FEI – What does it Mean On-Farm?

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AgFirst

FEI – What is it?

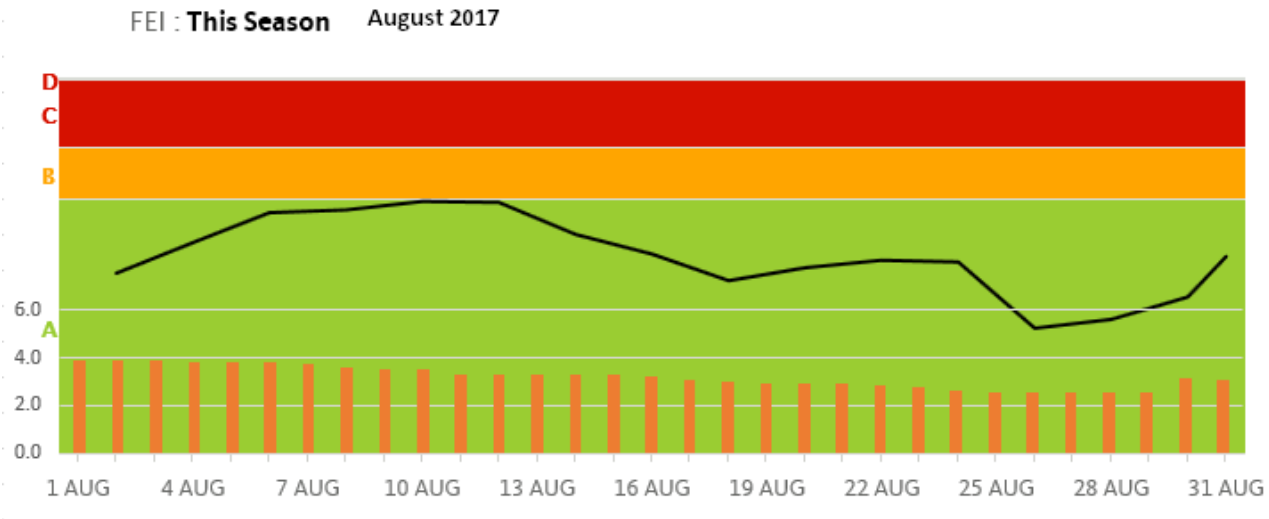
The Fat Evaluation Index has been developed by Fonterra to monitor the likely effect of PKE feeding on the composition and manufacturing properties of milkfat produced on farm.

Farmers will receive an FEI classification for each consignment of milk, based on a rolling 6 day average screening test. If this result is over a certain threshold, the milk will be tested via a more accurate method and demerit grades may be applied.

How Should Farmers Monitor their FEI?

It is crucial that farmers monitor the trend of their FEI rather than just the classification, that they receive on the daily docket. This trend is shown via the FEI graph which is available on the OnFarm App or the FarmSource website.

