Marginal Thinking: Making Money on a Dairy Farm

Steve Eicker[1],
John Fetrow, Steve Stewart, St Paul, MN

[1]Valley Agricultural Software, King Ferry, NY 13081
Email: eicker@vas.com

Take Home Messages

- Economic estimates that involve increased milk production need to account for the increased food costs (marginal feed costs, not average feed costs)
- The concept of marginality and marginal decision making is the key to making the right decisions on dairies
- Management practices that are widespread and well accepted may no be the best economic choices
- Significant profit opportunities can be lost in the false pursuit of reducing input costs

Introduction

In the end, food producers are the primary influence on food prices. Quotas and trade regulation may shape the context within which supply and demand operates, but global markets and local conditions still inevitably respond to supply and demand. Those who can produce food at the highest profit will continue to expand and those who do not maintain adequate profitability will decline in their contribution to total production. As production by the profitable enterprises expands and more food is available, the price will eventually fall. The most profitable producers will be willing to gain market share for a slightly lower price. As one sector of food production, the milk production business is not substantially different. Across the United States, successful dairies have expanded, and other dairies are disappearing. Since 1965, the number of dairy farms in the U.S. has fallen by nearly 90%, from almost 1.2 million to 120,000. Although the quota system has slowed this in eastern Canada, ultimately, the same market forces exist.

In other industries, successful businesses have been classified into one of three categories:

- Product supremacy – Mercedes Benz
- Customer intimacy – neighborhood car repair
- Operational excellence – McDonalds

A dairy sells a largely homogeneous product to distant (anonymous) customers. With some exceptions (e.g. organic dairies, on-farm cheese production to local customers) most dairies will not compete via the first two strategies. A successful dairy most likely will be categorized as operationally excellent. Operational-excellence businesses tend to do most of the following activities well:

- Early, wise adoption of technology
- Economies of scale
- Cost control
- Efficient use of resources
- Good decisions / problem solving

Technology adoption has been categorized into phases: innovators, early adopters, mass adopters, and late or non-adopters. The most money is made by the early adopters of an effective, profitable, new technology; they gain advantage before the market adjusts. Eventually, a sufficient number of businesses adopt the technology, and the milk price decreases as discussed above. (After that point, only the technology supplier makes a profit.)

The impact of economies of scale is easily observed in the U.S. dairy industry. In 1965, the average dairy herd size was approximately 15 cows. In 2000, it was approximately 70. Very few dairies are built today in the U.S. with fewer than 600 cows; most are more than 1,000. Economies of scale and specialization of function is driving this transformation and the change has been on-going over the past 5 decades in a nearly linear fashion and has been accompanied by an equally dramatic and linear increase in milk production per cow. (Figure 1)

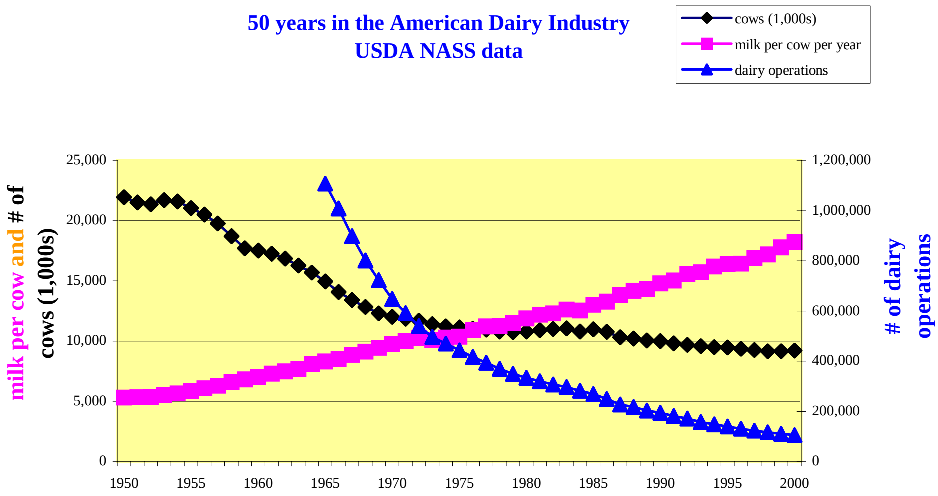

Figure 1: Changes in the U.S. Dairy Industry

As dairies have become larger and more specialized, they have also afforded the manager more time to shift his time and efforts from daily labor to business management. Coupled with increased leverage with suppliers due to increased scale, dairy managers have been able to capture significant cost savings and improve profitability.

