Dairy Industry Trends in the West[1]

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2007

DAIRYING

Background

The U.S. dairy sector is experiencing a period of rapid change characterized by several major economic and institutional trends that have implications for dairy producers and environmental quality. U.S. dairy farms are becoming larger, but fewer in number with more animals per cropland acre and more scale efficient. This increased concentration creates potential for associated manure management problems, particularly in urban influenced areas. For example, the supply of nutrients in manure on farms or within a geographic unit, e.g. county, increasingly exceeds the nutrient requirements of crops grown there. Consequently, dairy producers face increased manure management costs due to the imposition of new animal feeding operation regulations. Another is an expansion of "urban influences" into formerly rural traditional dairy producing areas that can increase production costs and impose other constraints that impact dairy producers' efficiency.

It has been argued that one way in which these concerns can be partially addressed is through the use of pasture-based dairy operations, where animals are allowed to graze for varying periods, reducing the quantity of manure accumulated in confined areas and potentially reducing odor problems. Though pasture-based operations often yield lower milk production per cow, they are perceived to be more "natural" and environmentally friendly than are conventional systems.

An additional influence is also in evidence. This relates to the rapid annual growth rate in organic milk production in an era when overall milk consumption per capita in the United States continues to decline. According to Hoards Dairyman (Fall 2006), sales of organic milk are growing 26 percent a year, making it the fastest-growing sector of the U.S. beverage industry. Meanwhile, supply is only growing 15 percent a year. Though today's definition and practice of organic milk production is relatively "new," pasture-based technology is not new, as pasture-based systems can be argued to have been the traditional production method. It is recognized that the definition of a "pasture-based system" in one region may differ from that in another region due to climate and related forage, housing, and associated constraints.

In general, pasture-based dairies have struggled to remain economically competitive with larger, technically sophisticated conventional dairies because lower costs do not always offset lower output, especially when comparing typically smaller pasture-based operations with the emergent high-volume conventional operations. The price premium that organic dairies command may in many cases alter this calculus. Regardless, players

[1] Paper presented at the Annual Meetings of the American Association of Agricultural Economics, Portland, OR, July 28 – 31, 2007

in the organic segment will seek to maximize profit subject to the managerial, physical, and institutional constraints placed on it.
This paper poses two questions: given that dairy farms are becoming larger and fewer, with associated problems of manure management and urban encroachment:

1. Will dairies become larger?
2. Will or can pasture-based systems and/or organic dairies prove to be as efficient (or more efficient) than conventional dairies such that it will change these trends?

Characteristics of Western Dairying
Western dairies tend be larger in terms of the number of cows, more intensive and higher density (more cows per acre), on smaller acreage, and with a higher percentage of income coming from milk production (Figures 1 – 4). They are generally less reliant on pasture, and much more reliant on purchased feeds and concentrates, with a low percentage of acres dedicated to hay. What acreage they do have is used to grow alfalfa or other crops for silage (Figures 5 – 8). Finally, they exhibit higher than average milk production per cow, experience lower milk prices, and lower net farm income per cow and per hundredweight (Figures 9 – 12).

The ARMS data show that Western dairies tend to have lower labor, fuel and fertilizer costs, and overall lower variable costs of milk production than other regions of the U.S. In contrast however, fixed costs in the form of land are much higher than other areas of the U.S., mainly because of the price of land which are bid up by the alternative uses for land in the West, particularly in California (Figures 13 & 14).

A number of factors influence the continued growth of dairying in the West and particularly in California. These include a favorable climate, with warm, dry summers and little humidity; so that cows only need to be provided with simple shade fitted with water sprays as protection from the summer heat. There is an abundance of alternative, complementary crops that can be used as feed for dairy cows including citrus pulp, cotton seed, almond hulls, and other inexpensive by products of the West's extensive agriculture. Western states have been blessed in many ways by their relative geographic isolation and population explosion, ensuring that it always has sufficient capacity for increasing milk production, and ready markets in which to sell dairy products.

Another characteristic of Western dairying that is not often recognized is the long term investment timing and technology adoption that occurs as a result of dairies having to relocate because of population growth and urban encroachment. Dairies, particularly in California, have traditionally located reasonably close to urban centers. As population growth and urban expansion occurs, that land becomes increasingly more valuable for urban zoning and alternative uses. This has allowed dairy producers to sell their acreage at reasonably high prices and to relocate to other urban fringe areas. In doing so, new dairies are modern and technologically efficient and able to be more intensively farmed. Thus the problems of "over-production traps" so often experienced in Midwestern and Eastern dairies are rare in the West.