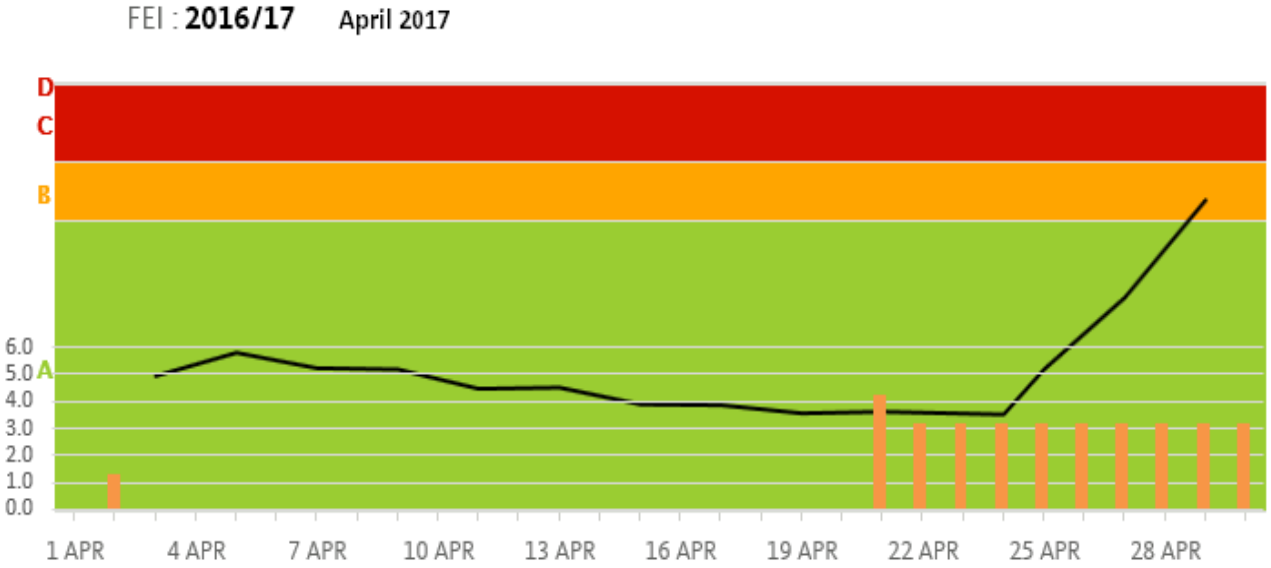
The following graph has the daily PKE levels added to show how much the FEI can vary within a classification band at certain feeding levels. The orange bars correlate to the feeding level scale (kgPKE/c/d) on the left hand side of the graph.



As this graph shows, at relatively steady levels of PKE feeding (3-4kg/c/d) the FEI can vary considerably within the "A" range. This is likely due to variations in total intake, usually due to a rise or fall in the amount of

pasture available. For example, during very wet weather, the pasture utilisation may fall and total intake may drop. As a result the PKE will be a higher percentage of the diet and the FEI may rise.

This dilution factor may also occur in the summer or autumn when pasture covers are dropping and PKE is introduced. The FEI could rise rapidly and pass from "A" through the "B" band to a penalty level within a few days.



It is difficult to see this simply on the docket classifications. Monitoring the graph each day will allow you to predict the problem before the FEI reaches "C" or "D" levels. Action can then be taken to avoid any demerits before they occur.

Strategies for Managing FEI

There are many changes farmers can make to reduce their FEI if needed. These range from short term feeding changes to larger system changes in stocking rate or calving date. All changes should be evaluated from an economic viewpoint.

The main factor influencing FEI is the proportion of PKE in the diet of the lactating cow. PKE fed to drystock does not affect FEI in milk after calving.

So anything that reduces the percentage of PKE in the total intake of milking cows will reduce FEI. Aim to keep PKE feeding at 20% of total intake.

Farm management strategies include:

- Save alternative supplements for milking cows and feed drystock only PKE
- Make more high quality silage by using more N and feeding PKE for longer into late spring
- Feed low rates of PKE throughout lactation and spread other supplements out for longer
- Consider cropping options – eg, maize silage, chicory, turnips – but beware of the economics of this. Fodder beet may push FEI slightly higher than other crops and is relatively expensive so may not be a good option
- Consider alternative supplements and blends – but beware of the economics
- Graze dry cows off in winter and push pasture cover higher at calving
- Consider stocking rate and calving date changes if profitable
- Calculate the economics of feeding PKE at downgrading levels for short periods to get through a temporary feed shortage
- Beware of OAD milking especially in late lactation as this tends to push FEI higher
- Consider drying off poor producers and light cows and save other feeds for milking cows

Always consider the longer term economics of any changes. The cost of purchasing alternative feeds or growing crops does not always add to the profitability of a business. The cost of the extra milk produced from these options can be surprisingly high and has been calculated at well over $6/kgMS in our Imported Feed Trial at NARF. Full details on this are in the following paper by Dr. John Roche.

Marginal economics – are you making money from milk, or milk from money?