Increased scale has also made it possible to spread overhead costs (facility investment, especially parlors, tractors and other large equipment, consultants, manure management, etc.) over more cows and increased the efficiency of use of these fixed assets and costs of operation.

Good business and problem solving decisions fall into two broad categories:

- Decisions made to increase profitability directly
- Decisions made to reduce risk (and in the longer term indirectly improve profit)

The remainder of this paper will focus on how a dairy becomes more profitable.

Making Money on a Dairy Farm

How does a dairy make more money? Simplistically, this is achieved by either (or both) lowering costs or increasing income. In spite of nearly every trade magazine headlines, keeping costs low is not the goal, higher profit is.

In the dairy industry, it is almost always much more profitable to focus on the income side rather than to try to decrease expenses per se. Of course, cost control is important. However, dairies can dilute their fixed costs by more milk/cow or more cows. Not planting crops will lower costs, as will not feeding cows. Fishing without bait is lower cost fishing.

Since individual dairy farms have little control over milk prices (some opportunity exists for improving milk components and milk quality), increasing income almost always means increased milk sales. In nearly every dairy meeting, someone shows a scatter graph of profit per cow vs. herd average. It appears like a shotgun blast. There is no obvious correlation between herd average and profit. Unfortunately, few people remember that correlation does not mean cause and effect - even fewer realize that lack of correlation does not guarantee lack of cause and effect. While it is clear that high milk production does not guarantee profitability, to state that milk production does not matter is foolish. On an individual dairy, increased milk production almost always results in increased profits.

To evaluate the financial impact of changes, one must be able to estimate the increased costs and the increased returns. This requires differentiating marginal costs from average costs, which implies a quick review of fixed vs. variable costs. Fixed costs do not change if production changes. Examples of fixed costs include insurance, land taxes, labor, trucks, etc. Variable costs typically include feed and manure management. (In a quota system, once a dairy is producing milk above their quota, quota purchase becomes a marginal cost or the reduced price of milk for over quota production must be considered.)

▪ Marginal Feed Costs

It is currently in vogue to insist that a dairy know its average daily feed cost per cow. Typically, this is done by dividing the feed bill by the number of cows. This can also be calculated per hundred pounds of milk (cwt): divide the feed bill by the number of cwt. Unfortunately, calculating the average feed cost per cwt is almost useless. The major determinant of average feed cost per cwt is milk production per cow, and that number is more readily available by looking at how much milk the dairy ships each day. In order to make decisions, what is actually needed is the marginal feed cost; the cost for the feed it takes for an existing cow to make <u>more</u> milk. This number is necessary to evaluate the financial impact of potential changes, such as semen purchases, or ration changes, etc. Average feed cost includes maintenance, which approaches 50% of the feed on many dairies. Marginal feed cost in Canada is typically near $7.50 per <u>additional</u> 100 kg of milk sold. Average feed costs per 100 kg range from $12 to $15, and they are greatly affected by milk production, which dilutes maintenance costs. Why is this important? Because at $7 marginal feed and $28 milk, there is a four to one return on increased milk production.

Spreadsheet 1 provides as example of the calculations involved. Using the assumptions in the example ($.300 / kg milk price; $70/ton for the total mixed ration (TMR), etc.), a herd with 100 cows milking can increase their profit by more than $10,000 per year if dry matter intake increases by only 0.5 kg per cow per day! The marginal profit per 100 kg is more than $20.00. Note that this profit per 100 kg for marginal milk is the same regardless of whether the dairy is currently already profitable or is losing money. The marginal economic impact of improved production does not depend on the farm's current average status.

Dairy cows live and die by the following rule: they will not make more milk unless they are fed more. There is a direct relationship between dry matter intake and milk production. Examples are everywhere: Heat stress decreases DMI and milk production drops. High producing cows eat more than low producing cows. Dairy farming has a related rule: Feed is WAY cheaper than milk.

Decisions on a dairy farm involve making a change. A change incurs added expenses, and hopefully, added income. Because added income usually results from increased milk production, it is important to account for the increased feed costs associated with the increased milk. Additional milk production from an existing cow costs only extra feed for milk production - there is no change in maintenance feed costs. Thus, using average feed cost per cwt will overestimate these additional costs because average feed costs include the cost of maintenance. The marginal feed cost must be used. In certain cases, using the wrong estimate will prevent dairies from making profitable changes.

