INTRODUCTION

The Balance Model is a conceptual model that has been designed to represent the balance of factors that contribute to optimum milk production per hectare, a key profit driver, on dairy farms. It is a significant component of a complete dairy benchmarking service, called Dairy Best Business, provided by Dairy Farmers Farm Services. The Balance Model is a useful extension tool that simplifies the presentation and interpretation of dairy farm benchmark data. Its visual and practical nature results in benchmark users and advisers being able to understand and relate to the model easily. This paper discusses the background and theory of the model and most importantly, its practical application.

THE MODEL

The Balance Model is a graphical representation of four factors that contribute to total milk production per hectare. It can also be linked to the financial measure of Margin Over Feed Costs (MOFC) per hectare, when income is calculated using a blend price for milk (i.e., when the effect of individual quotas are ignored). The model is constructed by plotting stocking rate on the milking area, total dollars spent on fertiliser per milking hectare, total dollars spent on purchased feed per milking hectare and litres per cow on an X:Y grid. The points on the X and Y-axis are joined to create a diamond shape to create the Balance Model.

The greater the distance between the points on the X-axis (i.e., litres per cow and stocking rate) the more milk produced per hectare. It seems that MOFC per hectare using a blend price, has a strong relationship with milk per hectare. The $R^2$ co-efficient between these two variables for 1998 and 1999 were $R^2$ 0.82 and $R^2$ 0.88 respectively for the NSW Benchmark data collected by Dairy Farmers Farm Services Group.

THE SHAPE AND SIZE OF THE MODEL

The shape of the Balance Model changes between regions and between years within regions. The ideal shape of the model to achieve a high MOFC per hectare would be wide along the horizontal axis and short or close together on the vertical axis. In other words, a compressed diamond. To be able to achieve this compressed diamond shape a dairy farmer would...
need to spend very little on both purchased feed and fertiliser per hectare and yet achieves excellent responses from these inputs. In reality the shape more often looks like a balanced or regular shaped diamond. The top 25% of farms, (when selected on EBIT, Earnings Before Interest and Tax, per hectare at a blend price) in all regions of NSW where there is adequate data, have larger diamond shapes than the average or bottom performers in that region. This implies the larger the Balance Model/diamond shape, the greater potential for EBIT per hectare. (Figure 2).

There is possibly a point where stocking rate, production per cow, fertiliser per hectare and/or purchased feed per hectare become uneconomical to increase. The data collected from farms in Dairy Best Business indicates that in practice (on farm), we have not reached these uneconomic levels.

**Figure 2.** The Balance Model Showing the Top Ten Percent (on EBIT per-hectare at a blend price) In NSW and The Average in NSW

The message that the Balance Model helps to communicate is that to achieve higher milk per hectare, and higher MOFC per hectare at a blend price, a farmer often needs to spend more on fertiliser and purchased feed per hectare than is currently the case. It also helps farmers to understand they should focus on achieving good responses from this purchased feed and fertiliser.

**WHERE IS THE MODEL APPROPRIATE?**

The concept of the Balance Model seems to be appropriate in higher rainfall (or irrigation) areas; where cattle are grazed; feed costs are similar to the prices paid in NSW last year, and where land is one of the major assets in the dairy business. This suggests the model can be applied to most dairying districts in NSW and may have application in other areas of Australia. It also suggests it may be inappropriate for use in dairy feed lot situations.

**THE IMPORTANCE OF MOFC PER HECTARE**

The four factors considered in the Balance Model have a relationship with MOFC per hectare. MOFC per hectare is an important measure, as a higher MOFC per hectare gives the dairy business a better chance of making a higher profit. The top 25% of farmers in the Dairy Best Business sample (selected on EBIT per hectare at a blend price) always have a larger diamond on the Balance Model than the average or bottom 25% for a similar geographic region. This indicates a larger diamond and larger MOFC per hectare is likely to contribute to a larger EBIT (Earnings Before Interest & Tax) per hectare. However, having a larger diamond does not guarantee success (success as measured by high EBIT).
A larger Balance Model does not guarantee a larger EBIT per hectare at a blend price for milk. There are many areas of cost in a dairy business that still have to be accounted for after MOFC and before calculating EBIT. A farmer therefore needs to have a high MOFC and good cost control in other areas of the business to ensure a healthy EBIT.

MOFC per hectare and per hectare and the relationships to the four individual factors of the balance model. Each individual factor of the Balance Model has a relationship with MOFC per hectare.

Stocking rate and MOFC per hectare
This is by far the best correlation with MOFC per hectare at a blend price of the four factors considered in the Balance Model.

The NSW results in 1998 and 1999 show strong correlations with stocking rate and MOFC/ha. (R^2 0.71 and R^2 0.64 respectively).

