Are you Efficiently Replacing Your Herd?

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Introduction

The top three costs of producing milk on most dairies in the US are Feed Costs, Replacement Costs, and Labor Costs. Normally expressed on a hundredweight basis, these three key areas are greatly impacted by management and herd performance. To efficiently produce milk, herds must excel in these critical areas. Accounting systems need to be designed to place costs into appropriate expense categories so these three key areas can be accurately assessed. Table 1 displays regional averages for Feed, Replacement, and Labor costs from 2006 to June 2010. Collectively these top three costs account for 65-72% of total costs.

Conceptually, Replacement Cost is the Cost of Maintaining Herd Size and Structure. Although dairy accountants have various methods to determine Replacement Costs, all methods are basically similar in concept. The formula [(value of cows sold - cost of replacement) / cwt milk sold] is the basis for determining Replacement Costs. The value of cows sold is impacted by the kind of cows that are sold (fat, late lactation culls that sell well or beat-up fresh cows that are thin and sell poorly), and the number that are actually sold (deads and condemned are generally not sold). The cost of replacement is impacted by the cost of purchased heifers, or the money invested in home-raised replacement (not including value at birth). Cull rate and quantity of milk shipped impact the calculation as well. A "trade in value" can be estimated as (cost of replacement – average value of cull). Currently, with low springer prices and moderate beef prices, trade-in values are quite low in many areas.

Replacement Cost is intended to represent the cost of maintaining herd size and structure. Often cull rate or herd turnover is used to measure herd health and replacement success. When fully considering the concept and implications of Replacement Cost, it becomes obvious that cull rate or any measure of herd turnover is a poor proxy for herd health or cost of maintaining herd size. The best measuring stick of successful herd replacement is Replacement Cost/cwt, and a reasonable goal in most areas of the country is <$1.50/cwt.

Replacement Cost is not a unique concept to the dairy industry. Definitions in unrelated industries include "The price that will have to be paid to replace an existing asset with a similar asset" (Investopedia.com) and "The actual cost to replace an item or structure at its pre-loss condition" (Wikipedia.com). The concept is routinely applied in the accounting and insurance industries. For a manufacturing business, it can be thought of as the cost of keeping productive assets needed to produce the desired volume of product.

Since it is normally expressed on a hundredweight basis, Replacement Cost is size and production neutral. It can be compared for herds milking 100 cows or 10,000 cows, or for herds milking 50 pounds per day or 100 pounds per day. In the simplest of terms for a 1000 cow herd, Replacement Cost is the cost of keeping 1000 cows in the herd day after day.

Replacement Costs in US Dairy Industry

Figures 1-5 summarize average Feed, Replacement, and Labor costs per hundredweight from 2006 to June 2010 for Genske, Mulder, and Company, LLP, clients. It is obvious that 2008 and 2009 were historically high for feed costs in the US Dairy Industry. Replacement Costs tended to be lower with mature industries (Washington, Arizona, and California). The Midwest and Texas summaries include many recently constructed dairies, many of which had no replacement enterprise after startup. Not surprisingly, they had the highest Replacement Cost. Labor costs have been less variable but are regionally trending in different directions.

Many believe that Replacement Costs are closely correlated with milk production and/or cull rate. Figures 4 and 5 represent scatter plots to illustrate these relationships. The 30 data points in both scatter plots correspond to average values for each of the 5 years (2006-2010) in each of the 6 regions (AZ, CA, ID, Midwest, WA, TX). Note that each data point does not represent a single herd, but rather the region average for a year. Accordingly, these scatter plots are biased by region and time, and are presented to characterize industry averages and not to make strong conclusions. Considering the bias and limitations of the observations in Figures 4 and 5, the scatter plots illustrate several general points. First, it is difficult to make any strong statements from the scatter plots. The strongest statement is that there are no clear patterns. Second, there are many factors that impact Replacement Costs, and looking at one factor only is misleading. The numbers are real accounting numbers across regions and time, which makes it difficult to clearly see patterns with so many variables.