Spreadsheet 1

MARGINAL VALUE OF EXTRA DRY MATTER INTAKE

Example Dairy	**02-Apr-02**
1.00	**kgs of added dry matter**
2.00	kgs feed added "as fed"
50%	percent dry matter in ration
1.80	added energy: Mcal
1.80	Energy/kg in dry matter
1.2	kgs of milk supported
0.68	energy per kg of milk Mcal
2.6	kgs of marginal milk per kg DMI
$0.75	**added milk revenue/cow/day**
$30.00	price of milk per 100 kg
$0.15	**added feed cost/cow/day**
$ 0.150	feed cost/kg dry matter intake
$0.08	feed cost per kg as fed
$80.00	Total mixed ration cost per ton as fed
$0.60	**added profit/cow/day**
100	cows in herd milking
365	days of milk per year
$22,000	**extra profit per year for the dairy**
$30.00	**milk price per 100 kg**
$7.50	**marginal feed cost per 100 kg**
$22.50	**profit per 100 kg of increased milk production**

■ Averages

Much of the data or information available to the practicing veterinarian is in the form of averages. Dairies are replete with averages: rolling herd average milk, average days-open, average milk per cow per day, average feed cost per hundredweight of milk, average age at first calving, etc. Averages are valuable and useful “first cut” parameters of a dairy’s performance. Dairy veterinarians and their clients use them daily as a shorthand summary of the dairy’s biological (milk per cow per day) and economic (net farm income from operations per cow) performance. Averages can be a useful measure of a farm’s status, but it is only one measure. When making specific management decisions, averages can be misleading sources of information.

Lag, Momentum, Bias, and Variation

First, the averages themselves may not accurately reflect the farm’s real status. Averages are vulnerable to several types of error. Averages may suffer from significant *lag*. The measured effect of a change in management status reflected in a calculated average may lag far behind the actual physical change on the dairy. For example, a failure of the breeding program in replacement heifers may not be reflected for more than a year in the average age at first calving. Many of the averages used on dairies contain a great deal of *momentum* built into the manner in which they are calculated. Rolling herd average milk production, for example, includes the production of cows over the past 12 months in its calculation. Extreme changes in current production are required to change the course of rolling herd average in a month’s time. Many of the averages used by dairies are also subject to *bias*. Services per conception is biased toward a favorable view of the reproductive status of the dairy, since only those cows that conceive enter into the calculation, ignoring the undesirable outcomes in open, repeat breeding cows. Culling and the deliberate exclusion of “do not breed” cows from many reproductive calculations can play havoc with the accurate expression of a dairy’s status.

Beyond these potential sources of error, averages also are deficient in characterizing a dairy because they, of necessity, express only the central point on a distribution. Averages do not describe or display the degree of spread, of *variation*, in the population. The degree of variation is a key element in evaluating a dairy farm’s performance, and identifying cows at the extremes makes it possible to affect their future. For example, average days open of 120 days may not be serious if all cows are open between 80 and 150 days. If the spread is from 45 to 250 days, the problem is likely more severe and costly. Even if a herd has a days open of 110 days, the individual cow left unbred for 180 days deserves identification and intervention.

Averages can be particularly dangerous when used in making *economic* decisions. Economic decisions based on averages can be seductively appealing; at first glance they can seem like “common sense”. In fact, dairies often make decisions based on such “common sense”. Often, these common sense decisions are wrong, and very costly.

The remainder of this discussion will consider some examples of this faulty thinking.

Before leaving the issue of averages, however, it seems prudent to step back and acknowledge that all averages are not useless. They can and should be used in evaluating a dairy, provided that the person doing so understands their shortcomings. In economic terms, the average performance of the dairy is critical. The bank will get paid from the average net income per cow. The dairy family will buy food and clothing from the average profits. Equity in the farm will be built on the average retained earnings. The point being made is not that averages can be ignored, but rather that one should think of averages as the goal to be attained, not the basis for managerial decision making. Management must act based on the specific case; averages “happen” as the sum of the experience of a series of specific cases. Keep in mind that on all dairies the average cow is healthy, pregnant, milking an average amount of milk, and happily bored. Today’s management cannot be based on her status. As a crude example, if on average cows do not get milk fever on a farm, it does not mean that the farm should not keep calcium on hand.