Finally, there are also a number of mitigating factors that could limit growth in the future. First, California and other Western states have a number of relatively strict environmental rules and regulations that have the effect of increasing the costs of dairying. It is no secret that the intensity of "California-style" dairying also has the potential to create problems of manure/waste concentration, resulting in a source of non-point pollution, particularly for water resources. These potential sources of pollution go hand in hand with the stricter environmental regulations and water policies that have been adopted. Western dairies are also susceptible to rapid urban encroachment due to population growth. To date, urban expansion has had some advantages for dairy operations located near expanding urban centers, as mentioned previously. But increasingly, counties are now establishing stricter permitting requirements that are making it increasingly more difficult for dairies to locate in certain areas.

Pasture-based dairying

Since most Western dairies are established as intensive dairy systems and rely on purchased feeds, high quality forages, silage, and supplemental concentrates, as well as available complementary feeds, pasture based dairying is not overly important, although there are areas where it is practiced widely. In flatter regions, pasture is usually irrigated, and thus does not rely on seasonal rainfall. Irrigation, where available, makes pasture production quite efficient and high yielding, and cows can successfully be pastured for up to 9 months of the year. In other areas, such as the coastal regions of the West Coast, where irrigation is not possible, pasture is useful for only about 3-5 months.

The availability of land that could be used for pasture may have a number of alternative uses that are more efficiently useful for other crops such as alfalfa production or for silage, thus decreasing the importance of pasture for dairying.

Pasture-based systems are often thought to be more efficient uses of resources for producing milk. In New Zealand for example, all dairying is pretty much pasture based, and they use an entirely different method of evaluating the efficiency of the system. They use milk produced per hectare as a measure of efficiency because they focus first on growing the pasture efficiently and milk production per cow becomes a secondary consideration. So a better comparison of these systems would be to compare cost of feed per unit of milk produced, or milk produced per dollar of feed.

Pasture-based dairying systems characteristically experience lower milk yields, and these are often thought to be offset by the lower feed costs associated with growing the pasture. In areas where pasture-based dairying is practiced in the Western U.S., there is little evidence to suggest that this is necessarily the case. For example, a comparison of the 2006 costs of milk production for California's North Coast, where there is extensive pasture based dairying, North Valley, where pasture based dairying has some significance, with South Valley, where there is virtually no pasture-based dairying at all, shows a number of interesting differences between pasture-based and conventional dairying. The overall picture is shown in Table 1.

North Coast dairies are clearly much smaller in terms of cow numbers, rely much more on pasture and less on concentrates and supplements, and experience lower milk production than do the other 2 regions. North Valley dairies tend to be a sort of cross between the pasture-based systems of the North Coast and the intensive dry-lot dairies of the South Valley. Note that while pasture is a feature of North Valley dairies, milk production and feeding regimens are much closer to South Valley characteristics. South Valley dairies are almost entirely dry-lot style dairies with little reliance on pasture, and much more reliance on dry roughage and concentrates.

Table 1: Comparison of Average Costs of Milk Production per cwt in 3 Regions of California, 2006

	North Coast	North Valley	South Valley
Average Cows per Herd	298	815	1,637
Ave Milk Sold/cow/month (cwt)	14.28	17.32	17.45
Percent of Total Calif. Milk	2.71%	36.34%	51.83%
	Feed Proportions (of total feed costs)		
Dry Roughage	38.6%	23.3%	26.1%
Wet Feed/Roughage	7.6%	20.0%	18.4%
Concentrates	47.9%	50.2%	50.9%
Minerals & Supplements	1.4%	6.3%	4.6%
Pasture	4.6%	0.2%	0.0%
	Variable Costs per cwt		
Total Feed Costs	$9.72	$7.42	$7.20
Total Hired Labor	$2.01	$1.69	$1.46
Herd Replacement	$2.13	$2.00	$2.06
Total Operating Costs	$3.20	$2.60	$2.82
Milk Marketing Costs	$0.62	$0.54	$0.48
Less: Misc. Income	$0.69	$0.78	$0.78
Total Cost/cwt	$16.99	$13.47	$13.25
Ave. Total Investment per cow	$2,248	$2,766	$3,023
Ave Total Investment per cwt	$157.42	$159.70	$173.24
Est. Total Costs per cwt	$174.42	$173.17	$186.49

