

# Factors Affecting Profitability of California Dairies

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## Summary

- Besides milk price, milk yield is one of the most important factors affecting profitability of California dairies.
- Higher milk yield maximized milk income in high milk price years and minimized losses in low milk price years.
- Larger herds are more consistent but not necessarily more profitable.
- At similar milk yields, herds milked 2X or 3X had similar profitability.
- Management decisions based on sound research provide for more profit.
- Focusing all management decisions on reducing feed cost or total cost compromise the financial position of the operation if that decision affects any of the variables that support high milk production.

## Introduction

In the last ten years milk price volatility has increased tremendously. Frequent milk price peaks and valleys have become repetitive trends over time in the dairy industry. During times of high milk prices, dairy owners are quite satisfied but when prices plummet, many dairy owners quickly become quite stressed due to a compromised financial position. As you can see in Figure 1, there have been four periods of stress in the last eight years in the western dairy industry. Three of them have been due to low milk prices and the last one has been due to a high feed price.

This extreme market volatility has resulted in many dairy owners putting a renewed emphasis on cutting costs whenever and wherever possible. Cutting costs is generally a good idea provided milk yield is not sacrificed. Any cost-cutting, management or feeding decision made that lowers milk yield is likely to decrease the profitability of the herd. Reducing milk output in the herd has direct consequences on the financial position of many areas of the operation.

Many dairy owners have taken drastic measures to cut costs during low milk prices which have occurred over the past couple of years. The effect of these drastic cost-cutting measures on the financial position of the dairy was likely appealing at first glance. However, the ramifications of these cost-cutting decisions on the herd performance and ultimately the financial position of the dairy needs to be considered but data demonstrating these cause and effect relationships was largely unavailable.

For over 50 years, the California Department of Food and Agriculture (CADFA) has been collecting cost of production information from several dairies across the state of California on a quarterly basis. Their analysis reports the average cost of production for individual dairies, a comparison of these dairies within their region and across the state and compares it to the prior year.

## Objective

Our objective was to collaborate with the CADFA to evaluate the cost of production on California dairies using regression analyses to find financial trends that could lead to improved profitability within the CA dairy industry.

## Methodology

Data was acquired from the CADFA which consisted of 166 herds for the year 2006 and 148 herds for the year 2007. This represents nearly 8% of the herds in California and close 200,000 dairy cows. The database was divided into four California regions, North Coast, North Valley, South Valley and Southern California. Organic herds were excluded from the dataset due to differences in pricing relative to conventional dairies in the state. Herds were categorized as Holsteins, Jerseys and Crossbreds. The herd size analyses included both lactating and dry cows.

Profit on these dairies was defined as milk income. Milk income consisted of the mailbox price paid to each dairy less the total cost of producing milk for each dairy. The total cost included feed cost (forage, concentrate and supplements), labor cost, herd replacement cost (value of cows entering the herd less the total receipts for the same number of cows culled and dead), operating cost (utilities, supplies, veterinarian, nutritionist, medicine, outside services, repairs and maintenance, bedding, manure haul, fuel and oil, interest, insurance, taxes, depreciation and miscellaneous), and milk marketing cost.

The total cost did not include management costs (manager's salary) since manager salaries are quite variable. Heifer replacement costs were accounted as a separate enterprise and were not used in the dataset. Income from the sale of heifer replacements and bulls was also excluded to further unify the data set, removing income from sale of genetics.

Dry matter intake was calculated as the amount of feed dry matter provided to the cows (orts or weigh-backs were not measured). Solids-corrected milk was calculated to 3.5% milk fat and 3.0% milk protein content. Feed efficiency was calculated using the average solids-corrected milk divided by average dry matter intake for the herd.

Each point in the figures below represents the income or cost of a single dairy for the year of analysis. The data were analyzed by fitting regression lines to the data points represented under each category. The best curve fit (highest  $R^2$ ) for a particular set of variables was utilized. No statistical analysis was performed as our main objective was to look only for trends in the dataset.