▪ Marginal Thinking:

When facing an economic choice, dairymen (and the veterinarian as their consultant), should base their analysis on the marginal impact of the decision, not on the farm’s average performance. A contrived example can help make this clear. Suppose, hypothetically, that a swine farm is facing hard economic times. The farrowing operation sells feeder pigs for $35.00 per pig. The farm’s average total cost per pig is currently $40.00. Thus on average, the farm is currently losing $5.00 per pig for each pig it sells. Their veterinarian, on a routine walk-through of the farrowing house, notices a newborn piglet with an inguinal hernia. She inquires about the farm’s policy regarding such pigs and is told that they routinely euthanize these pigs since they do poorly and are not worth the trouble. She offers to surgically correct the hernia for $10.00 and can assure the farmer that after surgery the pig will be healthy and indistinguishable from any other pig on the farm. Should the farmer pay an extra $10.00 for the surgery when he is losing $5.00 on every healthy pig that leaves the farm? Common sense would say no, but consider the following analysis:

Euthanise the pig:

$0 revenue
$0 expense
$0 profit

Surgically correct the pig:

$10	surgery
$10	feed to bring that specific pig to market size
$2	labor to move, sort, and vaccinate that specific pig
$1	vaccine and incidentals used on that specific pig
$23	total expenses that are added as a result of having the extra pig
$35	revenue when sold
$12	profit from that specific <u>(marginal)</u> pig!

So doing surgery (and paying $10 to do so) on the pig yields an additional profit of $12.00 versus the $0 profit from euthanasia. Obviously, the better choice for the farmer is to do the surgery and earn the profit. One might immediately protest that the analysis is flawed, since at the outset the scenario stated that the average cost per pig was $40.00, and the analysis of this pig shows the cost to be only $23, even with the added $10.00 for surgery. In fact there is no contradiction. The $40.00 of costs apply to the **<u>average</u>** pig, while the $23.00 of costs apply to the **<u>marginal</u>** pig. Our extra, surgically reincarnated pig is a marginal pig, not an average pig. This extra pig does not have to pay the mortgage, the electric bill, the insurance, manure handling, etc. If in doubt about this assertion, consider the farm's fiscal status if the pig is euthanized. The mortgage is not reduced, nor is the electric bill, nor the manure management fee, nor are a host of other expenses on the farm that, related to this specific marginal pig, are "fixed".

{The above example is a simple partial budget, the accounting technique used to calculate the marginal effects of a management decision. In this case the outcomes were assumed to be a certainty, i.e. euthanasia is 100% effective, as is the surgery, and once repaired, the pig is always sold. There are additional techniques that can be used to deal with uncertainty in a marginal analysis (such as decision tree analysis or stochastic modeling) that achieve an "expected value" of the profit outcome of a particular decision.}

Ultimately, the best management decision will depend on the outcome of the marginal analysis, the manager's preference, and on what other investment opportunities are available.

The example of the marginal pig is instructive. It illustrates the power and profitability of the last increment of production. In nearly all cases, the most profitable unit of physical production is the last one, viewed from a marginal analysis perspective. In practical application, the profit from the marginal pig is $12.00, even though the average profit from every pig that preceded it was a loss of $5.00. What does the extra profit mean to the farm's financial status? Assuming the scenario held for an entire year, the marginal pig's addition to profit would be accounted for by reduced costs per pig, not increased revenue per pig. The average cost per pig would be reduced from $40.00 to $39.98 or some similarly small amount and the average profit per pig would increase from a loss of $5.00 to a loss of $4.98. In itself not a major result, but what if this could be done on one pig in every two litters? Hernia surgery may not have that potential, but what about attended farrowing?

▪ Calculating Marginal Feed Costs

Few dairies actually know their marginal feed costs; amazingly, many think they know their average feed cost per cwt, and almost all know their daily feed cost per group. Although it is not exact, using average daily feed costs for pen groups allows an estimate of the marginal feed costs. Our goal is to estimate two values: the average maintenance cost per cow per day, and the additional feed cost per cwt of marginal milk. Note the first is per cow per day, and the second is per cwt, regardless of how many cows or how many days it takes to produce that extra milk.

Spreadsheet 2 shows a hypothetical example of the relationship of production and **average** cost of production. Given the cost of feeding the cow producing 40 kgs of milk ($4.50) and the cost of feeding a dry cow ($1.50), the cost of feed to support the 40 pounds of milk production can be calculated ($4.50 - $1.50 = $3.00). If it costs $3.00 to support the milk production of a cow making 40 kgs of milk, then each kilo must cost 7.5 cents for the feed. Using the maintenance cost of feed for the dry cow as an estimate for all maintenance costs ($1.50) and knowing the feed cost of a marginal kg of milk (7.5 cents) the cost of feeding at each level of production can be calculated. Given a price for milk, revenue and income over feed costs can also be calculated.

