TALKIN' MILK SOLIDS

Ian Gibb
Farmanco, Kyabram

Take home messages

- **Milk payments are on the basis of protein, fat and volume**
- **Using milk volume only can lead to misguided decisions with regards to optimum season of calving**
- **Similar errors can occur when making other farm management decisions based on milk volume, rather than yield of milk solids**
- **Changes in grain feeding can alter milk composition as well as milk volume, leading to different response curves to additional grain feeding**
- **Responses should be assessed as marginal not average**

Protein + Fat (= Milk solids)

The term 'Milk Solids' (MS) is already part of the lexicon in the dairy industry. The Kiwis have been using it for quite a few years and Australian manufacturers also refer to MS at times. Unfortunately the term MS doesn't mean what it implies, total milk solids; it means kg of milk Protein plus kg of Fat (P+F). There are other 'solids' in milk like lactose and minerals that are not included in MS.

Milk payment systems

The basic formula for milk payment to almost all farmers is Protein + Fat – Volume. The reason for this is that protein and butterfat are the main components of value. Lactose also has value but it tends to come along as a passenger anyway. A formula that included P+F+L-V would add to complexity but very little to accuracy. Volume is a negative factor because transport and manufacturing costs are related to volume.

Within the formula P+F-V:

- Protein has a value about 2.5 times fat
- Volume charges average around 2.7 cents/litre
- Their relative values have changed very little in 20 years.
- Protein and fat values change during the year, which impacts on the seasonal value of milk.

As well as base prices and charges there are also all sorts of add-ons, deductions and penalties including quality, off-peak, ratio and volume incentives as well as stop charges, levies, share deductions and quality penalties. Ultimately, what really matters is how much the farmer is left with as net milk income.

'Milk' price

It gets even more complicated when we want to express 'milk' price per unit of output. We can do this as:

- Cents per litre (net dollars divided by total litres produced)
- Dollars per kg fat (net dollars divided by total kg of fat produced)
- Dollars per kg protein (net dollars divided by total kg of protein produced)
- Dollars per kg MS (net dollars divided by total kg of protein + fat produced)

All of these 'milk' prices are legitimate but some are a lot more useful than others.

- Litres, for example are quick and easy to measure. Unfortunately though, cents per litre is misleading:
  - if used to compare milks of different composition, (between farms or between times of year)
  - or when making management decisions.

  There have been various attempts to overcome these deficiencies by comparing a 'standard litre' (eg. FCM or ECM) but in general this only adds to the difficulty and confusion.

- Dollars per kg fat or protein (equivalent) overcome some of the deficiencies of cents/litre but add to confusion as each only represents part the value of milk components.

- Dollars per kg MS is not perfect either.
  - It is more complex:
    - We need milk volume as well as tests for protein and fat
    - We then have to add protein and fat yield together and divide this figure into net dollars to get $/kg MS.
  - Adding P+F implies that they have equal value, which is not true.

Despite these limitations, $/kg MS overcomes most of the deficiencies of cents/litre. It is a much better measure when milk composition varies (and can therefore be used to compare between farms or times of year) and is a useful measure for making management decisions.