### **Relationship Between Milk Yield and Profitability**

Each variable was analyzed for the year 2006 and 2007 (Figure 2). Total cost/cow/year increased in all breeds as milk yield increased. The range for total cost in 2006 was \$1,500 to \$3,500/cow/year. Total cost/cow/year increased \$500 in 2007, ranging from \$2,000 to \$4,000/cow/year. In 2006, Holstein herds milking between 60-65 lbs/day averaged \$2,582/cow/year while high producing herds (>80 lbs/day) averaged \$2,972/cow/year. In 2007, Holstein herds milking between 60-65 lbs/day averaged \$2,780/cow/year while herds producing >80 lbs/day averaged \$3,483/cow/year.

There was a negative trend between total cost and milk yield when analyzed on a hundred-weight (cwt) basis. As milk yield increased, total cost/cwt decreased in all breeds. In 2006, Holstein herds milking between 60-65 lbs/day averaged \$13.17/cwt while herds >80 lbs/day averaged \$11.19/cwt. In 2007, Holstein herds milking between 60-65 lbs/day averaged \$13.93/cwt while herds producing >80 lbs/day averaged \$13.01/cwt. This data indicates that even though higher producing herds within each breed have higher cost/cow than lower producing herds, high producing herds had lower cost/cwt of milk produced.

The milk mailbox price in 2006 was quite low, averaging \$11.46/cwt for the Holsteins herds. However milk rebounded to an average of \$17.69/cwt in 2007. The relationship between milk yield and milk income/cow/year in 2006 was weak. However, there was a stronger trend between the two variables in 2007,

milk income/cow/year increased as milk yield increased. More consistent trends were observed when total cost and milk income/cow were analyzed on a hundred-weight basis. As milk yield increased, total cost/cwt decreased and milk income/cwt increased regardless of year, breed or milk price.

Milk income/cwt ranged from -\$6.00/cwt to \$1.50/cwt in 2006 and from -\$2.00/cwt to \$7.00/cwt in 2007. Most herds had a negative milk income/cwt in 2006; however income losses were minimized in herds with greater milk yield. In fact, Holstein herds milking between 60-65 lbs/day averaged (\$1.80) loss/cwt while high producing herds (>80 lbs/day) averaged \$0.21/cwt, even though milk price averaged \$11.46/cwt during 2006. In 2007, most herds had a positive milk income/cwt with higher producing herds generally yielding the highest milk incomes. Holstein herds milking between 60-65 lbs/day averaged \$3.59/cwt while herds producing >80 lbs/day averaged \$4.30/cwt. This indicates the importance of maintaining high milk yield even when low milk prices are experienced. High producing herds minimize their losses in low milk price years and maximize their returns in high milk price years.

### **The Relationship Between Milk Income, Feed Cost, and Total Cost**

During low milk price years, dairy owners rely more heavily on nutritionists to take drastic measures to reduce feed cost/cow/day. Milk yield and composition, herd health, reproductive performance and other factors are derived from nutrients ingested by the cow. Nutritional advisors are always striving to determine how to reduce feed cost without sacrificing herd performance. Using the data provided by CADFA, we were able to examine the relationship between feed cost/cow/year and milk income/cow/year as an indicator of profitability.

As expected, regardless of breed, higher milk yields were accompanied by greater feed cost/cow/year. Feed cost/cow/year ranged from \$1,000 to \$2,000 in 2006 and from \$1,250 to \$2,250 in 2007, a \$250/cow increase from 2006 to 2007 representing half of the total cost/cow/year increase of \$500 as previously noted. In 2006, Holstein herds milking between 60-65 lbs/day averaged \$1,428/cow/year while high producing herds (>80 lbs/day) averaged \$1,704/cow/year. In 2007, Holstein herds milking between 60-65 lbs/day averaged \$1,618/cow/year while herds producing >80 lbs/day averaged \$1,995/cow/year. The highest producing herds were generally the most expensive herds to feed on a per cow basis within each breed. However, when analyzed on a feed cost/cwt of milk produced, the highest producing herds had the lowest feed cost/cwt. Feed cost/cwt ranged from \$5.00 to \$8.25 in 2006 and from \$6.00 to \$8.50 in 2007.