The line for average feed cost per 100 kg is most telling. Notice that in a herd with a single TMR fed to all cows, the “average” feed cost per cwt varies hugely across production levels. Average feed cost per kg is a terrible measure of the economic efficiency of a dairy’s feeding management, e.g., purchasing cost control, inventory management, ration balance, feed delivery, etc. Average feed cost per 100 kg is almost entirely a proxy figure for the herd’s production level. As mentioned earlier, it is easier to determine the herd’s level of production by simply dividing milk sold by cows milking. Average feed cost per 100 kg provide almost no information regarding how well management is making feeding decisions.

Spreadsheet 2

Calculation of the income over feed costs at various levels of production

Example herd 02-Feb-06

	costs and revenue by production level				
production (kgs)	dry	10	20	30	40
maintenance feed costs	**$ 1.50**	$ 1.50	$ 1.50	$ 1.50	$ 1.50
feed cost for milk produced	$ -	$ 0.75	$ 1.50	$ 2.25	$ 3.00
total feed cost per day		$ 2.25	$ 3.00	$ 3.75	**$ 4.50**
feed cost per kg milk		$ 0.22	$ 0.15	$ 0.12	$ 0.11
feed cost per 100 kgs milk		$ 22.50	$ 15.00	$ 12.50	$ 11.25
milk revenue		$ 3.00	$ 6.00	$ 9.00	$ 12.00
income over feed costs		$ 0.75	$ 3.00	$ 5.25	$ 7.50

feed cost per additional kg milk	$ 0.075
milk price / 100 kg	$ 30.00
milk price per kg	$ 0.300
profit per kg of additional milk	**$ 0.225**
profit per 100 kgs additional milk	**$ 22.50**
return on 1 dollar spent on consumed feed	**$ 4.00**

Unfortunately, a similar measure gained popularity in the press – feed efficiency. It is not possible to determine the origin of this mistake, but it probably relates to the simplicity of calculation. Feed efficiency is merely the amount of milk divided by the amount of feed. However, this suffers from the exact same issues as average feed cost per 100 kg milk. As a matter of fact, it is the same calculation, merely adjusted by feed cost per kg feed.

So, as we now understand, daily feed is really two components – maintenance feed and marginal feed. A high producing cow has very similar maintenance feed to a low producing cow. But that maintenance feed is a far greater proportion of the diet of the low cow. So, big surprise, a low cow has lower feed efficiency. In simple terms, she is not diluting her maintenance as well as the high producing cow. This "feed efficiency" is merely a function of milk production. As enticing as it might appear to certain people, the use should be banned on knowledgeable dairy farms.

Spreadsheet 3: New York 1996 actual example of average feed costs

Calculation of the income over feed costs at various levels of production

New York Example: 1996 02-Apr-02

	costs and revenue by production level				
production (lbs)	dry	30	**50**	70	**80**
maintenance feed costs	$ 1.50	$ 1.50	$ 1.50	$ 1.50	$ 1.50
feed cost for the milk	$ -	$ 0.90	$ 1.50	$ 2.10	$ 2.40
total feed cost per day		$ 2.40	**$ 3.00**	$ 3.60	**$ 3.90**
feed cost per lb milk		$0.080	$0.060	$ 0.051	$0.049
Feed cost per 100 lbs milk		$ 8.00	$ 6.00	$ 5.14	$ 4.88
milk revenue		$ 3.60	$ 6.00	$ 8.40	$ 9.60
income over feed costs		$ 1.20	$ 3.00	$ 4.80	$ 5.70

feed cost per additional lb milk	$ 0.030
milk price / cwt	**$ 12.00**
milk price per pound	$ 0.120
profit per pound of additional milk	**$ 0.090**
profit per 100 lbs additional milk	**$ 9.00**
return on 1 dollar spent for consumed feed	**$ 4.00**

Spreadsheet 3 provides another approach to the same issue and shows how marginal feed cost per cwt can be estimated on an operating dairy. In this approach, all that is known is the level of production and the average cost per cow per day for two production groups. In this example from an actual New York dairy in 1996, the group making 50 pounds of milk (average) cost $3.00 per day per cow, while the group averaging 80 pounds of milk cost $3.90 per day. The difference in production was 30 pounds of milk and in feed cost was $0.90, or 3 cents per marginal pound of milk. Armed with this information and the milk price, the rest of the table can be calculated. At the risk of being redundant, notice that at $12.00 milk, for every ADDITIONAL dollar of feed a cow eats, she returns 4 dollars in ADDITIONAL milk income, a 4:1 return on the expense of additional consumed feed.