John Roche, Principal Scientist, Animal Science, DairyNZ

Key lessons learned from the 2nd year of the current experiment at the Northland Agricultural Research Farm

Pasture-only farmlet

- In year 2, operating profit at $6.12/kg MS was $2,728/ha, with an operating cost of $3.68/kg MS.
- Despite a wet spring in 2016, high MS production/cow and per ha were achieved with no purchased supplement;
- Strict decision rules around drying off cows for pasture cover and cow body condition score in autumn ensured that the farm achieved pasture and condition score targets at planned start of calving for Year 3;

Palm kernel farmlet

- In Year 2, operating profit at $6.12/kg MS was $2,726/ha, with an operating cost of $4.05/kg MS;
- High MS responses to supplementary feeds can be achieved when there are strict decision rules that ensure high pasture utilisation;
  - In Year 1, the PKE farm produced 36 kg MS/cow and 159 kg MS/ha more than the pasture-only;
  - In Year 2, the PKE farm produced 20 kg MS/cow and 153 kg MS/ha more than pasture-only;
- However, MS responses vary from year to year; in two consecutive years, with the same decision rules in place, response to supplements varied from 110g to 125 g MS/kg PKE DM (100 to 115 g MS/kg PKE purchased);
- In Year 2, when MS responses to supplements were good (96 g MS/kg Palm Kernel; PKE) and PKE was relatively inexpensive ($267/t delivered), the cost of the extra milk produced from using PKE was:
  - $5.53/kg MS, if no allowance was made for the capital cost associated with running the system;
  - $6.38/kg MS, if an allowance of 6.5% was made for the cost of capital;

  Unless milk price was more than $6.38/kg MS, the MS from PKE COST money to produce.

Cropping farmlet

- In Year 2, operating profit at $6.12/kg MS was $2,154/ha, with an operating cost of $4.47/kg MS;
- The response to cropping was variable and very dependent on crop yield;
  - In Year 1, the Cropping farm produced 6 kg MS/cow and 15 kg MS/ha more than the PKE farm;
  - In Year 2, the Cropping farm produced 23 kg MS/cow and 65 kg MS/ha less than the PKE farm;

- The marginal cost of the MS produced in the cropping farmlet during Year 2 was:
  - $11.79/kg MS, if no allowance was made for the capital cost associated with running the system;
  - $13.08/kg MS, if an allowance of 6.5% was made for the cost of capital;
- The value of crops in any production system is very dependent on the cost of establishing the crop and the yield at the time of grazing/harvest;
- The strategy of using crops to increase stocking rate and ensure cows are well fed through the summer and early autumn must be carefully considered.

What do we mean by marginal economics?

In marginal economics, we attempt to measure the cost of producing an extra kg MS and compare this with the MS price. This is based on the principal that the increase in MS production associated with inputs is large to begin with, but gets smaller and eventually flattens with increasing inputs. For example,

- applying P fertiliser to very low Olsen P land will lead to a large increase in pasture production;
- however, the increase in pasture production declines as the Olsen P of the soil increases;
- applying P fertiliser to soil with above optimum Olsen P grows very little additional pasture.

This is the law of diminishing returns. Similarly, the first 100 kg of supplement provided to a cow results in greater marginal MS production than the second 100 kg, which is greater than the third 100 kg, and so on.

The danger in marginal analyses

There is a danger with marginal analyses; all the costs associated with system change may not be accounted for. For example, people often talk about the '***margin over feed***', which accounts for the milk production associated with supplementing the cow and the cost of the feed, but does not account for any other cost. Analyses of databases in New Zealand and in other countries have highlighted that many costs increase, with increasing use of non-pasture feeds (e.g., fuel and oil, labour, repairs and maintenance).

The experiment at the Northland Agricultural Research Farm offers us a great opportunity to quantify some of those costs. For example, between 50 and 60% of the operating expenses on a dairy farm relate to each individual cow. Therefore, increasing the stocking rate leads to an increase in the majority of expenses/ha (e.g., animal health, breeding expenses, rearing costs, etc.). Costs associated with an increase in stocking rate must be accounted for in addition to the cost of the purchased feed/cropping in any evaluation of the system change.

Irrespective of the chosen farming system, it is important to understand the point at which further milk production is costing you more than the price you are receiving; in technical terms, this is the point at which

the marginal cost of milk production (i.e., marginal cost) is greater than the milk price (i.e., marginal revenue; Figure 1).

Differences between the farmlets

At NARF, we are examining differences in MS production between two self-contained farmlets and a third farmlet importing PKE to fill any shortfall in pasture production (PKE farmlet).