In Figure 4, with the exception of a few outliers, there does not appear to be a strong correlation between turnover and Replacement Costs. Some herds had low Replacement Costs with higher culling rates; some had low Replacement Costs with lower culling rates. It is worthy to note that the average Replacement Cost for the 21 data points with cull rate <35% was $1.73; for the 9 data points with cull rate >35%, average Replacement Cost was $1.94. This graph suggests that high replacements costs are unlikely at low cull rates, but low Replacement Costs are possible at any cull rate.

In Figure 5, strong relationships are lacking for reasons similar to Figure 4. It is noteworthy that data points above 70 lbs of milk averaged $1.56 Replacement Cost; data points below 70 lbs averaged $1.86. This graph suggests that high Replacement Costs are unlikely at high production levels, but low Replacement Costs are possible at all production levels.

Based on the industry data presented from 2006 to 2010, what are realistic goals for Replacement Costs? Generally speaking, Replacement Costs should be dropping as heifer prices slide. As noted in the GAAP Method section, there is lag in the GAAP method for calculating Replacement Costs, so the impact of the current heifer market will not be immediately evident on financial statements. In past years, the best dairies have constantly achieved Replacement Costs less than $1.50/cwt (Table 2). Considering the current heifer market, top herds will probably be below $1.25/cwt in the near future.

GAAP (Generally Accepted Accounting Principles) Method for Determining Replacement Cost

Generally Accepted Accounting Principles are rules that all accountants in the United States are required to follow when preparing accrual based financial statements. For dairy purposes, when a cow is put into productive use the cost is depreciated over the animals useful life, which is usually 5 to 7 years. It is referred to as depreciation of dairy cows expense. Once the cow is removed from the herd (sold or died), the remaining cost that has not been depreciated is removed and compared to the cull cow proceeds. This is either a gain or loss from sale of cows. Generally, dairy cows are removed using the FIFO method (First in First Out). In layman's terms this means the oldest cows on the depreciation schedule are removed first.

Figure 6 is a simple example of tracking depreciation and calculating Replacement Costs using the GAAP method. Using an example herd with simple metrics, there is a depreciation schedule for cows and a Replacement Cost calculation. Assume the dairy was started in 2007 and has a 33% historical cull rate. In 2010 the dairy sold 128,772 cwts and received $90,350 in cull cow proceeds. In the example, heifer prices reflect historic trends: $2250/head in 2007, $2200/head in 2008, $1600/head in 2009, and $1300/head in 2010. Note that since cull rate is 33% only 3 years of cows are on the depreciation schedule at the end of each year

Using 2007 as an example year to explain the calculations in Figure 6:

- 200 heifers were purchased at $2250 for a total of $450,000.
- The current depreciation on those heifers in 2010 is $32,143; the depreciation in 2007-2009 totaled $160,174.
- The remaining basis at the end of 2010 is $257,763 (450,000 - $160,714 - $32,143).

The GAAP Replacement Cost in Figure 6 is $2.11per cwt. This is comprised of depreciation ($0.82) and Loss on Sale of Cows ($1.30) as follows:

- The Depreciation is simply the sum of all 2010 depreciation. Cows purchased in 2007, 2008, 2009, and 2010 had depreciation in 2010 that totaled $105,000 or $0.82/cwt.
- The remaining basis at the end of 2010 ($257,763) is offset by cull cow proceeds ($90,500), for a $166,793 or $1.30/cwt Loss on Sale of Cows.

Note that the more expensive cows purchased in 2007 were removed in 2010, which resulted in a high herd Replacement Cost ($2.11/cwt) for 2010. When cattle prices are stable the GAAP method accurately reports herd Replacement Cost. When cattle prices are fluctuating, as we have seen in the past 5 years, the GAAP method will eschew herd Replacement Cost. The cash method may be more useful when prices are fluctuating, as it more closely reflects markets and management in the year measured.