Spreadsheet 4: California 1997 actual example of average feed costs

Calculation of the income over feed costs at various levels of production

California Example: 1997 | 02-Apr-02

	costs and revenue by production level				
production (lbs)	dry	30	**45**	70	**90**
maintenance feed costs	$ 2.25	$ 2.25	$ 2.25	$ 2.25	$ 2.25
feed cost for the milk	$ -	$ 0.83	$ 1.25	$ 1.94	$ 2.50
total feed cost per day		$ 3.08	**$ 3.50**	$ 4.19	**$ 4.75**
feed cost per lb milk		$ 0.103	$ 0.078	$ 0.060	$ 0.053
feed cost per 100 lbs milk		$ 10.28	$ 7.78	$ 5.99	$ 5.28
milk revenue		$ 4.20	$ 6.30	$ 9.80	$ 12.60
income over feed costs		$ 1.12	$ 2.80	$ 5.61	$ 7.85

feed cost per additional lb milk	$ 0.028
milk price / cwt	**$ 14.00**
milk price per pound	$ 0.140
profit per pound of additional milk	**$ 0.112**
profit per 100 lbs additional milk	**$ 11.22**
return on 1 dollar spent for consumed feed	**$ 5.04**

Spreadsheet 4 shows a similar example for a dairy in California in 1997. In this case, increasing production from the 45 pound group to the 90 pound group costs a marginal increase of $1.25. $1.25 / 45 pounds = 2.8 cents of feed for a marginal pound of milk, or $2.80 per cwt of marginal milk. If milk were $14.00 per cwt, this would be a 5:1 return on feed expense!

Never look at feed efficiency or average feed costs as a measure of the efficiency of a feeding program; look only at marginal returns to make decisions! Average cost per ton of soybean meal may be a useful number in determining if the farm is doing an efficient job in purchasing feed. Average feed cost per hundredweight, in contrast, is so confounded by the herd's production that it is misleading at best as a measure of the farm's efficiency in feed procurement and delivery. Feed cost per hundredweight on most dairies is something of a foregone conclusion. If the herd is producing poorly, the average feed cost per hundredweight will inevitably be high. If the herd is filled with high producers, the average feed cost per hundredweight will inevitably be low. Average feed cost per hundredweight is not the best monitor of how well a farm controls its feed purchase costs. Calculations based on the benchmarks of "good cost control" versus "poor cost control" farms can show that more than one half of the apparent losses to herds attributed to poor cost control in purchasing feeds are not, in fact, due to the price of the feed purchased, but are due instead to the low production and failure to dilute out maintenance costs.

Clearly, the most effective way to reduce average feed costs per hundredweight is to feed and manage cows so that that they are shifted to the right in the spreadsheets, that is, so that they produce more milk. The marginal cost of feed is so small (7 to 8 cents per kg of milk) compared to the marginal value of milk (27 to 30 cents per kg) that it is essentially always a good idea to feed more to make more milk. When the milk price is low, the proper behavior is to try to make more milk per cow. When the milk price is high, the proper behavior is still to try to make more milk per cow. It is pretty simple.

While it is certainly true that dairy farmers should try to purchase their feeds as cost effectively as possible (buying feeds cheaply), it is probably rarely wise to buy poor feeds because their price is low (buying cheap feeds). The impact of marginal milk on profit is simply too great to forego. Veterinarians and nutritionists need to help their clients refocus away from feed cost savings and toward increased production and profit.

Does A Low Production Group Save Money By Reducing Feed Costs?

Group feeding cows by production group is so widely practiced in the dairy industry that is seems like common sense that it must be a wise management practice. If it costs an average of $4.00 per day to feed a cow in the high group and $3.00 per day in the low group, it would seem only to make sense to move cows to the cheaper ration as their production declines in later lactation and save the $1.00 of feed costs. If the average cow in a 100 cow dairy spends on average only the last 100 days in the low group, the savings should be $10,000 per year in feed costs (100 cows, 100 days each, $4.00 -

$3.00 = $1.00 per day). As appealing as this arithmetic may be, it is not true. Several presumptions lie behind the preceding analysis. First, it is presumed that the cow, once moved to the lower cost ration, will continue to produce the same amount of milk that she would have made had she stayed on the more expensive ration, or said another way, that she would have stayed on the same lactation curve on the cheaper ration. If this was true, and a farmer plans to move the cow on Monday, one could ask why not on Sunday? If a dairyman can move a cow from an expensive ration to a cheaper one without affecting production, why not do it sooner? Using this logic, one would push the group move date earlier and earlier in the lactation until either the whole herd is fed the cheaper ration (a mistake) or one is forced to admit that the only time one should move a cow to a cheaper ration is when one expects the production to decline. Presumably, production losses in a moved cow should be worth less than the feed savings.