Source: California Department of Food and Agriculture

Almost all major categories of costs in the pasture-based systems of the North Coast are higher than the other two regions. Importantly, note that feed costs per hundredweight are much higher on the North Coast than the other two regions, mainly because milk yields are so much lower. However, when total investments in the dairy operation are taken into account, estimated total costs of milk production per hundredweight are somewhat lower in the North Coast and North Valley regions than in the highly intensive South Valley region.

There is also a danger of underestimating the efficiency of these systems when the cost of milk production per hundredweight is used without taking into account the actual value of the milk produced. Cows in pasture-based systems tend to produce higher total solids in the form of fat and non-fat solids than cows in more intensive systems. Since all dairy producers are paid for their milk based on the total solids produced, a more accurate comparison should be made by adjusting milk yields for the solids produced.

Comparisons could be made by simply comparing costs per total solids (percent fat plus percent solids-not-fat) produced. A more accurate picture is gained by comparing costs per hundredweight of solids-corrected milk (SCM). The formula for solids-corrected milk is:

$$SCM = 13.3 * \text{lbs Fat} + 7.09 * \text{lbs SNF} - 0.081 * \text{lbs Milk}$$

Without going into too much detail, note that research has shown that total solids tend to be proportionately lower for higher yielding cows. As is well known, fat and SNF vary widely across systems by season, by breed and by feeding regimen. The relationship between milk production per hundredweight and milk production per hundredweight solids-corrected milk is shown in Figure 18.

The cost comparison from above has been adjusted for solids-corrected milk and reported in Table 2.

Table 2: Comparison of Average Costs of Milk Production per cwt Solids-Corrected Milk (SCM) in 3 Regions of California, 2006

	North Coast	North Valley	South Valley
Ave Milk Sold/cow/month (cwt)	14.28	17.32	17.45
Ave. Fat Test (%)	4.04	3.91	3.74
Ave. SNF test (%)	8.91	8.94	8.88
Total Solids (%)	12.95	12.85	12.62
Fat (lbs)	0.577	0.677	0.653
SNF (lbs)	1.272	1.548	1.550
Total Solids (lbs)	1.849	2.226	2.202
Solids Corrected Milk (SCM)	15.537	18.582	18.253
	Variable Costs per cwt		
Total Feed Costs	$8.93	$6.91	$6.88
Total Hired Labor	$1.85	$1.58	$1.40
Herd Replacement	$1.96	$1.86	$1.97
Total Operating Costs	$2.94	$2.43	$2.70
Milk Marketing Costs	$0.57	$0.50	$0.45
Less: Misc. Income	$0.63	$0.73	$0.74
Total Cost/cwt	$15.62	$12.56	$12.67
Ave. Total Investment per cow	$2,248	$2,766	$3,023
Ave Total Investment per cwt	$157.42	$159.70	$173.24
Est. Total Costs per cwt	$173.04	$172.26	$185.90

As hypothesized, average percentage fat and SNF tests and percentage total solids are somewhat higher in the pasture-based system of the North Coast, than in the North Valley and South Valley regions. However, the milk yields in the North Valley and the South Valley are proportionately higher such that the *absolute magnitudes* of fat, SNF and total solids are higher in the latter two regions. In addition, the levels of solids-corrected milk are also higher in the latter two regions. However, it is interesting to note

that while the South Valley exhibits higher average milk yields than the North Valley in Table 2 (17.45 cwt vs. 17.32 cwt), the adjustment for total solids indicates that the North Valley yields higher SCM than the South Valley (18.582 cwt vs. 18.253). When we use SCM yield to estimate costs of milk production, North Valley and South Valley costs are still lower than the pasture-based North Coast regions, but now North Valley appears to exhibit lower costs of production than the South Valley. In addition, the differences between the North Coast and the North Valley and between the North Coast and the South Valley are considerably reduced.

In summary, pasture-based systems have the *potential* to be more efficient than conventional dry-lot dairies, but conventional systems outpace them from the point of view of variable costs because of their ability to capture economies of size and scale.