When milk price is low, it is not uncommon to see dairies focus on reducing feed cost/cow as a means to reduce total cost. Our analysis indicates no such relationship exists when comparing milk income/cow/year and feed cost/cow/year. In addition, there was no relationship between total cost/cow/year and milk income/cow/year among all breeds. However, there was a strong relationship (average  $R^2=0.76$  for all breeds and both years) between milk income/cow/year and total cost/cwt. Decreasing total cost/cwt of milk increased milk income/cow/year in both 2006 and 2007 among all breeds. This indicates that when making a decision to change rations at any point in time, during high or low milk prices, one should take into consideration how this decision affects milk production.

### **Relationship Between Herd Size and Profitability**

Larger herds can often capitalize on economies of scale by diluting costs of production. Herd size in this data set ranged from 100 to 4,600 cows. Figure 3 shows the relationship between total cost/cow/year and herd size. There was no apparent relationship between these two variables for Holsteins and crossbreds. However, as Jersey herds increased in size they had a higher cost/cow/year. One other noteworthy observation

is that the relationship is a funnel-type, indicating a great deal of variability and a wider range of cost/cow/year in small herds relative to the larger herds. As herds become larger they seem to become more consistent.

When total cost/cwt of milk was regressed against herd size there was a slight trend toward lower total cost/cwt as herd size increased for Jersey and crossbred herds but not Holstein herds. This is likely due to the higher milk yields in the color breed herds as herd size increased. Holstein herds had similar milk yield across herd size, although there was more variability in the smaller herds relative to the larger Holstein herds. Herd size explained only 7% of the reduction in total cost/cwt of milk.

There was no relationship between feed cost/cow/year and herd size in any of the breeds. However, regressing feed cost/cwt against herd size resulted in a weak, negative trend for Holstein herds and a strong, negative relationship among color breeds. As herds become larger they had lower feed cost/cwt of milk produced. This is likely a result of the higher milk yield in the larger color breed herds.

### **Impact of Feed Efficiency on Profitability**

In order to validate the feed intake data, dry matter intake was regressed on milk yield. There was a strong, positive relationship (average  $R^2=0.78$  for all breeds and both years) between dry matter intake and milk yield. Herds producing around 60 lbs of milk/day had dry matter intakes between 46 to 51 lbs/day while herds producing 80 lbs of milk/day had dry matter intakes between 54 to 58 lbs/day.

Feed efficiency had a strong relationship with milk yield (average  $R^2=0.71$  for all breeds and both years). As milk yield increased feed efficiency increased. Feed efficiency of Holstein herds ranged from 1.0 to 1.6, Crossbred herds from 1.2 to 1.5 and Jersey herds from 1.35 to 1.65. There was a positive relationship between milk income/cwt of milk produced to feed efficiency. Increasing feed efficiency increased milk income/cwt in all breeds and both years. There was a negative relationship between feed cost/cwt and feed efficiency. Increasing feed efficiency decreased feed cost/cwt in all breeds and both years 2006 and 2007. For example, in Holsteins, lower feed efficiencies (~1.1) had a feed cost/cwt near \$7.0 while higher feed efficiencies (~1.5) had feed cost/cwt between \$5.0 and \$6.0 in 2006 and increased in 2007 by \$1.0 for both low and high feed efficiency herds. Clearly, one way of reducing feed cost is improving the feed efficiency of the herd and careful consideration should be given when making changes in nutrition or management factors that affect feed efficiency.

### **Two Versus Three Times Per Day Milking**

The analysis for 2X vs. 3X milking includes only the Holsteins herds as there was not enough color breed herds milked 3X. Figure 4 shows the relationship between total cost/cwt of milk and milk yield. On average, herds milked 2X produced 68 lbs/day of milk while herds milked 3X produced 78 lbs/day. As milk yield increased total cost/cwt decreased in both years. Herds milked 3X clustered to the right of the graphs indicating the higher milk yield. As a group in this analysis, herds milked 3X had lower total cost than herds milked 2X. However, if one considers only herds producing over 70 lbs of milk/day, total cost/cwt of 2X and 3X herds were quite similar (Figure 5).