As expected, the analysis based on average feed cost per cow in the two groups is flawed. The proper analysis should be based on a marginal cow. That is the one that will be moved. Some assumptions are needed for this analysis as well. First, the analysis assumes that the cow, once moved, will continue to eat the same amount of dry matter as before the move. This may be optimistic, since the social effects and the likely higher NDF of the cheaper ration may drive intakes down, but for this analysis we will remain optimistic about intakes. Further, it is assumed that any impact on production as a result of the move will be sustained for the rest of the lactation, i.e. that the cow, once shifted to a lower lactation curve will remain on that curve. Last, it is assumed that milk production will be driven by energy intake, and that the new, cheaper ration is adequate in the other nutrients to support the milk production provided for by the energy intake.

Spreadsheet 5 presents the analysis for a cow consuming 19 kgs of dry matter on the day of the move. The expensive ration costs 18 cents per kg of dry matter and the cheaper ration costs 16.5 cents, or roughly 10 percent less per mouthful. The expensive ration contains 1.7 Mcal per kg of dry matter, the cheaper 1.6 Mcal. The move (presuming no change in dry matter intake) does indeed save $1,000 per year in feed costs. However, the reduction in energy intake, if fully translated into reduced milk production, causes a loss of $11,000 in milk revenue. The net result of moving the 100 cows in the herd is a loss of approximately $10,000. This is a far financial distance from the expected $1,000 in savings based on the average feed costs in the two groups.

Spreadsheet 5: Estimate of the economic effect of moving a cow to a low group

Does it pay to move a cow from a high cost ration to a lower cost ration?

19	cow's current dry matter intake	
$ 30.00	price of milk per cwt	
100	cows in the herd that will move to the lower group per year	
100	days the cows will spend in the lower group if moved	
High Cost Group		Lower Cost Group
$ 4.00	cost to feed the average cow in the group	**$ 3.00**
22.0	average dry matter intake in the group (kgs)	**18.0**
$ 0.18	cost of ration per kg of dry matter	$ 0.165
$ 3.40	ration cost eaten by the cow to be moved	$ 3.30
$ 0.10	savings from reduced feed costs per cow per day	
$ 10.00	savings per cow per lactation	
$ 1,000	savings in the herd per year	
1.7	NE(l)/kg DMI in the ration	**1.6**
32.3	energy intake by the cow to be moved	30.4
1.9	difference in energy intake after move (Mcal)	
0.7	energy requirement per kg of milk	
2.7	Kgs of milk no longer supported by ration	
$ 1.08	value of milk not produced	
$ 108	Lost income per cow per lactation	
$ 11,000	lost income for the herd per year	
$ (.98)	loss per cow per day from the move	
$ (98)	loss per cow per lactation	
$ (10,000)	**Net financial effect of the move**	

The expected savings in feed costs would be wiped out if milk Production dropped by as little as 33% of the prediction In this case, by as little as 1.3 kgs per day

If asked, most dairymen will concede that cows decline in production when moved to a cheaper, less energy dense ration. In the example case, if the cow loses more than 1.2 kg of production, the value of any feed cost savings are wiped out. Again, it simply does not pay to try to reduce feed costs at the expense of production. The marginal value of milk is too much greater than the marginal costs of feed. Most very high producing herd dairies (more than 12,000 kg per cow), when asked, will admit that they do not really have a low group ration. They may feed cows as groups (heifers, breeding cows, etc.), but the driving motive is rarely because they are trying to reduce feed costs.

It is probably safe to say that the overwhelming majority of dairies in North America limit feed their milking cows. Usually this is done out of ignorance and out of the misguided attempt to reduce average feed costs by reducing the cost of feed fed to a given cow on a given day. Dairymen and professional nutritionists alike focus on the cost of feeds, tweak their linear programs, limit feed delivery or access to the bunk, feed poor, cheap feeds in an effort to reduce average feed costs per hundredweight. The individual dairyman would be well served to feed more and better, even more expensive feeds per pound of dry matter, if the result is increased production per cow. It may very well be that there is reason to group feed cows in order to reduce costs of protein, or expensive additives in later lactation. **It is unlikely, however, that it is ever financially wise to deliberately limit the energy intake of a milking dairy cow.** The exceptions, like particular individual very fat cows, do not outweigh the enormous losses that dairies incur by trying to “feed cheaply”. Marginal milk is simply too valuable.