Cash Method for Determining Replacement Costs

Many herds in the US do not have a dairy accountant, or choose to ignore GAAP methods and avoid determining Replacement Costs. For these herds, a cash method can be used to estimate Replacement Cost/cwt. As discussed previously, the Cash Method may be more useful at times than the GAAP method, particularly when heifer prices are fluctuating. The Cash Method formula is very simple:

$$\frac{\text{(Cost of Raising or Purchasing Replacements) - (cull cow income)}}{\text{Cwts of milk produced}}$$

Cost of Raising or Purchasing Replacements

- Includes all costs incurred for getting an animal to the day of calving.
- For home raised heifers, this includes all costs from birth until day of calving, and includes feed, labor, vaccines, health treatments, equipment costs, etc. To answer the question "should an expense be included in Replacement Costs", consider if this cost would go away if the heifers were off site. If the answer is yes, then it should be part of Replacement Cost.
- For purchased heifers, it includes all costs involved with purchasing the animal, including hauling and commissions. It also includes the costs incurred from the time of purchase until calving, such as feed, labor and health costs. So if an animal is purchased 30 days before calving, the cost of the animal plus 30 days of expenses are included.
- For purchased adult cows, all costs associated with purchasing the animal are included.

Cull Cow Income

- Includes the revenue received from selling cull cows and cull heifers.
- Includes the revenue received from selling heifers for dairy purposes.
- In a situation where all heifers are purchased, the value of heifer calves sold can be included in the value of cows sold.

Cwts Milk Produced

- The quantity of milk sold for the time-frame under consideration

Factors Impacting Replacement Costs

There are several factors that directly impact the calculation of Replacement Costs, including death loss, milk production per cow, cull rate, average cull value, and heifer costs. The graph in Figure 7 summarizes the impacts of each factor on Replacement Costs, using the Cash Method. The graph was calculated by taking a "best case" scenario (80 lbs milk/cow, 30% cull rate, 2% death loss, $500 cull value, $1200 replacement animal cost) that results in a very low Replacement Cost ($0.89/cwt), and changing each factor 10 increments to determine independent impacts on Replacement Cost. The increment and range of data for each item are listed in the graph legend. For example Death Loss was 2% in the Best Case scenario, and was increased by 10 increments of +1%, for a range of 2% to 12%.

Summarizing Figure 7:

- The linear change in Replacement Cost for each independent incremental change was as follows:
    - **Death Loss**: For each 1% increase in death loss from 2-12%, Replacement Costs increased by 2.2 cents per cwt. So increasing death loss from 5% to 10% (5 increments) without changing other factors would increase Replacement Costs 11 cents per cwt in this scenario.
    - **Cull Rate**: For each 2% increase in cull rate from 30-50%, Replacement Costs increased by 6.3 cents per cwt. So increasing cull rate from 30% to 40% (5 increments) without changing other factors would increase Replacement Costs 31.5 cents per cwt in this scenario.
    - **$/cull**: For each $25 drop in cull value from $500 to $250, Replacement Costs increased by 3.1 cents per cwt. So decreasing cull value from $500 to $375 (5 increments) without changing other factors would increase Replacement Costs 15.5 cents per cwt in this scenario.
    - **Heifer Cost**: For each $50 increase in heifer cost from $1200 to $1700, Replacement Costs increased by 6.7 cents per cwt. So increasing heifer cost from $1200 to $1450 (5 increments) without changing other factors would increase Replacement Costs 33.5 cents per cwt in this scenario.
- The only non-linear change was for Milk per Cow:
    - **Milk/cow:** Over the range of incremental change in Figure 1 (80 to 60 lbs), Replacement Costs increased by 2.3 cents per cwt when milk per cow dropped from 80 to 78 lbs, and 3.8 cents per cwt when milk per cow dropped from 62 to 60 lbs. The average change in Replacement Cost, across the range of 60 to 80 lbs milk per cow, was 3.3 cents per cwt for each 2 lb change in milk per cow.
- Within the range of the factors, cull rate and heifer cost had the largest impact on Replacement Cost. This assumes that no other factors change.

- Changes in milk production per cow impacted Replacement Costs more so at lower production levels within the range of factors, although the differences were small.

Heifer costs are a major driver of Replacement Costs. Using the marginal heifer costs from Figure 7, $2000 springers would increase Replacement Costs $0.67/cwt compared to $1500 springers (assuming similar performance). Many herds in 2007 and 2008 that had to purchase expensive springers were in the unfortunate position of buying $2000+ heifers. Those with home raised heifers had less than $1500 invested in the heifer at freshening, giving these herds a significant advantage in Replacement Cost. The current heifer market is an oddity in that purchased springers are similar in value to home-raised heifers. In most years, there is a significant advantage to dairies providing their own heifers.