In 2X and 3X herds, milk income/cwt and milk yield were positively correlated. As milk yield increased so did milk income/cwt in both years. On the other hand, milk income/cow/year and total cost/cwt were negatively related (average  $R^2=0.77$ ). Total cost/cwt of milk increased as milk income/cow/year decreased. Feed cost/cwt of milk and total cost/cwt were positively correlated. Increasing feed cost/cwt resulted in an increase in total cost/cwt. When variables were positively correlated (milk income/cwt by milk yield and feed

cost/cwt by total cost/cwt), 3X milked herds clustered to the right side of the graphs while the 2X herds clustered to the left on negatively correlated variables (total cost/cwt by milk yield and milk income/cow by total cost/cwt). Interestingly, when all these variables were analyzed for herds producing 70 lbs of milk or more, regression lines for 2X and 3X herds were nearly identical, indicating that there were no differences between the herds.

This data indicates that at similar milk yields (over 70 lbs) there is no difference for the variables analyzed for 2X versus 3X herds. Therefore, 2X herds producing over 80 lbs of milk were as efficient as 3X herds producing over 80 lbs of milk. However, one cannot determine from this dataset if herds milked 3X would produced less milk/cow if they were milked 2X.

### **Profitability During 2006 and 2007**

In order to find profitable herds, milk income/cwt in 2006 was regressed on milk income/cwt in 2007 (Figure 6). On the horizontal axis (2006), herds on the right side of the bold vertical line (herds with milk income/cwt >\$0) had a positive milk income/cwt while herds on the left side had a negative milk income/cwt. On the vertical axis (2007), herds above the bold horizontal line (milk income/cwt >\$0) had a positive milk income/cwt while herds below the line had a negative milk income/cwt. There were 16 profitable Holsteins herds; herds that were able to have a positive milk income/cwt in both years. These herds averaged 75.6 lbs of milk/day with a standard deviation of 7.6 lbs.

### **Conclusions**

One cannot dispute the fact that the price of milk has a significant impact on the profitability of dairies in California; however, milk yield is a very important part of the profitability equation. The trends reported herein indicate that herds with higher milk yield maximized milk income/cwt in high milk price years and minimized losses in low milk prices years. Differences among herds became less variable as Holstein herds became larger in size but this did not always yield more profit. However, larger color breed herds were more profitable than smaller ones. At similar milk yields, herds milked 2X or 3X yielded similar profitability.

In conclusion, one effective way to reduce feed cost and improve milk income in CA dairy herds is to increase milk yield. We can accomplish this by improving the herd's reproduction, days in milk, cow comfort, cow health, transition management, forage quality, feed efficiency, using research proven technologies and feeding well balance diets. We have to make fundamentally sound decisions based on repeatable research responses whenever possible. Making sound decisions will help us be more profitable as an industry. Focusing strictly on reducing feed cost or the total cost of producing milk will compromise the dairy's financial position if that decision sacrifices milk yield.