Organic dairying in the west

To be approved under USDA's organic standards, milk must be 100 percent under continuous organic management for one year prior to delivery. Cows producing organic milk must be fed 100 percent organic feed, and there is zero tolerance for antibiotics and artificial stimulants. Parasiticides also cannot be used on a regular basis and require 90-day withdrawal times. There are to be no genetically modified organisms (GMOs) or their derivatives used, including chymosin (used in cheese making) and rbST. In addition, cows must have access to pasture. All organic operations must be certified and registered by a USDA approved agency.

Organic vs. conventional

Converting from conventional to organic production is a long-term commitment that needs to be carefully planned and executed to avoid the financial stress that can occur during the transition period. The fact that Western dairy producers rely on mostly purchased feeds and grow very little of their own feed (apart from pasture in some regions), means that organic dairy producers must find sources of organic supplemental feeds that satisfy the stipulated standards. These feeds often cost 25 – 50 percent more than conventional feeds. This is an important aspect of the differences between organic and conventional milk production, as will become clear from the survey data. Organic producers rely much more heavily on feeding pasture, and experience lower milk yields.

Since organic milk producers are prohibited from using drugs, prophylactic medication and growth stimulants or regulators, the problem of dealing with sick or ailing cows is much more complicated than it is for the conventional dairy producer. Organic producers have several ways of dealing with this problem. First, some natural medications such as aspirin, garlic and Echinacea are often used to combat common cow ailments. Second, because the best way to deal with sick cows is to prevent ailments in the first place, organic producers often scale back milk production, trying not to push the cows as hard as conventional producers might do to maximize milk production. As one producer put it "Cows are like cars, if you push them too hard, they break". This usually leads to a reduction in milk production of 10 – 20 percent. Third, organic producers often attempt to maintain high standards of cow comfort to provide a better environment for their cows so

that the possibilities of ailments like sub-clinical mastitis are reduced. This can lead to higher operating costs.

Since cows entering an organic dairy herd must be fed organic feeds at least one year prior to the taking of milk, most organic producers find it necessary to raise their own replacements organically, or to purchase specially raised organic cows. This often adds an additional 10 - 20 percent to the cost of replacement.

A significant cost for most organic producers is the cost of converting their dairies from conventional to organic. During this one-year transition period, organic producers are producing organic milk, but it can only be sold as conventional milk. The costs associated with this transition can only be recovered after the dairy has been certified organic.

Organic dairy producers are usually certified by an accredited certifying agency. In California, the cost of certifying an organic dairy herd may run anywhere from $2000 - $3500. In addition, pastures are also certified as organic. Organic dairy producers may also incur higher transportation costs and other small-market access costs. Thus, marketing organic milk also has some additional costs relative to conventional dairying.

With a planned reduction in milk production per cow, and assuming feed costs are about 50 percent of total costs, herd replacement about 15 percent, and operating costs about 12 percent, we might conservatively estimate that these additional costs would add about 15 - 20 percent to the total costs of an organic dairy relative to a conventional operation.

1999 California Survey of Organic Dairies

Table 3. Basic Data, 1999

	Conventional	Organic	Ratio
Yearly Cull Rate (%)	29%	25%	0.86
Milk Cow Hay Price ($/ton)	$135.20	$147.50	1.09*
Price of Concentrates ($/ton)	$156.94	$210.07	1.34***
Concentrates Fed (lbs./cow/day)	25.05	16.24	0.65***
Milk Sold (lbs/milk cow/day)	61.66	53.78	0.87*

One-tailed t-test significance: * = 10% level, ** = 5% level, *** = 1% level

1. Feed Costs

Organic producers must pay significantly higher prices for alfalfa hay and concentrates than conventional producers (Table 3). The higher prices paid for organic feed, however, do not necessarily translate into significantly higher feed costs, although they clearly have an influence (Table 4). Total feed costs for organic producers are only 5-6% higher than for conventional milk producers, and are not statistically significant, despite the fact that the price of organic hay and organic concentrates are significantly higher than conventional feeds. The only statistically significant difference between organic and conventional feed costs occurs in the cost of pasture.