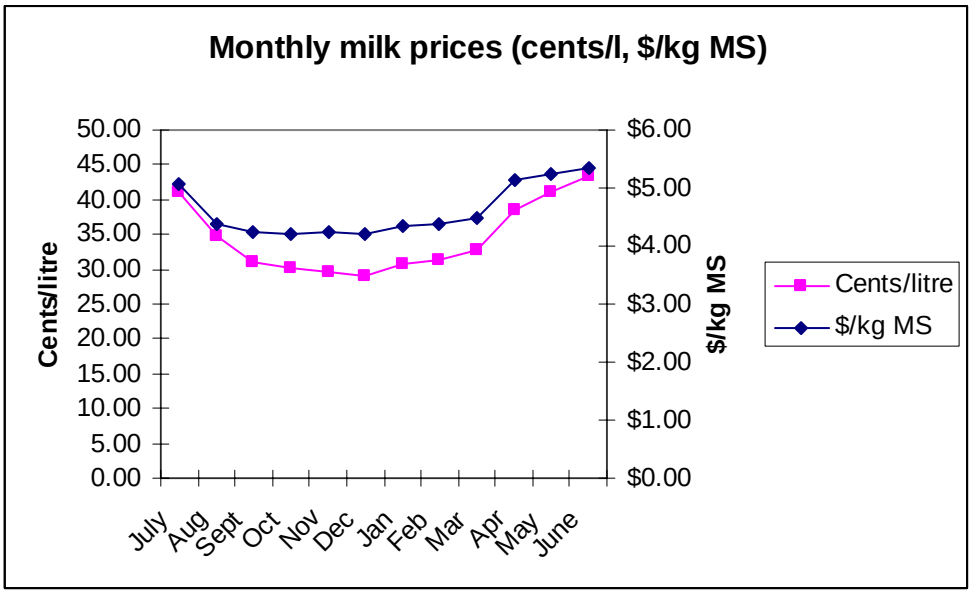
Comparing milk price in $/kg MS and cents/litre

Prices during a season

Milk composition (protein and fat test percentages) varies during the year, especially in seasonal calving herds. This has an impact on apparent milk prices expressed in cents/litre and $/kg MS. Figure 1 depicts the situation for a medium sized, seasonal-calving herd. Step-ups and incentives have been taken back into the months they belong to.

The 'price message' in cents per litre is that winter milk has 40% more value than spring milk. The $/kg MS figures show only a 25% difference. This overstatement of price or 'error' in cents/litre is due to differences in milk composition between winter and spring. It is quite possible that farmers looking at relative prices in cents/litre could, for example, make a misguided decision to change to autumn calving. This is an example of how using milk price in cents/litre can be misleading.

Figure 1. Effective monthly milk price (in cents/litre and $/kg MS) for a seasonal calving herd, using estimated 2005/06 final prices.



How often have you heard a farmer say something like, “It is hardly worth producing milk in spring. It is only worth 20 cents/litre. Winter milk is worth twice as much.” Statement like this contains a combination of two errors.

- The first is that it is not valid to compare spring and winter milk in cents/litre when they have different composition. This is not comparing ‘apples and apples’.
- The second error has nothing to do with the use of cents/litre. It is a result of forgetting about step-ups, retrospective payments and incentives. When these are added back there is nothing like a twofold difference.

The first error is avoidable by using a measure of milk price that is relatively insensitive to milk composition, like $/kg MS. The second calls for a better understanding of milk payment systems.

Prices within a month

To make sense of prices in cents/litre ‘adjustments’ have to be made for changes in milk composition. The most common way that dairy companies deal with this is to publish a table that covers the normal range of milk composition.

Table 1. Milk price in cents/litre for a range of milk compositions based on April 2006 prices.

Butterfat test percentage	Protein test percentage 2.60%	2.80%	3.00%	3.20%	3.40%	3.60%	3.80%
3.6%	26.0	27.4	28.9	30.3	31.7		
3.8%	26.6	28.0	29.4	30.8	32.3	33.7	
4.0%	27.2	28.6	30.0	31.4	32.8	34.3	35.7
4.2%		29.2	30.6	32.0	33.4	34.8	36.2
4.4%		29.7	31.1	32.6	34.0	35.4	36.8
4.6%			31.7	33.1	34.6	36.0	37.4
4.8%				33.7	35.1	36.5	38.0
5.0%					35.7	37.1	38.5
5.2%						37.7	39.1
5.4%							39.7

This table covers milk over a normal range of composition (from a protein:fat ratio of 0.68:1 to 1:1). The features of this table are:

- Price in cents/litre increases as either protein and fat test % increase
- When both protein and fat test % increase, price in c/l increases rapidly
- The range of prices between the extremes of normal composition are almost a factor of two (from 26.0 to 39.7 cents/litre). We would see a similar pattern (with different numbers) in any other month.