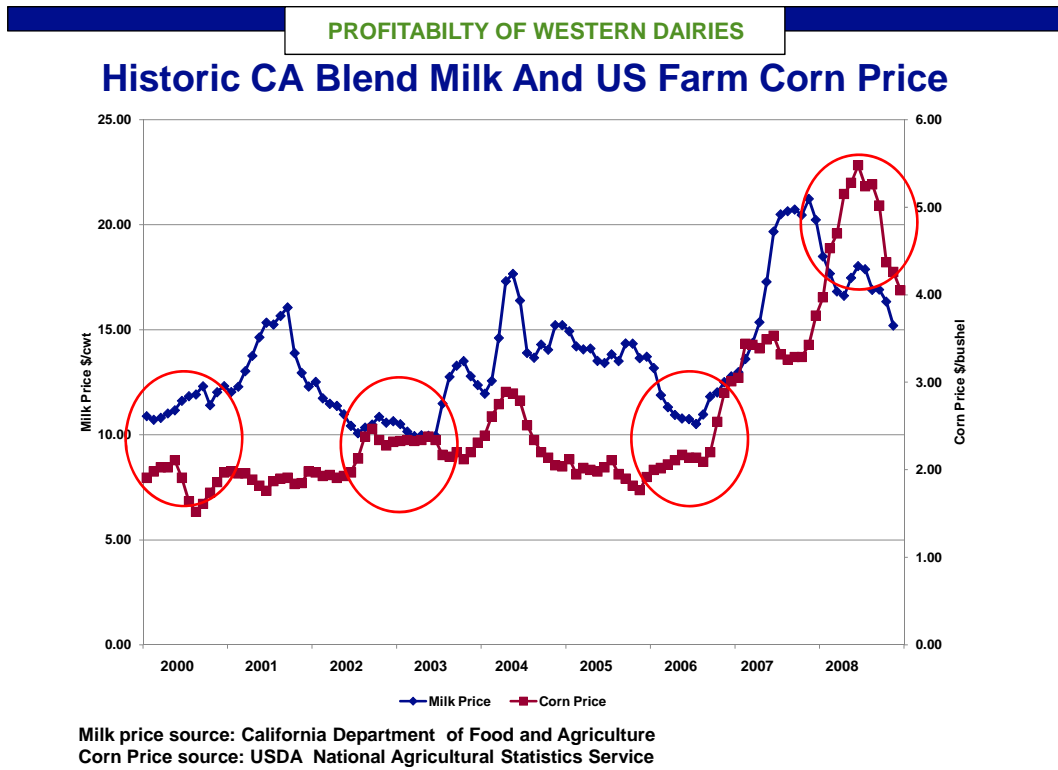
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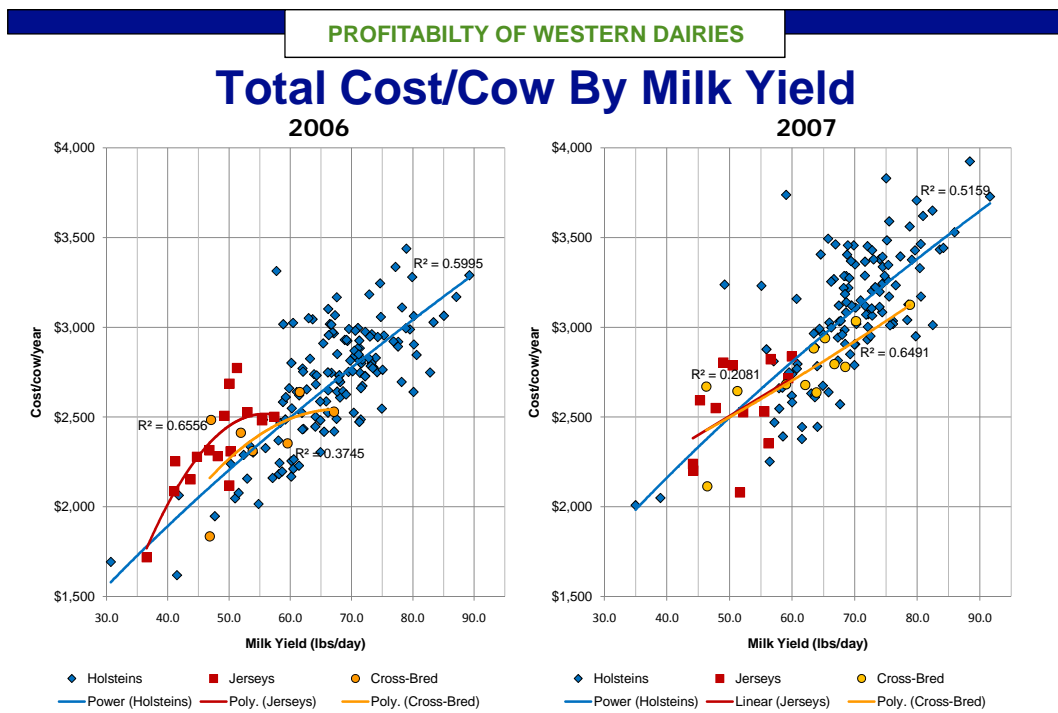
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**Figure 1.** Historic California State blend (quota and over-base) price and US corn price pay to corn growers.