For dairies that supply their own heifers, reducing the costs of rearing will directly reduce Replacement Costs. Feed is the largest expense, and most herds closely monitor feed costs. A hidden feed cost is delayed age at first calving. Herds with low rearing costs get heifers pregnant quickly and into the herd quickly, resulting in a tight distribution of calving ages.

Comparing Herd Scenarios Using Cash Method

Table 3 illustrates Replacement Costs for four 1000 cow herds with varying cull rates, death loss, and production levels. Using the Cash Method formula, Replacement Cost for Herd A is: [($1200*350) - ($500*300)] / 217,000 = $1.24/cwt. For Herd B the calculation is: [($1700*350) - ($175*250)] / 217,000 = $2.42/cwt.

Often in the dairy industry milk production and cull rate are viewed as primary determinants of operational efficiency (low cost per cwt). If this were true, Herd A and Herd B would have similar Replacement Costs, yet they are more than a dollar per hundredweight different. The four herds in Table 3 dispel some of the myths related to Replacement Costs.

Description of Each Herd

- **Herd A** had average production, average cull rate, low death loss, and high quality cull cows. All replacements were internal. Herd A represents a typical management model.
- **Herd B** had average production, average cull rate, high death loss, and poor quality cull cows. This herd had to purchase some replacements to stay full due to insufficient heifer numbers, which inflated heifer costs. Herd B represents a herd with health problems and poor financial results despite reasonable production and cull rate.
- **Herd C** had low production, low cull rate, low death loss, and high quality cull cows. All replacements were internal, and at a lower cost. Herd C represents a "low input cost" management model.
- **Herd D** had high production, high cull rate, low death loss, and high quality cows. All replacements were internal. Herd D represents a "high input" management model, with a

high replacement stream where healthy lower-producing cows are replaced by younger more productive cows.

Myths Dispelled from Table 3.

- *Myth #1: High Cull rate means high Replacement Costs.* This is often true but not always. Herd D is a high producing herd that has excellent herd health. Death loss is relatively low and the cull cows are valuable. The dairy ships a lot of milk, which dilutes the Replacement Costs over more hundredweights.
- *Myth #2. Low production is not a viable business model.* A low production, low input model can be very successful, provided Feed, Labor, and Replacement Costs are low. Lower producing herds can achieve low Replacement Costs by having low death loss, low cull rate, and high quality culls. Herd C is an example of this.
- *Myth #3. A dairy only sells milk.* Dairies also sell a lot of beef. The quality of cows being sold greatly impacts cull cow income and Replacement Costs. Selling fat, late lactation cows is very different from selling skinny fresh cows or thin lame cows. The high death loss and low value of culls is killing Herd B.
- *Myth #4. Lowering cull rates will always lower Replacement Costs.* Depending on market conditions, simply lowering cull rate may not improve Replacement Costs. Keeping low producing cows and holding on to cows too long to where their cull value is lessened will typically not improve Replacement Costs.
- *Myth #5. Herd health is tied to cull rate.* Low Replacement Costs result from a healthy herd where management makes good economic decisions on cows, regardless of cull rate. Herd D is a high producing herd with a high cull rate but reasonable Replacement Costs. Unhealthy herds like Herd B have higher death loss, poorer quality culls, and higher Replacement Costs despite reasonable cull rates.

Startup Dairies

Replacement Costs are easy to track and understand in a steady-state situation where the herd is mature and not growing. Startup or growing dairies have different circumstances regarding Replacement Costs. Table 4 outlines two start-up scenarios where the initial population is either heifers or cows (replacements are heifers in both cases):

Startup Where Springing Heifers Are Purchased. Typically these herds have low culling rates, but with a high portion of the culls being dead or condemned, and culls having a lower value. An example of a heifer startup is portrayed in Table 4 (Startup-Heifers). In this example the herd started with 1000 heifers, and had a low cull rate with moderate production. All replacements were from purchased heifers. There were more deads, and the value of sold cows was lower. Heifers needed to replace sold animals were all purchased. This scenario resulted in a $1.59 Replacement Cost per cwt.

