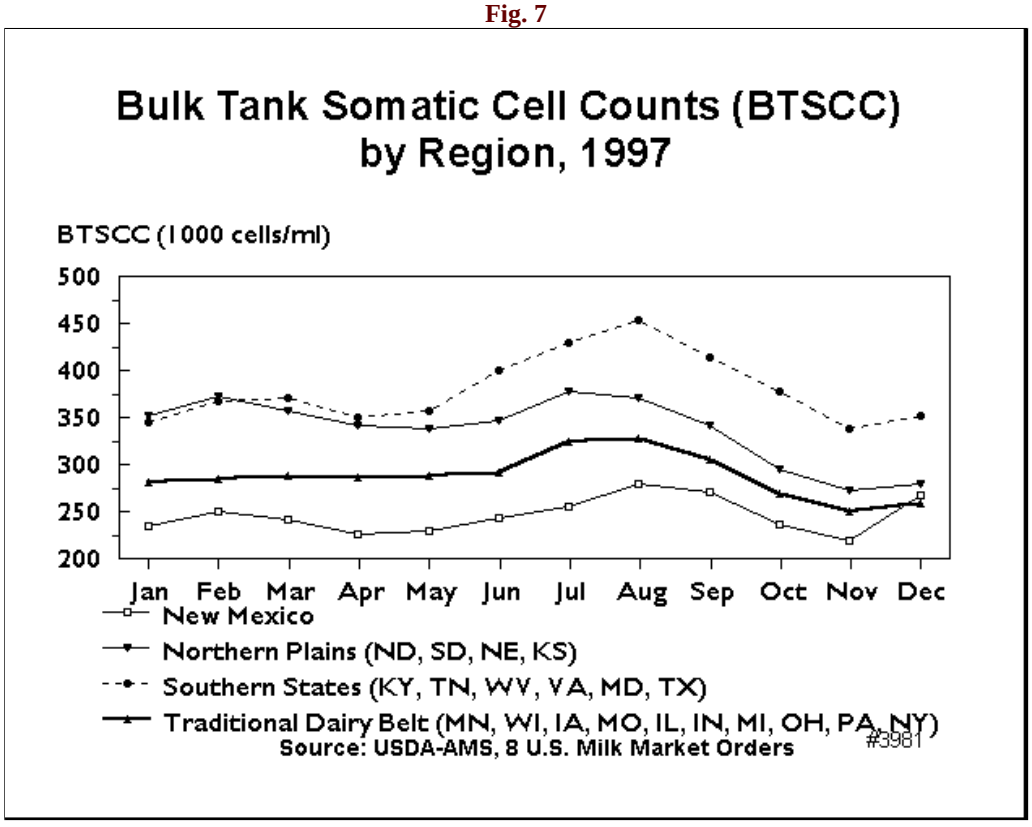


Fig. 7



As herd size (measured by pounds of milk shipped per month) increased, BTSCC decreased (Figure 7). Size categories were:

- less than 50,000 pounds (fewer than 36 cows),
- 50,000-99,999 pounds (36-71 cows),
- 100,000-199,999 pounds (71-142 cows),
- 200,000-499,999 pounds (142-355 cows), and

- 500,000 or more pounds (355 or more cows).

(Number of cows was based on a national average milk production of 16,915 pounds per year.[3])

The less than 50,000 pound category had the highest average BTSCC of 339,000 cells/ml., 10 percent greater then the next highest size group, the 50,000-99,999 pounds category. The 50,000-99,999 pound category average BTSCC was 6 percent greater than that for the 100,000-199,999 pound category, which in turn was 2 percent greater than the 200,000-499,999 pound category. These differences were statistically significant at $p \leq .05$. The difference between the 200,000-499,999 pound category and the 500,000 or more pound category was less than 2 percent and not statistically significant. Combining 1996 and 1997 data, the difference between the 200,000-499,999 pound category and the 500,000 or more pound category was statistically significant as the 500,000 or more pound category had much lower BTSCC from January to August. The relative ranking of the other categories remained unchanged for the combined years of 1996 and 1997.

Summary

BTSCC from milk marketing orders can provide a picture of the quality of our nation's milk supply. There is a seasonal trend in BTSCC as averages increased during the summer months. Because of limited data, it has been difficult to determine any yearly trend. However, one could predict a future decline based on the fact that larger herds, on average, had lower BTSCC than smaller herds and average herd size in the United States is increasing.

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1 Individual BTSCC were averaged using geometric means. The International Dairy Federation recommends reporting BRSCC average as geometric means as opposed to arithmetic means distributed normally, but tend to follow a lognormal distribution. International Dairy Federation, *Recommendations for Presentation of Mastitis-Related Data*, Bulletin 321, 1997.

2 J.K. Shearer and D.R. Bray. 1995. Maintaining udder health and milk quality during periods of hot weather. National Mastitis Council, Inc. Proceedings of 34th Annual Meeting.

3 USDA, Economic Research Service, *Agricultural Outlook*, table 14, August 1998.