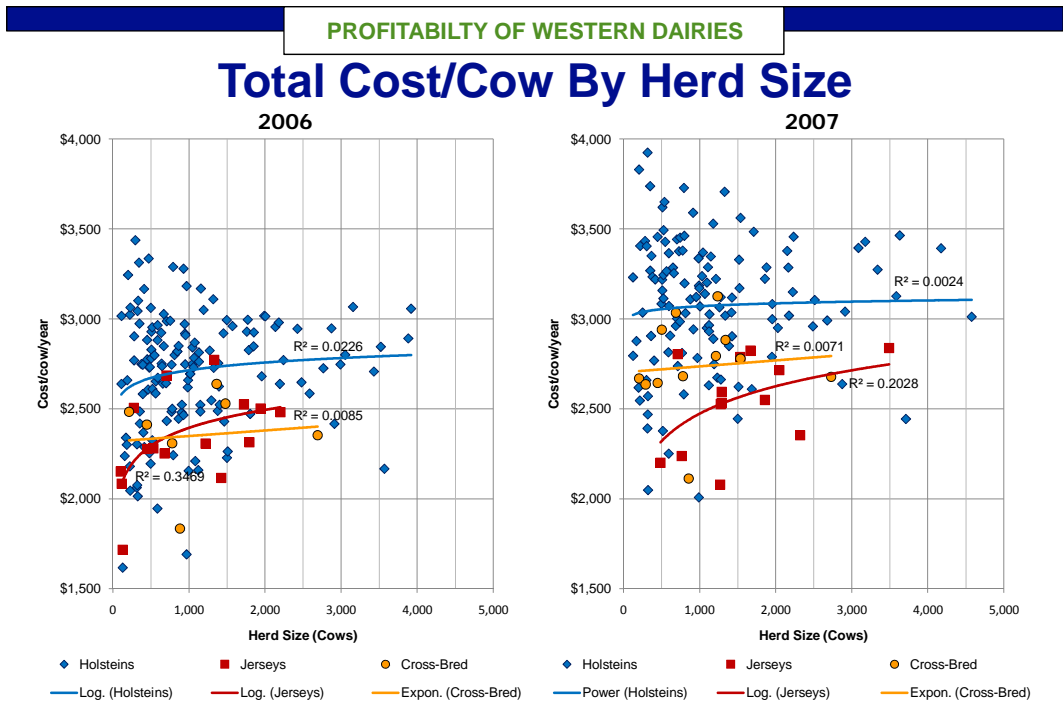


**Figure 2.** Total production cost per cow per year by milk yield



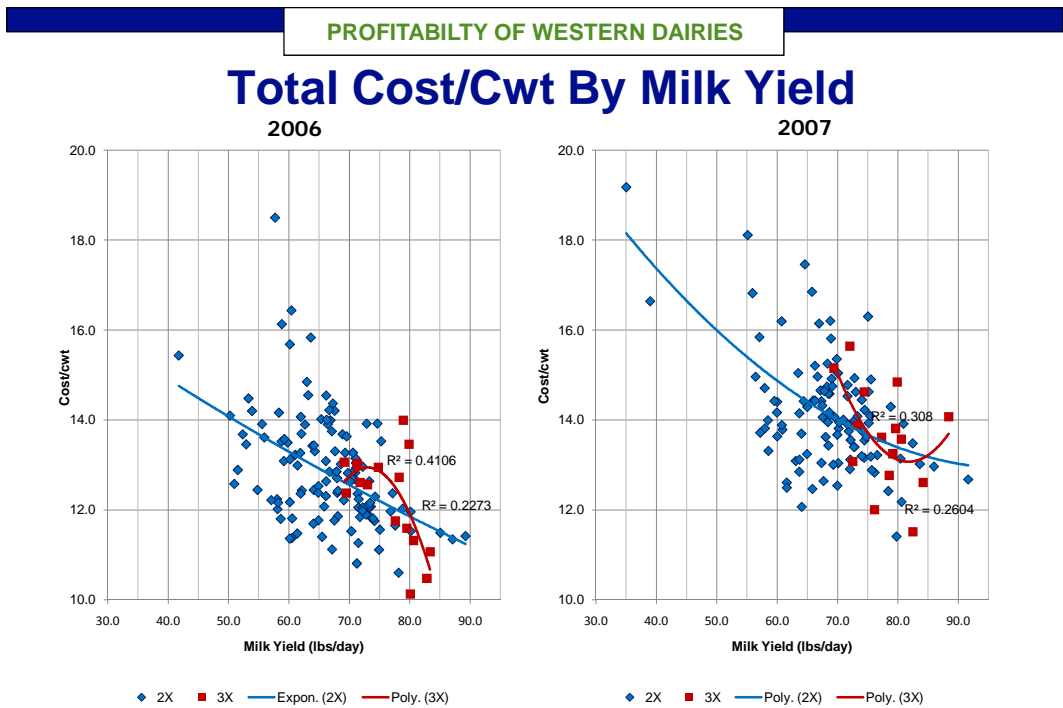
**As milk production increases: Cost/cow/year increases**