If we wanted to quote an 'average' price in cents/litre we could say 32.0 cents/litre but we would need to qualify this by saying plus or minus 25% or else specify both protein and fat tests.

The equivalent table in $/kg MS demonstrates the difference.

Table 2. Milk price in $/kg MS for a range of milk compositions based on April 2006 prices.

Butterfat test percentage	Protein test percentage 2.60%	2.80%	3.00%	3.20%	3.40%	3.60%	3.80%
3.6%	$4.20	$4.29	$4.37	$4.45	$4.53		
3.8%	$4.15	$4.24	$4.33	$4.41	$4.48	$4.55	
4.0%	$4.12	$4.20	$4.29	$4.36	$4.44	$4.51	$4.57
4.2%		$4.16	$4.25	$4.32	$4.40	$4.47	$4.53
4.4%		$4.13	$4.21	$4.28	$4.36	$4.42	$4.49
4.6%			$4.17	$4.25	$4.32	$4.39	$4.45
4.8%				$4.21	$4.28	$4.35	$4.41
5.0%					$4.25	$4.32	$4.38
5.2%						$4.28	$4.34
5.4%							$4.31

Table 2 covers exactly the same range of composition as Table 1 but the effect of varying composition on price is much less severe. If we quoted an 'average' price of $4.32/kg MS we would only expect to see a price range of about 5% either side, one fifth of the 'error' we saw for cents/litre.

The key message here is that MS is a much more useful measure of milk price than cents per litre as it is not distorted to any great extent by changes in milk composition.

Management decisions based on $/kg MS and Cents/litre

Similar errors occur when making management decisions if changes in production are expressed in litres or milk price is expressed cents/litre. Again, this is mainly a result of changes in milk composition.

Changes in milk production day-by-day

It is convenient and easy to track daily milk production by watching milk volume. The dipstick in the vat provides an easy measure. There are a lot of factors that impact on daily milk production but the two most important ones are interval between milkings and level of feed intake. Once interval between milkings is ruled out by milking at consistent times, it is tempting to attribute daily changes in milk volume entirely to level of feeding and use this as a guide to how much supplement to feed. Anyone who has tracked both milk volume and MS production will know that MS does not vary on a day-by-day basis nearly as much as volume does. When production falls, fat test percentage and to a lesser extent, protein test tend to increase. The end result is that MS production is much less volatile than litres.

It is easy to overreact when judging supplementary feeding levels by changes in milk volume. Tracking MS provides a more useful message.

In the process of collecting data to calculate MS there is also a lot of useful information about the diet the herd is getting:

- MS production (kg/cow/day) provides a good measure of the valuable part of production (volume only really tells you how much volume charge you will pay)
- Fat test and protein:fat ratio provide a guide to fibre levels in the diet
- Protein test provides a guide to energy levels in the diet

Changes in the value of milk production

The nutrition industry in Australia has tended to focus on production responses in litres and the value of production responses in cents/litre. There appear to be three reasons for this:

- A lot of the technology nutritionists use comes from the USA where many farmers are paid for milk volume and a lot of milk is produced in feedlots. Feedlots feature year-round consistent production and minimal variations in milk composition, which makes measurement by volume valid in this environment (but not a valid measure here).
- Milk volume is quick and easy to measure.
- Many nutritionists do not appear to understand Australian milk payment systems. Most farmers in Australia are paid for the MS components on the formula Protein + Fat-Volume, not for volume. Volume is always a negative factor.