▪ 30 Day Dry Periods

Every few years, a new fad hits the dairy industry. This is good news for the trade magazines, or else their ad revenue might decrease. However, many of these get-rich-quick schemes later turn out to be not so useful. A few examples – extended lactations from delayed breeding, and 4x-6x milkng of fresh cows – arrived with great fanfare, but few dairies found them profitable.

Shorter dry periods seem very attractive. For many dairies, they only need one dry cow ration, which simplifies formulation and delivery, and makes feeding dry cows much more consistent. In addition, it appears that there is small impact on the following lactation. So the opportunity to accrue the additional cash prior to freshening seems like an obvious decision.

This example demonstrates a failure with an improper partial budget. From a single cow perspective, it looks great. But some assumptions were flawed. First, we assume there is excess parlor capacity, milking cow housing capacity, (and quota capacity). Oops, stop right there. If there was truly excess capacity in all those areas, a bigger mistake is already in place. Fill the barn! Never ever run a facility at under-capacity. It is perhaps the most expensive “disease” on a dairy.

So the true comparison is not the dry cow to herself, milking 30 extra days, but the difference between milking a cow 8 months pregnant vs. milking the average cow in the herd. In every dairy that has tried this, the milk production during that extra month of lactation (the eighth month) is at least 20 kg below the herd average. Filling the parlor with these cows is no longer a get-rich-quick scheme.

▪ Sire Selection

Sire selection serves as another common example of faulty decision making on dairies. Investing money on better semen pays off in more milk production in the future. That increased milk production will require greater feed consumption. It is important to properly account for the increased costs and increased income to make the correct decision.

Each dairy must decide what price they are willing to pay for semen performance. Semen is always an investment in the future. Even in the hypothetical situation where the semen purchased today results in a successful pregnancy, the gestation period of nine months occurs before the calf is born. In general, there is nearly a two-year growth phase before the first freshening. Finally, there is another year before the first lactation is completed. Thus the investment in semen is made with current dollars, but the payoff is three to six years in the future.

In addition, the conception rate of the dairy affects the cost-benefit ratio. If the conception rate is two services per pregnancy, and half the calves are females, it takes at least four units per female calf. Typically, some inseminated animals are culled, some animals abort, some calves are twins or die, so that it often takes nearly five breedings per live calf. Not every heifer gets pregnant, freshens, and completes her first lactation to become a second lactation cow. On most dairies, the annual semen purchases divided by the number of lactation two cows exceeds six straws. If these assumptions are close, then it takes at least six units of semen to achieve the predicted benefit of that sire.

The benefits are best estimated as the predicted difference between two sires. This difference will occur on average for at least two years, and will also be partially passed on to future offspring. Thus, a 200-kg difference between two bulls will perhaps return 500 kg in future milk. Two important adjustments must be made. First, the income will not accrue for three to fours years, and secondly, the extra milk produced will need extra (marginal) feed.

The goal of breeding a cow is to change the status of that cow from open to pregnant. Money is spent on semen, insemination, heat detection, veterinary examinations, and medications. These expenses can be estimated. It is much more difficult to estimate the value of these interventions. What is the economic value of a pregnancy? Knowing the value of a pregnancy allows us to make better decisions about the economics of reproductive interventions, and can justify the energy and expense in getting a cow pregnant.

■ Summary

Any economic estimates that involve increased milk production need to account for the increased feed costs. These must be calculated using marginal feed costs, not average feed costs. Any drop in milk production is not a complete loss, there is typically some savings in feed costs. However, the value of milk far exceeds the value of marginal feed costs. Getting cows to eat one more bite, thus trying to get them to produce one more kg of milk will almost always produce more profit. It should be a mystery to every nutritionist, veterinarian, feeder, manager, and banker if a dairy ever has an empty feed bunk.

The concept of marginality and marginal decision making is the key to making the right decisions on dairies. In some respects, veterinarians are comfortable in thinking in marginal terms, since each therapeutic decision in an individual cow is a marginal decision in economic terms. Dairy farmers and their advisors can be led astray, however, when they begin to base the next marginal economic decision on the overall historic average performance in a herd or the industry. Management practices that are widespread and well accepted may not be the best economic choices. Advisors to dairy producers have a responsibility to think freshly (and marginally) about the standards of management to which we have all become accustomed.

Many dairy farmers forego very significant profit opportunities in the false pursuit of reducing the costs of inputs. By focusing on the costs of inputs and not the inputs' marginal impact on revenue (milk) and therefore profit, many dairy producers box themselves into a cycle of poor investment decisions, poor profitability, and a poor lifestyle. Advisors, properly prepared and with the proper conceptual basis, can help them break out of that cycle and improve their clients' livelihoods and lives.