Startup Where Mature Cows From Another Dairy Are Purchased. In the scenario portrayed in Table 4 (Startup-Cows), mature cows were purchased to start the dairy and heifers were purchased to replace cows. Compared to the heifer startup, milk was higher, cull rate was higher, death loss was lower, and cull values were higher. This scenario resulted in a $2.54 Replacement Cost per cwt.

The decision to start with heifers or cows is complex, and the scenario described in Table 4 only evaluates Replacement Cost. Starting with heifers typically requires more investment than starting with cows, but typically is less expensive to replace in the first 2-3 years.

Conclusions

Replacement Costs are typically the 2nd or 3rd highest cost of producing milk on dairies in the US. Herd health and cost of raising or buying heifers are key drivers. Purchasing heifers when the springer market is high escalates Replacement Costs. The difference in Replacement Costs from the poorest herds to the most efficient herds exceeds $1.00/cwt. Lowering Replacement Costs is critical to lowering total cost per hundredweight and a significant opportunity for many dairies.

References

Genske, Mulder, & Company, LLP. 2010. Accounting summaries containing averages for all clients in AZ, CA, ID, Midwest, TX, and WA from 2006 through June 2010. Personal Communication.

Table 1. Five-year average costs from accounting summaries (average from 2006 to June 2010)[1].

	Feed cost/cwt	Replacement cost/cwt	Labor cost/cwt	Feed+Labor +Replacement	% of total costs
Arizona	$ 8.22	$ 1.68	$ 1.38	11.28	70%
California	$ 7.85	$ 1.55	$ 1.22	10.63	72%
Idaho	$ 7.83	$ 1.64	$ 1.28	10.75	70%
Midwest	$ 7.23	$ 2.27	$ 1.59	11.09	65%
Texas	$ 7.52	$ 2.04	$ 1.46	11.01	67%
Washington	$ 7.27	$ 1.56	$ 1.38	10.21	68%

[1] From Genske, Mulder, & Company, LLP.

Table 2. Replacement Cost for top 25% for total cost of production[1].

	2006	2007	2008	2009	2010
CA	$1.26	$1.49	$1.49	$1.45	$1.39
ID	$1.32	$1.69	$1.48	$1.62	$1.87
TX	$1.43	$1.83	$1.64	$1.64	$1.71
WA	$1.10	$1.31	$1.48	$2.32	$1.29

[1] From Genske, Mulder, & Company, LLP.

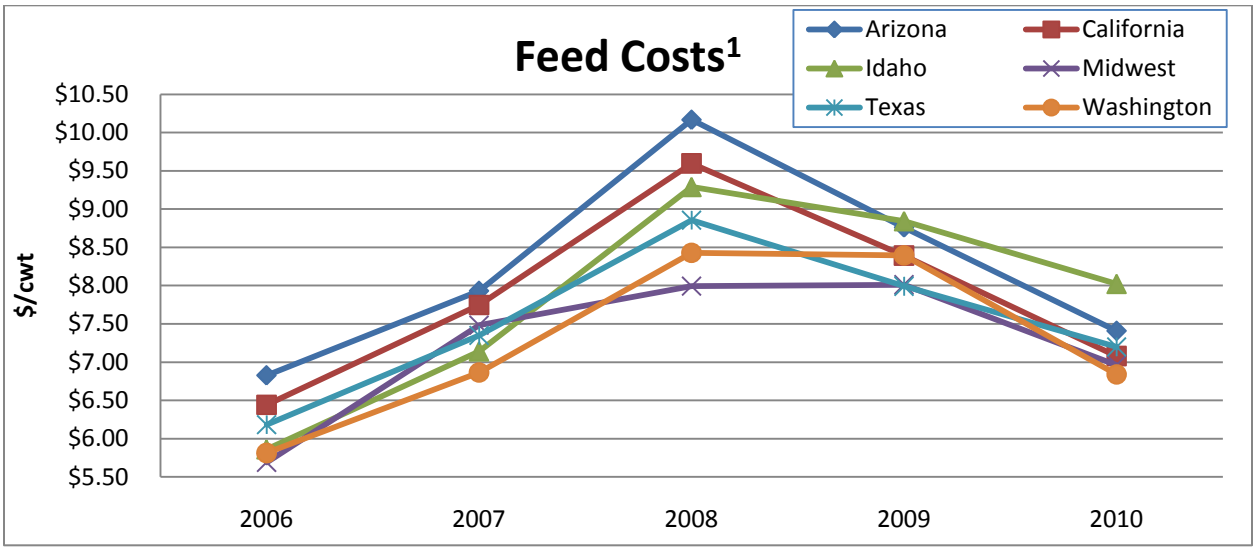
Table 3. Replacement Costs calculated using the cash method for four different herds.