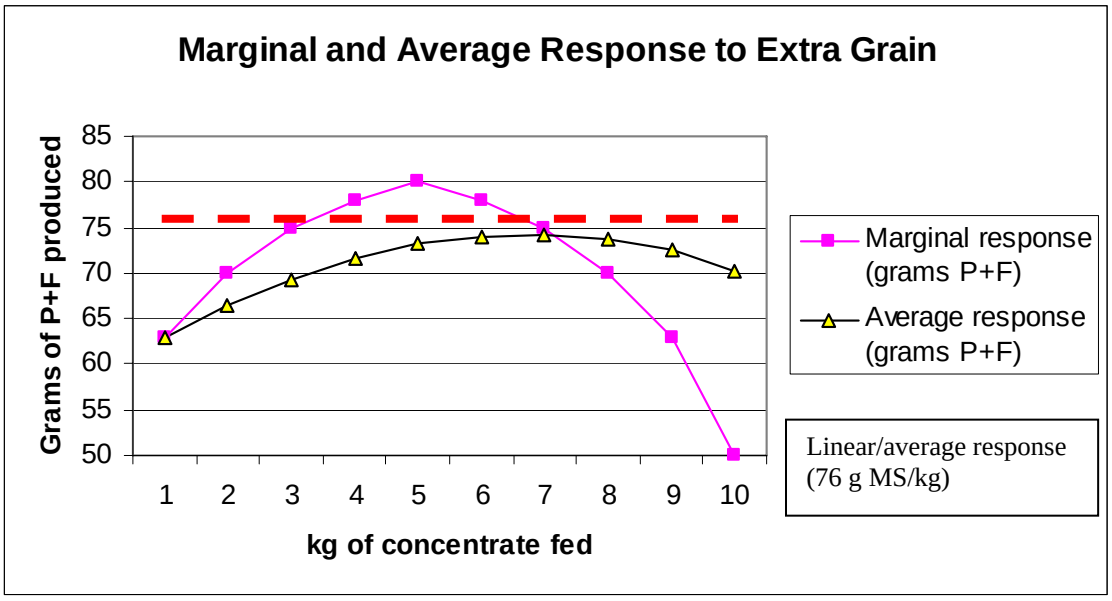
Unfortunately the errors in using production responses in litres and value of milk in cents/litre are compounded when used to estimate the value of extra production. The result is frequently a message to ‘feed more’ when the real economic message should have been ‘feed less if you want to make more profit’.

A further factor in production responses that is often overlooked is that the important issue is the 'extra MS produced from an extra kg of supplement', not the average volume produced per kg of supplement. The difference between 'marginal response' and 'average response' is critical:

- 'Marginal response' is the extra output for the last unit of input. In the case of supplementary feeding it is the extra output from 1 to 2, 4 to 5 kg or 9 to 10 kg. We know from experimental data that this marginal response peaks and then starts to fall. At some point the value of the extra output will be equal to the value of a kg of extra grain. This is called the 'break-even' point.
- 'Average response' is output with grain minus output without grain divided by the total number of kg of grain fed. Apparent average response will always fall more slowly than marginal response. This is simply a function of the arithmetic.

An even more serious error results when it is assumed that responses are linear (eg. one litre/kg of grain). This implies that no diminishing returns occur at higher feeding levels, which we know is simply wrong. For example, by assuming 1 litre/kg we are implying a response of 76 g of MS/kg of grain for milk with a 3.6% protein test and 4.0% fat test. Figure 2 illustrates that this is likely to be true in only a very limited number of situations.

Figure 2. Marginal, average and linear/average responses in grams of MS (Protein + Fat) per kg of grain fed to a herd on paspalum dominant pasture



- The marginal response curve shows a peak at the 5th kg of grain at about 80 g MS/kg. It also shows marginal response falling away quickly at higher levels of grain feeding. At some point (break-even) it would become uneconomic to feed more. The break-even point will vary with milk price and grain cost.
- The average response curve peaks at the 7th kg of grain and then falls quite slowly. If we relied on this to determine the right level of grain feeding we would be tempted to feed too much.
- The naive linear response line suggests that we will always get 76 g extra MS when we add another kg of grain which is clearly wrong.

