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To feed or not to feed - the science behind the DairyNZ Supplementary Feed Calculator

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**Background**

The profitability of supplement use depends on both the revenue generated from the purchased feed and how much it costs to buy and provide it.

DairyNZ has produced the Supplementary Feed Calculator to help farmers make tactical decisions about purchasing feeds during a short term feed shortage.

The Supplementary Feed Calculator (dairynz.co.nz/supplementaryfeed) uses international and New Zealand research results to estimate the milk production response to providing supplements to milking cows under different feed deficit situations and at different stages of lactation.

It estimates the likely profitability of doing this under different milk price scenarios and compares the value proposition of different feeds.

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**Total milk production response to supplement**

In the Supplementary Feed Calculator, the milk production response to feed offered is the sum of the milk produced when cows are receiving the supplement (immediate response) and milk produced later as a result of pasture spared and cow body condition score (BCS) gained from the supplement (deferred response). Multiple experiments have been undertaken evaluating the milk production response to supplements under different levels of feed deficit.
Although both the immediate and the deferred responses decline with increasing pasture dry matter intake (DMI), the deferred response is especially sensitive to feeding level (See Figure 1). For example:

- in severe pasture deficit situations (e.g., unsupplemented post-grazing residual of 1200kg DM/ha for a milking cow), as much milk is produced after the period of supplementation as during the feed deficit when the supplements are offered;
- when cows are relatively well fed (e.g., unsupplemented post-grazing residual of 1600kg DM/ha), the deferred milk production is only approximately 10 percent of the immediate response.

The total milk production response to supplement (immediate plus deferred response) is determined by many biological and management factors which have been taken into account in the Supplementary Feed Calculator. They include the following:

- **Stage of lactation**
  The use of a cow’s own body reserves for energy in early lactation and the amount of energy consumed that is partitioned towards gaining BCS in mid and late lactation can influence the immediate response to supplements. This is important, as any BCS gained through supplementation will be subsequently used for milk production (i.e., deferred milk production response) and it is therefore important to account for it.

- **Amount of purchased supplement that is wasted**
  The Supplementary Feed Calculator’s estimate of feed wastage is:
  - 5% for in shed feeding;
  - 10% for feed offered on a feed pad;
  - 15% for feed fed in trailers in the paddock;
  - 20% for feed offered in the paddock during dry conditions;
  - 40% for feed offered in the paddock during wet conditions.

In addition, for silage, some energy is assumed to be lost in the fermentation process.

**The amount of pasture refused – ie, substitution of supplement for pasture**

When grazing cows are fed supplements, pasture DMI declines\(^{4,5}\), therefore, increases in supplement offered do not result in equal increases in total DMI, even in feed-restricted cows. The substitution rate is lower and the milk production response greater during autumn than during spring\(^6\). In the Supplementary Feed Calculator, substitution rate (i.e., pasture spared) is used to calculate the change in post-grazing residual following supplementation.

- **Amount of supplement offered:**
  As the amount of supplement offered increases, the total response to supplement declines\(^5\). This is because the cow becomes less hungry with every extra kg of supplement consumed and there is more substitution.

- **Type of feed and the processing of that feed:**
  The type of supplement offered affects the composition of the milksolids produced\(^{6,7}\). Feeds high in starch and sugar (e.g., barley, maize, tapioca; also called non-structural carbohydrate or NSC), on average, increase the production of milk protein more than milk fat, while feeds high in fibre and/or fat (e.g., palm kernel, soyhulls, broll) increase the production of milk fat more than milk protein\(^6,8\). (see Figure 2). This is important because milk protein is generally worth substantially more than milk fat. However, this effect of feed type only occurs over the period while supplements are being consumed (i.e., there is no deferred response).

The Supplementary Feed Calculator uses this effect of dietary NSC and fibre to estimate the increase in milk protein and milk fat and uses the milk company’s Value Component Ratio (VCR; the value of fat relative to protein) to allow a more accurate prediction of milk revenue.

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**Figure 1.** Immediate and deferred milk production responses to supplement (g MS/MJ ME easten) with increasing post-grazing residual. The response to supplement decreases with increasing post-grazing residual; in particular, the amount of milk produced post-supplementation (i.e., the deferred response) declines quickly.

![Figure 1: Immediate and Deferred Milk Production Responses](image-url)
Revenue and Costs

The Supplementary Feed Calculator accounts for all of the above factors, which allows a more accurate estimation of total revenue. As well as accounting for direct costs of supplements, it also includes associated costs (e.g., tractor running costs, depreciation, and repairs and maintenance). The Supplementary Feed Calculator makes no allowance for capital costs (i.e., it is assumed that the equipment for feeding is already available) or variable costs that aren’t associated with feeding.

Limitations of the Supplementary Feed Calculator

Although a useful resource to help estimate the value proposition from different feeds in a unique situation, the following limitations should be kept in mind:

a) the Supplementary Feed Calculator is a resource to help with tactical purchases of feed and should not be used to make strategic decisions around feeding that lead to a change in the farming system and extra costs. These are not accounted for in the Supplementary Feed Calculator.

b) The Supplementary Feed Calculator is not a ration balancing model. The resource assumes that energy is the dietary factor that is limiting production. This will be true in the vast majority of situations. However, in an extremely dry summer or in a system already feeding more than 30 percent of the diet as energy supplements, there is a risk that other nutrients (e.g., protein or specific amino acids) become limiting and the response to different supplements could be more or less than proposed.

References