	Herd A	Herd B	Herd C	Herd D
Herd Size	1000	1000	1000	1000
Milking Cows	850	850	850	850
Milk lbs/cow/day	70	70	60	85
Cwts/year	217,000	217,000	186,000	263,000
Cull rate	35%	35%	25%	45%
Death loss	5%	10%	5%	5%
$/cull	$500	$275	$500	$500
Culls/yr to sell	300	250	200	400
Replacements, $/head	$1200	$1700	$1100	$1200
# replacements	350	350	250	450
Replacement Cost/cwt	$1.24	$2.42	$0.94	$1.29

Table 4. Replacement Costs portrayed for startup dairies where the initial population is heifers (Startup – Heifers) or mature cows (Startup-Cows).

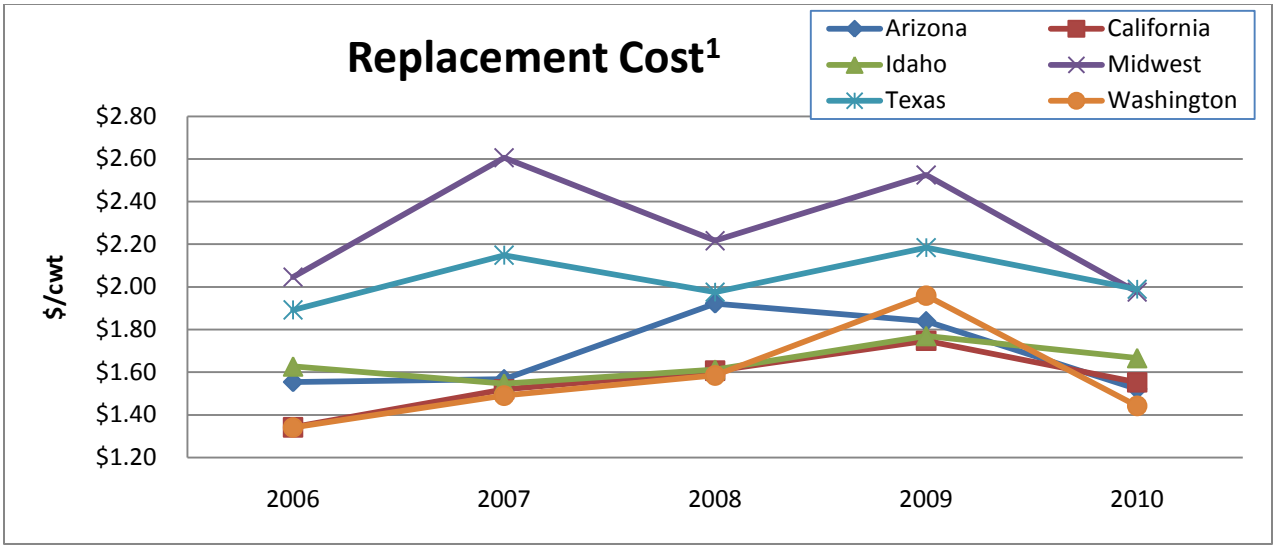
	Startup- Heifers	Startup- Cows
Herd Size	1000	1000
Milking Cows	850	850
Milk lbs/cow/day	65	70
Cwts/year	201,000	217,000
Cull rate	20%	40%
Death and condemned loss	10%	8%
$/cull	$200	$400
Culls/yr to sell	100	320
Replacements, $/head	$1700	$1700
# replacements	200	400
Replacement Cost/cwt	$1.59	$2.54

Figure 1. Feed Costs per cwt by region from 2006 to June 2010[1].