Table 4. Feed Costs, 1999

	per cow per month		Per cwt	
	Conventional	Organic	Conventional	Organic

Dry Roughage	$31.29	$35.44	$1.98	$2.24
Wet Roughage	$14.30	$14.07	$0.89	$0.80
Concentrates	$51.55	$48.70	$3.24	$3.09
Pasture	$2.10	$6.66*	$0.14	$0.45*
Total Feed Costs	$99.25	$104.87	$6.25	$6.57

One-tailed t-test significance: * = 10% level, ** = 5% level, *** = 1% level

There are several reasons for this lack of significant differences between feed costs for organic and conventional operations. First, while organic hay and concentrate prices are much higher (9% and 34% respectively), it is clear that organic producers rely much more on pasture than on purchased feeds. This would account for the statistically significant differences in the costs of pasture. Second, as shown in Table 1, organic producers also appear to feed significantly smaller amounts of concentrates (64%) than do their conventional brethren, obviously preferring to rely more heavily on pasture. These results emphasize the important differences between organic and conventional milk production. Organic producers rely mostly on substituting pasture for high priced purchased and concentrate supplemental feeds to reduce the cost of producing organic milk.

2. Costs of Production.

The survey results indicate that the cost of organic milk production is about 10% higher than conventional milk production, although this difference is not statistically significant on a per cow basis, and is significant only at the 10% level on a per hundredweight basis (Table 5).

Table 5. Costs of Production, 1999

	Per cow per month		Per cwt	
	Conventional	Organic	Conventional	Organic
Feed Costs	$99.25	$104.87	$6.25	$6.57
Labor	$27.66	$31.05	$1.78	$1.95
Herd Replacement	$22.94	$28.41*	$1.44	$1.87**
Operating Costs	$32.39	$32.79	$2.05	$2.14
Interest Expenses	$20.30	$11.57**	$1.29	$0.75**
Depreciation	$6.53	$10.95***	$0.41	$0.68***
Taxes & Insurance	$1.40	$3.60***	$0.09	$0.24***
Less – Misc. Income	-$3.72	-$3.27	-$0.24	-$0.21
Transition Costs	$0.00	$5.34	$0.00	$0.20
Total Costs per cow	$206.74	$225.32	$13.07	$14.19*

One-tailed t-test significance: * = 10% level, ** = 5% level, *** = 1% level

Miscellaneous income is the additional income derived from the sale of drop calves and the sale of manure, and is reported as part of the costs of production in order to comply with the way in which the CDFA report their statistics, which are used here for comparison.

Labor Costs

Labor costs are expected to be slightly higher on organic operations. For example, one major source of increased labor costs is the man-hours required to remove things like weeds and thistles from pastures by hand because organic producers are prohibited from

using herbicides in their fields. However, labor costs for organic dairies in our survey are rather disparate among the survey participants. About half of the participants had higher than normal labor costs because they simply paid higher wages. The other half of the survey participants had lower than normal costs because they did not engage much additional labor at all. They were small, family-run enterprises.

Herd Replacement Costs

As originally hypothesized, herd replacement costs are significantly higher for organic producers because replacement heifers must be raised organically, or must be purchased from specialized organic heifer breeders. Most organic producers report paying about 15 – 20% more for organically raised heifers, although the survey results show that replacement costs increase by about 24% on a per cow basis and 30% on a per hundredweight basis (Table 5). However, there is some evidence that these increased costs are offset somewhat by the fact that organic producers have a lower rate of culling and replacement than do conventional producers. Organic producers do not push their cows as hard as conventional producers do to maximize milk production. This, in turn, means that organic cows remain longer in the herd, and thus reduce the incidence of culling and replacement.

Operating Costs

Operating costs include utilities, supplies, veterinary, repairs and maintenance, hired services, tractors, etc. Despite the fact that some operating costs for organic operations may be higher than for conventional enterprises because of a focus on cow comfort, among other things, some costs are also lower. Veterinary and medicine costs, for example, are much lower on organic dairies than on conventional operations, while many other operating expenses are about the same. Overall, operating costs on both organic and conventional dairies are about the same.

Interest, Taxes & Insurance Costs

Interestingly, the results show that interest expenses for organic producers are almost half that for conventional producers. This may be an anomaly in the survey results and some of the difference can be explained by the way CDFA measure these costs. Taxes and insurance expenses for organic producers are more than double those of conventional producers. This difference may be explained by a number of factors. The reported tax and insurance expenses for conventional producers may be lower because of the way they are calculated[2].