**Figure 3.** Total production cost per cow per year by herd size.



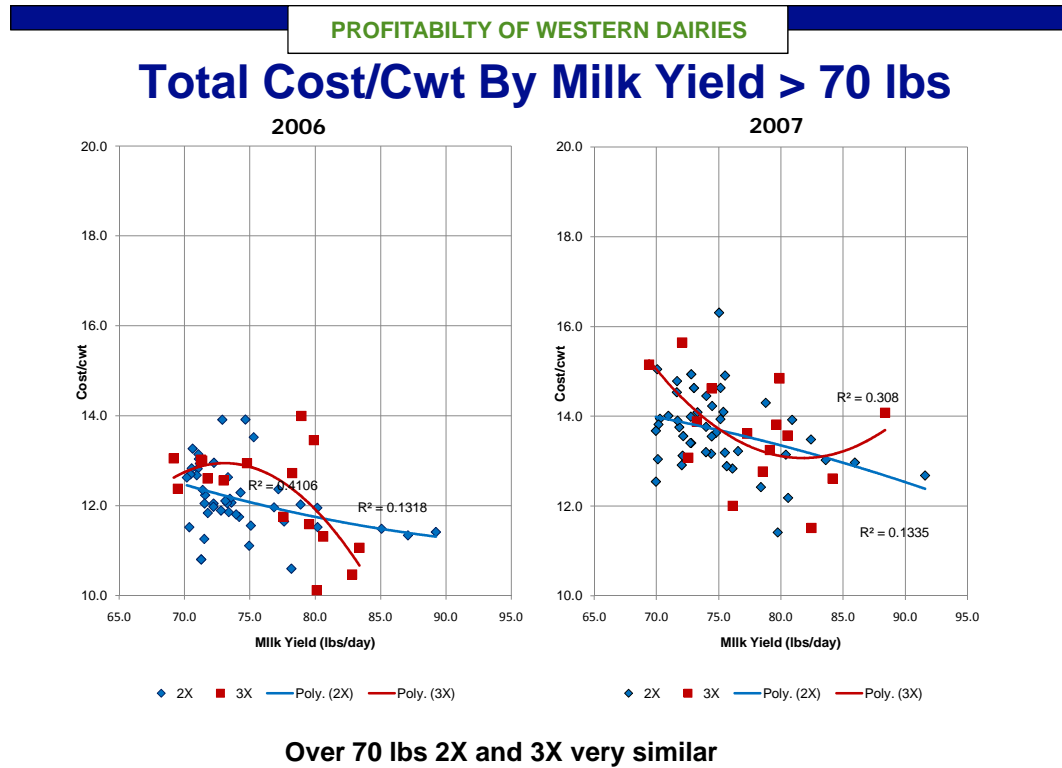
**No relationship between Herd Size and Cost/cow/year**

**Figure 4.** Total cost/cwt of milk produced by milk yield.



**As milk production increases: Cost/cwt decreases**

**Figure 5.** Total cost/cwt of milk produced by milk yield in Herds producing over 70 lbs of milk/day.



**Figure 6.** Milk income/cwt in 2006 and 2007.