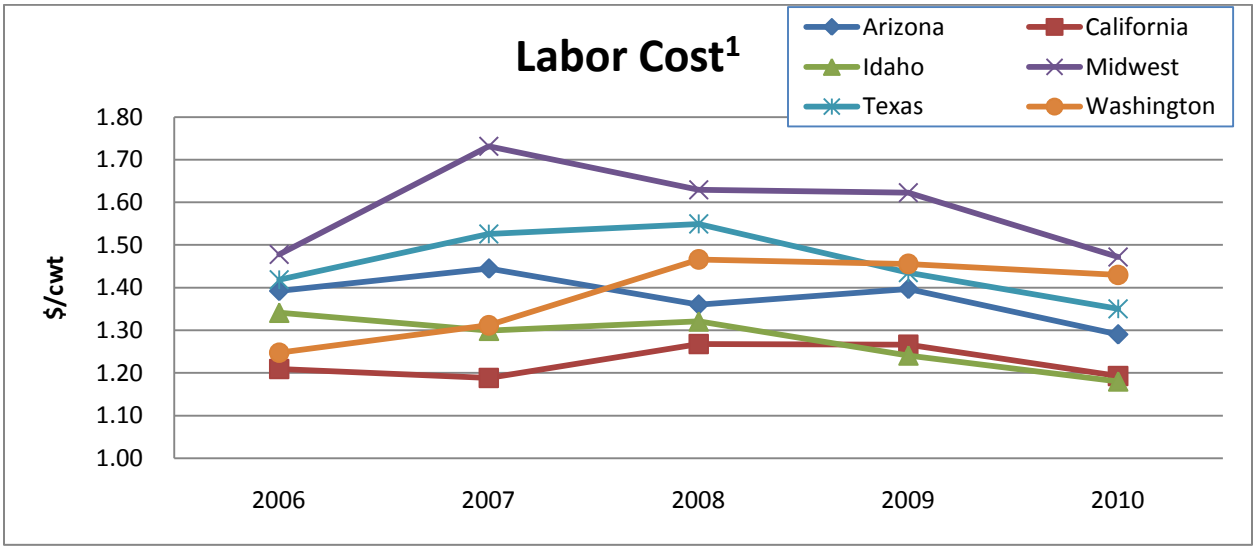
[1] From Genske, Mulder, & Company, LLP.

Figure 2. Replacement Costs per cwt by region from 2006 to June 2010[1].



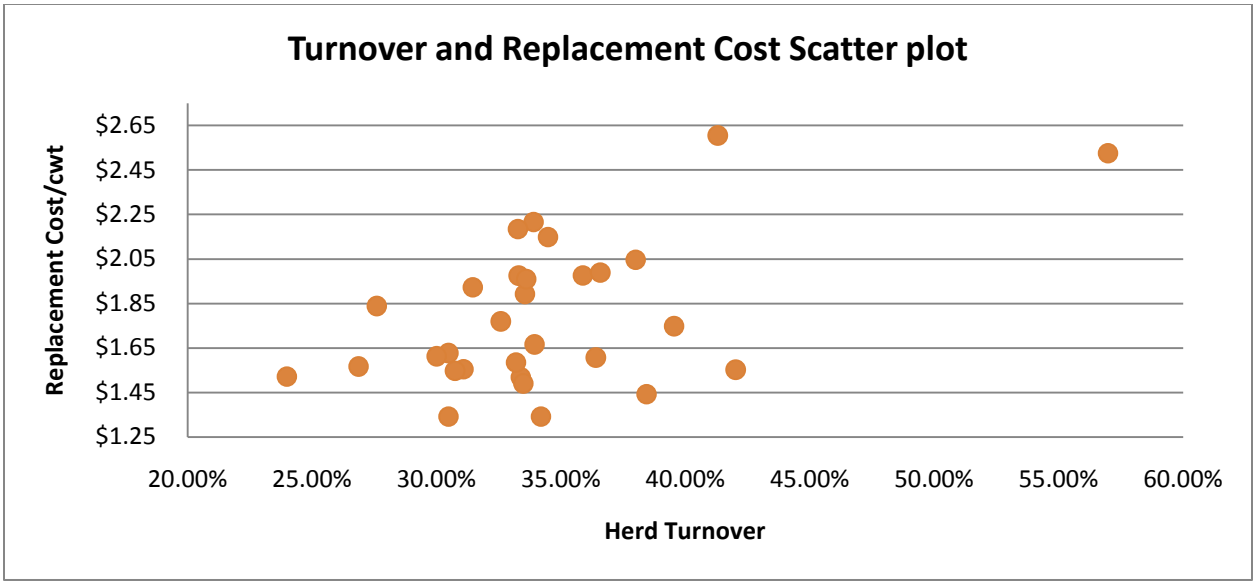
[1] From Genske, Mulder, & Company, LLP.