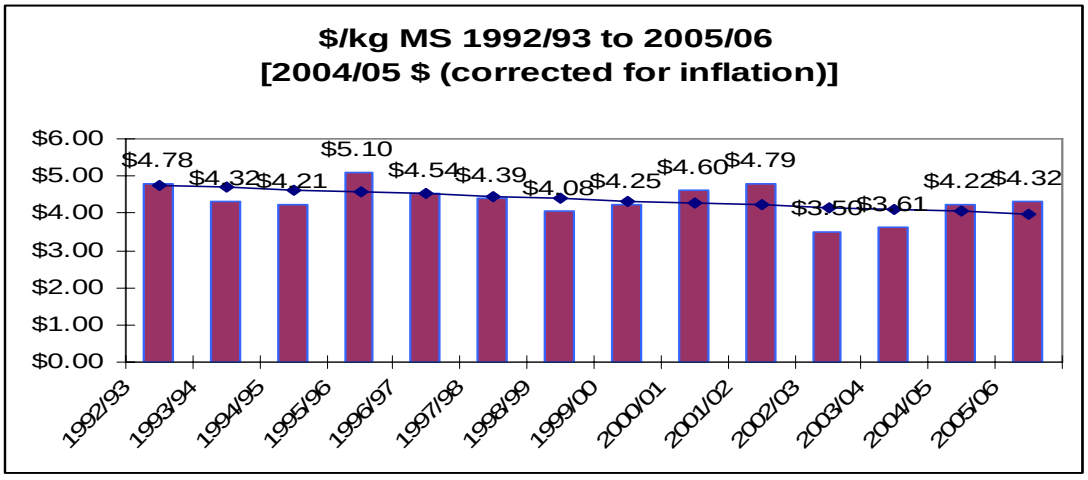
This is only one marginal response curve for supplementary feeding for very specific conditions (pasture type, amount of pasture on-offer, time of year, stage of lactation, etc.). The curve would look different under different conditions but the message would be the same; *Using average response data (or even worse linear/average in cents/litre) to predict feeding levels rather than marginal response data will result in feeding too much and reducing profit.*

Twenty years ago when very little grain was fed (and even then at low levels) feeding too much was not a problem for the dairy industry. Now many farmers are feeding beyond the maximum marginal response point and some even beyond break-even. Farmers need both production monitoring in MS and an understanding of marginal responses to avoid unprofitable feeding.

Fluctuating Milk Price and Risk

The UDV has commissioned Farmanco to publish milk price data in northern Victoria since 1992. The graph below shows the highs and lows and the trend line for milk price over this period.

Figure 3. Milk price (in $/kg Milk Solids) at farm-gate over 14 years for a 'typical' farm in northern Victoria, after correction for inflation. All prices are net of levies and other compulsory charges. Note that prior to 2000 farm-gate price includes VDIA payments



In 'real' dollar terms (after correction for inflation) the peak price years were 1995/96 and 2001/02. The price for 2005/06 includes as assumption that there is one more step-up to come.

Milk price has varied by around plus or minus 15% above and below this trend line over the last 14 seasons. There is no reason to believe that this pattern will change in the near future. Fluctuating milk prices represent a major risk for all dairy farming systems. Systems that have lower profit margins are at greater risk.

Against a framework of decreasing real prices and increasing costs the only defence available to farmers has been to increase productivity. It seems however that some farmers (and many service providers) have confused productivity and production and assumed that more production means more profit. *When 'more production' means*

'more litres' without reference to production costs there is a very good chance that 'more production' could mean less profit and higher risk. The industry needs to start looking at profit, not production if it is to remain competitive. Measurement of production in kg MS and price in $/kg MS would be a step in the right direction.

Ian Gibb has 33 years of dairy industry experience and has operated the consulting firm Farmanco Pty Ltd, based at Kyabram in the Goulburn Valley, since 1989. Farmanco provides advice on farm management decision making to dairy farmers across the irrigation area of northern Victoria and southern NSW.

Ian is also involved in project work for various government agencies, commercial banks, dairy companies and other industry groups in the region. He has been invited to speak at numerous industry conferences and workshops and regularly contributes to industry publications and newsletters.