Transition Costs

Dairy producers who decide to convert their operations from conventional to organic must endure a period of transition whereby they must feed and operate as if they are

[2] In the CDFA Feedback reports used to calculate the costs of conventional dairying, tax and insurance expenses are reported at a constant $1.88 per cow per month for the North Bay and $1.23 per cow per month for the North Valley, regardless of the size of the enterprise or facilities, or any of a number of other factors that influence tax and insurance expenses. By contrast, tax and insurance expenses reported in the results of the organic survey are actual expenses, and vary from enterprise to enterprise.

organic, but can only get conventional prices for their milk. These costs must be taken into account because they are an important aspect of the financial wellbeing of the enterprise.

Although we inquired about transition costs in our survey of organic dairies, most producers did not specifically account for these costs. The costs associated with converting from conventional to organic include the increased costs of feeding, and the other costs of organic dairy operation outlined above, including a lower yield of milk. To estimate these costs, it is assumed here that each dairy incurred the same costs as an organic dairy, but received only the conventional price for their milk. The cash costs associated with transition from conventional to organic are assumed to be exactly the same as borrowing the difference in net farm income from a bank, and repaying the loan at 10 percent interest over a period of 6 years. (Most financial institutions contacted about these rates specified loans ranging from 3 - 8 years, at interest rates ranging from 8 – 12 percent). The estimated average cost associated with transition in 1999 is $288.25 per cow, or about $0.92 per hundredweight of milk. Amortized over a 6-year period at 10%, the cost is $5.34 per cow per month, or about $0.20 per cwt. These costs are therefore added into the calculations of total costs (Table 5) and for the net farm income calculations below.

In summary then, our results show that the cost of production on a per cow or a per hundredweight basis is about 10% higher for organic producers than for conventional producers. While the differences are not strongly statistically significant, the differences appear to be due to reduced milk production, slightly higher feed costs, slightly higher average labor costs, significantly higher herd replacement costs, and significant transition costs.

Net Farm Income

Net Farm Income (gross revenues minus total costs of production) for organic farms was more than twice that for conventional dairies on both per hundredweight basis and per cow basis in 1999 (Table 6), mostly because of the higher prices paid to organic producers for their milk. Organic producers are paid a fixed price per hundredweight for organic milk and the price does not vary monthly. These prices are determined by the organic creameries that purchase the milk. In contrast, conventional producers are paid a blend price, determined by national markets for butter and cheese, which varies, sometimes dramatically, each month. In previous years, such as 1998, when average blend prices paid for conventional milk were higher, these differences in net farm income would not be as dramatic. In 1999, average blend prices for milk in California were slightly higher than the average for the 8-year period 1994 – 2001.

Table 6. Net Farm Income per Month, 1999

	Conventional	Organic	Ratio
Ave. blend price per cwt.	$14.16	$18.03	1.27***
Less marketing costs/cwt.	$0.51	$1.50	2.97***
= Net price per cwt.	$13.65	$16.53	1.21***
Times cwt. of milk sold	16.06	15.27	0.95

= Net receipts per cow	$219.22	$252.41	1.12*
Less total cost per cow	$206.74	$225.32	1.09
= Net income per cow	$12.48	$27.09	2.34*
Divided by cwt. of milk sold	16.06	15.27	0.95
= Net income per cwt.	$0.77	$1.77	2.47**

One-tailed t-test significance: * = 10% level, ** = 5% level, *** = 1% level

Marketing costs for organic producers are much higher because of transportation costs and additional costs associated with organic certification. In addition, milk yields are lower for reasons referred to previously. These two factors bring gross income (or net receipts) per cow much closer together for the two groups, (net receipts per cow are only 16% higher for organic producers than for conventional) emphasizing the fact that the higher prices paid to organic milk producers may be justified on the basis of organic milk supply.

Statewide Comparison of Costs

The costs of organic milk production are 19 percent higher than average statewide cost of conventional milk production on a per cow basis, and 23 percent higher on a per hundredweight basis. Labor costs, interest expenses and depreciation costs for statewide conventional milk production are lower than those estimated from the regional feedback reports, while herd replacement costs and operating costs on a per cow basis are higher.

A comparison of net farm income between organic and conventional dairies using statewide average costs shows that, despite the higher prices paid for organic milk, average net farm income is *lower* for organic production than for conventional milk. Net farm income for organic production on a per cow basis is only 75% that of average statewide conventional milk production, and only 84% on a net income per hundredweight basis.