The two self-contained farmlets are: 1) pasture-only, with surplus pasture conserved as silage and fed back when the herd is short of feed, and 2) a pasture farmlet with approximately 25% of the farm being used to grow turnips, fodder beet, and maize silage (Cropping farmlet). The Pasture farmlet has a stocking rate of 2.6 cows/ha and the PKE and Cropping farmlet have stocking rates of 2.9 cows/ha.

As well as MS production and feed use measurements, machinery use and labour hours/farmlet were recorded. By allocating costs appropriately, we can estimate the cost of the marginal milk produced on the PKE and cropping farmlets.

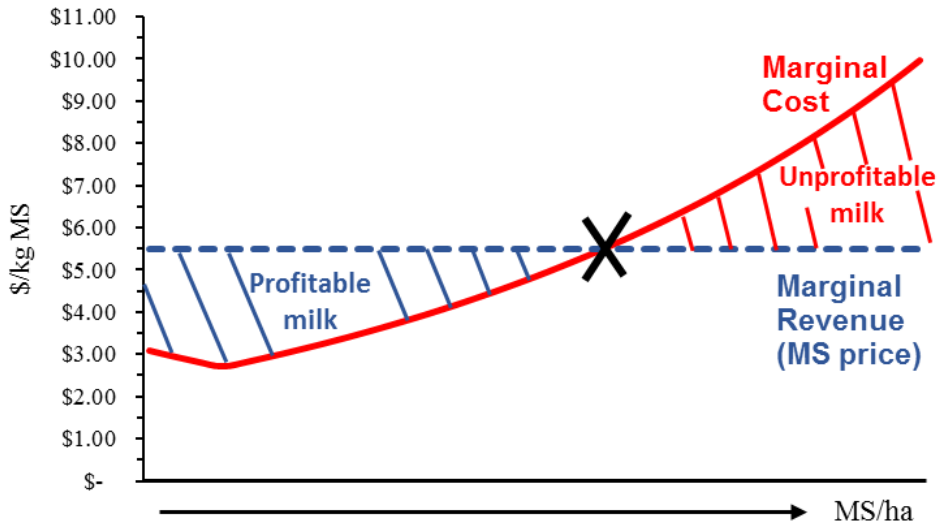


Figure 1. *The relationship between marginal cost and marginal revenue. When marginal cost is less than milk price (marginal revenue), profit/ha increases with greater production. When the marginal cost is greater than the marginal revenue, the increased production reduces farm profitability (note: the farm may still be making a profit). In theory, profit increases with increasing MS/ha until marginal cost = marginal revenue (the X on the graph). In arguing about which system of farming is best, many people have lost sight of this basic economic principle.*

Results –marginal cost of extra milk produced

The milk production on the different farms and the total cost of production separated into the cost of milk produced from pasture and the marginal cost of the additional milk production in the PKE and Cropping farms are presented in Figure 2.

The average cost of production for the Pasture, Cropping, and PKE farms was $3.69, $4.40, and $4.06/kg MS in Year 1, and $3.68, $4.47, and $4.05/kg MS in Year 1, respectively. So, cost of production was relatively consistent across years and there isn't a large difference between the farms.

However, the average cost of production hides the cost of producing the extra MS; on average,

- each kg of additional (i.e., marginal) MS on the Cropping farm cost **$7.97** to produce in Year 1 and **$13.08** to produce in Year 2;
- each kg of additional MS on the PKE farm cost **$6.05** to produce in Year 1 and **$6.38** to produce in Year 2.

These results are consistent with analyses that we have undertaken on other experiments.