This strong correlation is likely to be because of:

- Stocking rate helps to utilise home grown feed per hectare. This, in turn can drive down pasture costs. (E.g. On the South Coast of NSW in 1999, the top 10% of farmers harvested 10.39t of pasture Dry Matter (DM)/Ha at a cost of $96/t DM compared with the average farm harvesting 8.62t DM/Ha at a cost of $127/t DM).
- Stocking rate directly effects milk per hectare and drives income per hectare lifting the potential to maximise MOFC per hectare.
- Stocking rate assists to turn grass into milk without the extra cost of conserving the product and then feeding out a conserved product that can cause high substitution rates. (e.g in the NSW 1999 data, the cost of conserving a tonne of dry matter of grass was $94 above the cost of growing the pasture. This resulted in a total conserved feed cost of $238 per tonne dry matter).

Fertiliser per hectare and MOFC per hectare
When fertiliser as an independent variable is compared to MOFC, the results between years and districts are variable.

The NSW 1998 results showed a reasonable correlation (R^2 0.17) but the NSW 1999 results showed a low correlation. In the NSW South Coast area there was a reasonable correlation in both years and a slightly stronger correlation in 1999 (R^2 0.21).

This correlation possibly changes for a variety of reasons. These include:
- Farmer decisions in very wet or very dry years to significantly change their fertiliser usage for that year.
- The use of capital applications of fertiliser. Large amounts of fertiliser in one year to improve soil fertility quickly.
- Decisions to mine fertiliser. Farmers who have a high fertiliser history deciding to use up some of that reserve.
- Lag time. Fertiliser responses can take time and if a lot of fertiliser is put on at the end of a financial year, the benefits may come in the following financial year.
- Fertiliser may be the major nutrient source but it is not the only nutrient source for the farm. Nutrients are also purchased in feed supplies and recycled by cattle. The amount of recycling of nutrients can depend on individual farmer decisions.
- An imbalance of fertiliser would result in dollars spent on fertiliser that have low responses in feed grown and an effect on MOFC per hectare.
- Poor utilisation of home grown feed also effects the results on the fertiliser to MOFC per hectare correlation.
- Changes in fertiliser prices between years and districts. Different types of fertiliser mixes used by farmers in different areas.
- Lack of rain or irrigation water effects responses to fertiliser and therefore the correlation with MOFC per hectare.
- Low stocking rate and reliance on pasture conservation (adding costs & increasing losses) would change the relationship with fertiliser per hectare and MOFC.
- Past fertiliser history. For example, a low history of fertiliser may result in applying similar nutrients as other farmers, but possibly different results in responses.
- Different soil types with different exchange capacity’s effect the responses achieved.
- In some cases, timing of fertiliser applications can influence the responses achieved.
- The response from farmers is generally that fertiliser grows grass and is therefore easy to justify as a major factor contributing to milk per hectare and MOFC per hectare.

Purchased Feed Per Hectare and MOFC / ha.
As an independent variable, purchased feed cost per hectare has a relationship that varies between years. The relationship in 1999 was strong (R^0.39) while the relationship in 1998 was weaker (R^0.12). Purchased feed per hectare is used in the Balance Model because there is no relationship between purchased feed per cow compared to MOFC per hectare and/or litres per hectare. There is some relationship between purchased feed per cow and litres per cow. The relationship between purchased feed per hectare and MOFC per hectare varies as:
- The cost of purchased feed between years and between districts varies.
- Different types of purchased feed have different responses and substitution rates resulting in differing levels of MOFC per hectare.
- If inappropriate purchased feeds are used, the responses and resulting MOFC is affected. Conversely appropriate use of purchased feeds can result in cow’s harvesting more grass than would be the case without the inclusion of these feeds.

Per Cow Production and MOFC per hectare.
Litres per cow correlated to MOFC per hectare are variable between years and between districts. In the 1999 NSW data there seemed to be very little correlation ($R^2 0.08$) but in the 1998 NSW data the relationship was reasonable ($R^2 0.23$). In that same year, the relationship for the NSW South Coast area was non-existent while the relationship for the Riverina area was reasonable ($R^2 0.35$).

Logically, one would expect a relationship between litres (standardised) per cow and MOFC per hectare. The efficiency of getting more milk per production unit (the cow) and effectively diluting maintenance requirements of the cow would normally result in more milk per kilogram of feed and consequently result in higher MOFC per hectare. Why there are relationships between litres per cow and MOFC in some regions and not in others is still open to debate.

**SUMMARY**

The Balance Model has been successful as an extension tool to help dairy farmers understand and improve their dairy business and to help extension people identify business opportunities for farmers. The model is best applied on a regional basis where the region has similar production and environmental features. When planning strategies with an individual farmer, it is a useful practice to plot the Balance Model for the individual farm and for the top 10% or 25% of farmers in that region. This effectively sets a practical target for the potential size and the shape of the model for the individual farm. It is important to recognise that the Balance Model is a small but powerful component of a comprehensive benchmarking service for dairy farmers in NSW.

Email: chittick@shoalnet.com.au