Figure 3. Labor Costs per cwt by region from 2006 to June 2010[1].



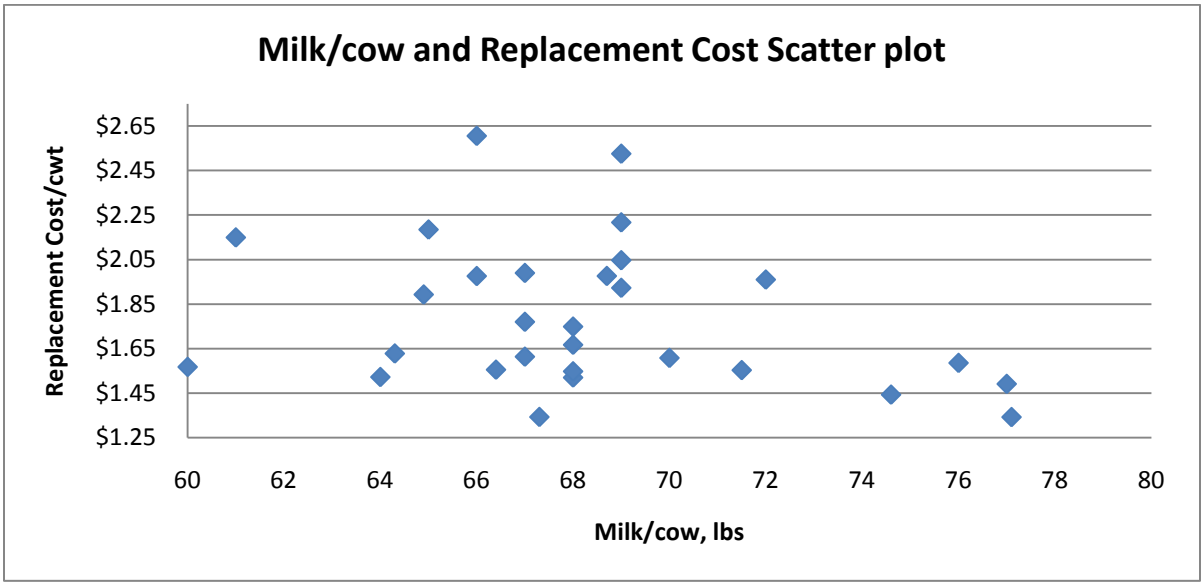
[1] From Genske, Mulder, & Company, LLP.

Figure 4. Herd Turnover and Replacement Costs scatter plot, using data from 2006 to June 2010[1].



[1] From Genske, Mulder, & Company, LLP.

Figure 5. Milk production and Replacement Costs scatter plot, using data from 2006 to June 2010[1].



[1] From Genske, Mulder, & Company, LLP.

Figure 6. Example of GAAP accounting method for determining Replacement Costs.

Year Purchased	# Head	Cost	Prior Depreciation	Current Depreciation	Remaining Basis
2007	200	450,000	(160,714)	(32,143)	257,143
Sold 2010	(200)	(450,000)	160,714	32,143	(257,143)
2008	200	440,000	(94,286)	(31,429)	314,285
2009	200	320,000	(22,857)	(22,857)	274,286
2010	200	260,000	-	(18,571)	241,429
Totals	600	1,020,000	(117,143)	(105,000)	830,000

2010 Herd Replacement cost:

		Amount	Per Cwt
	Depreciation - dairy cows	105,000	0.82
***	Loss on sale of cows	166,793	1.30
	Total Herd Replacement Cost	271,793	2.11
	Remaining basis from 2007	257,143	
	Cull cow proceeds	(90,350)	
***	Loss on sale of cows	166,793	

Figure 7. Factors impacting Replacement Costs: incremental changes of death loss, milk/cow, cull rate, $/cull, and heifer cost. Increment and range for each item is noted in legend.