Conclusions

Organic milk production in California is a very small, but rapidly growing segment of the dairy industry. Depending on the continued demand for organic milk and dairy products, organic milk production offers a viable alternative to smaller production units who cannot, or do not wish to compete in the conventional milk market on the basis of economies of size. For the producer contemplating a switch, there are several aspects of organic milk production that should be taken into consideration.

First, almost all of the higher costs associated with organic milk production appear to be due to the mandatory rules that circumscribe organic milk production. The most important of these higher costs is the cost of feed, which comprise about half of the total costs of milk production. Organic supplementary feeds usually cost 25 – 50 percent more than conventional feeds. However, most organic dairy producers have managed to overcome what would otherwise be prohibitively higher feed costs by substituting pasture as the main feed. While substituting pasture for higher cost organic supplementary feeds reduces the cost of organic milk production, it also reduces milk production per cow.

Second, the lower milk yields experienced by feeding pasture have two complementary advantages, apart from lower feed costs. One advantage is that the cows are not pushed to maximize milk production, and therefore tend to remain healthier than their conventional cousins. Another advantage is that the cows tend to remain productive for a longer period of time, thus reducing the need to cull and replace at the same pace that conventional dairy operations do. This in turn reduces herd replacement costs.

Third, other mandatory items that increase the costs of organic dairying such as certification and licensing costs, small market transportation costs, and the opportunity costs associated with not being able to use conventional medicines on sick or ailing cows are relatively small in the whole scheme of total costs. However, it should be recognized that these costs do add up and contribute to the overall increased costs of organic dairying. Transition costs are mandatory, and they are significant, although for most producers, the amortized loan amounts to only 2 –3% of total costs.

Finally, despite the higher costs and lower milk yield, the higher, fixed price per hundredweight that is paid for organic milk does allow organic dairy producers to increase profitability compared to their same-size, regional neighbors, but does not necessarily increase the overall profitability of milk production compared to the statewide average dairy producer.

Limits to size of operation

Will dairies in the West get larger? Can pasture-based and/or organic dairying become as efficient, or more efficient, than conventional dairies such that they provide a competitive element to the growth in the size of conventional dairies?

There seems to be no end to the size of conventional operations that western dairies can handle, save share managerial ability. Even managerial ability could be adjusted to handle operations of more than 10,000 cows. So the limits appear to be determined mainly by physical capacity, including the ability to handle manure efficiently. New breeding technologies such as *in vitro* fertilization, cloning and transgenics also appear to favor the ability of dairy operations to become larger, rather than limiting it.

Pasture based dairying and organic operations appear to be limited in size by the very nature of the operation. The physical ability to handle and manage large numbers of cows when they require movement currently appears to limit the number of cows that one operation can handle. This limitation is a major constraint in capturing the size and scale economies that appear to be driving conventional dairies to larger size. In addition, the recent revocation of a large California organic dairy's registration because of their inability to demonstrate that cows have access to pasture puts more limitations on the ability of organic dairies to capture size and scale economies.

While the competitiveness of conventional dairying appears to be associated with capturing economies of size and scale, pasture-based systems and organic operations appear to be limited in capturing these same size and scale economies, and therefore their competitiveness appears to be associated with the ability to grow pasture efficiently, such

that they can achieve costs of production efficiencies similar to those of the large conventional dairies.

The connection between efficiency and profitability depends on how "efficiency" is measured. Previous studies do not appear to have taken into account the fat and SNF yields associated with intensive conventional systems vs. pasture-based systems. The assumption is that absolute milk yield is the only parameter to be taken into account. The use of solids-corrected milk

The problems associated with larger sized conventional operations (manure management and urban encroachment) may also be overcome by means other than focusing on pasture-based and organic systems. For example many large conventional dairy operations are now looking at more efficient ways of disposing of manure, including methods of turning it into energy production. Manure management problems can now be addressed through new technologies associated with efficient disposal of manure via aerobic or anaerobic systems.

Finally, urban encroachment is also a potential problem, but at least up until recently, as mentioned previously, has also had positive aspects associated with the forced relocation of dairies. There does appear to be any good measure of the potential for urban encroachment as a disruptive force to dairying.