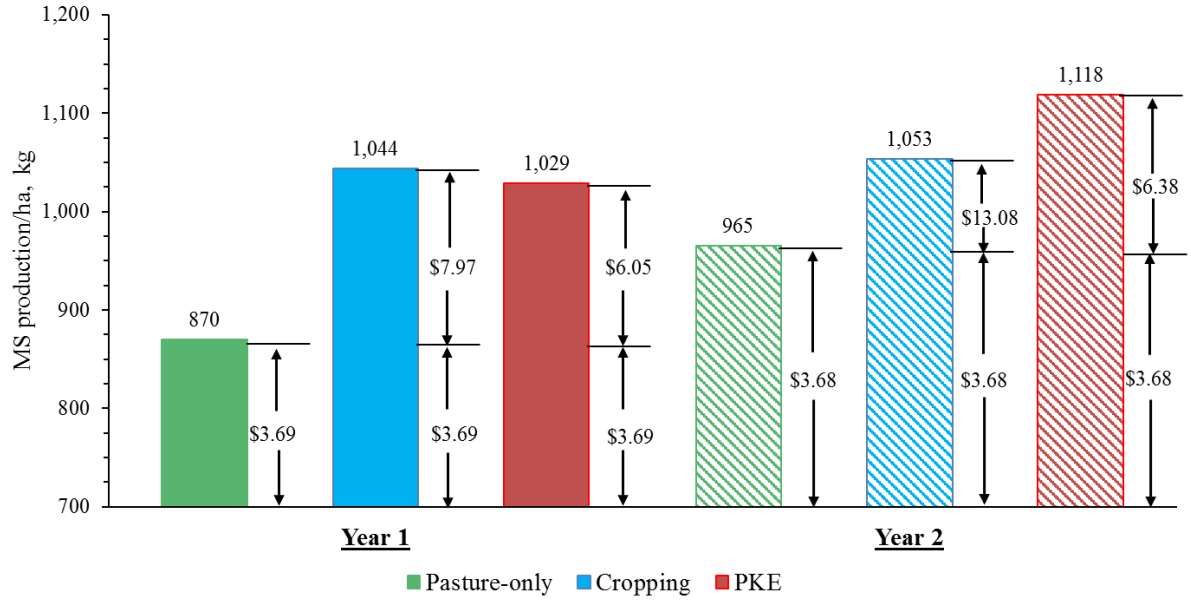


Figure 2. *Milksolids production/ha in the Pasture, Cropping, and PKE farms, the cost of production in the pasture farm, and the marginal cost of the additional milk produced in the Cropping and PKE farm in Year 1 and 2.*

Difference between strategic and tactical use of purchased feed

There is a difference between the strategic and tactical use of feed.

The strategic use of feed is planned from the start of the year. For example, if someone increases stocking rate by 0.25 cows/ha, they will either plan to import 1 t DM supplement/ha (i.e., assumes a cow eats 5 t DM/year) or feed each cow less. In this scenario, the farm gets both the benefits and additional costs associated with the change to the system (e.g., greater milk production/ha, but greater herd replacement, animal health, and breeding expenses/ha). In farm system analyses, on average, the total increase in costs associated with the system changes needed to use purchased feeds is approximately 50% greater than the cost of the feed. So, for example, if purchased feed is $1/kg MS, total costs will increase by approximately $1.50/kg MS, on average. It is this strategic response to imported feed that is being investigated at NARF.

This is different to the tactical use of feed. Tactical use of feed is where a farmer purchases 'unplanned' feed to minimise a short-term feed deficit (e.g., cold and wet August, dry February). In this situation, they don't capture the benefits of an increase in stocking rate, but they also do not incur many of the costs associated with change to the system. However, the total cost is greater than the marginal cost of the feed, because there is an increase in associated costs (e.g., labour, fuel and oil, repairs and maintenance, electricity, etc.). These costs are included in DairyNZ's *Supplement Price Calculator* (https://www.dairynz.co.nz/feed/feed-management-tools/supplement-price-calculator/), which will help calculate the value proposition of purchasing supplementary feeds in a range of situations.

Conclusion

The average cost of milk production can be a misleading statistic in evaluating the cost/benefit of system change. It is important to focus on the marginal response, while accounting for all costs that will change to achieve the additional production. It is this metric that determines whether you are ***making money from milk, or making milk from money***.

It is important to distinguish between strategic (i.e., planned, proactive) and tactical (i.e., unplanned, reactive) use of supplementary feeds. The large responses to supplementary feed in the NARF experiment are a result of changes to the farm system and not just a response to purchased PKE.

These are the results of two year's data. The experiment is ongoing and will provide a great opportunity to evaluate the effect of system change in Northland and other regions of New Zealand.