Dairying in a Variable Climate Trial – NARF

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This trial is being run by the Northland Dairy Development Trust (NDDT) in conjunction with the Northland Agricultural Research Farm (NARF). The project is funded by DairyNZ, Ministry of Primary Industries (Sustainable Farming Fund) and Hine Rangi Trust with support from commercial sponsors.

Summary

A farm systems experiment commenced at the Northland Agricultural Research Farm (NARF) in June 2018 to understand the impact of supplement use on farm profit and other outcomes. This study will run for three years. Three farms are being compared, being: a pasture only farm (**Pasture Only Farm,** 2.7 cows/ha); a farm that supplements only with palm kernel expeller (PKE, **PKE Only Farm**, 3.1 cows/ha) and a farm that supplements with PKE and other supplements (**PKE Plus Farm**, 3.1 cows/ha). The PKE Plus farm feeds PKE until milk FEI dictates feeding other supplements. All farms can make and feed back silage.

Prior to the commencement of this study, computer modelling was undertaken using Farmax software to understand the likely challenges, solutions, production and financial returns. Three different climatic conditions were tested, being an average season, a wet winter and a dry summer. Changes in milk price and feed costs were then tested.

Computer modelling predicted that in a climatically average season, milk production on the Pasture Only farm would be 883 kg MS/ha, 1,093 kg MS/ha on the PKE Only farm and 1,209 kg MS/ha on the PKE Plus farm. At a $6.00/kg MS milk price in a climatically average season, the PKE Plus farm was predicted to have the highest economic farm surplus (EFS) at $2,049/ha, while the Pasture Only and PKE Only farms were predicted to be similar at $ 1,737 and $1,742/ha respectively. The modelling also showed that the EFS of the PKE Only farm would be most affected by both a wet winter and dry summer scenario due to the higher stocking rate and milk fat evaluation index (FEI) constraining PKE feeding during challenging seasons. Of the three farms, the Pasture Only farm was predicted to have the highest EFS under a $4.00/kg MS milk price and the lowest under a $8.00/kg MS milk price. Modelling has indicated that of the three farms, the PKE Plus farm showed the least vulnerability to climate variability in terms of milk production and farm profit. Data collection from the actual farm systems trial is underway and will confirm or deny these modelling predictions.

The first season of the actual study is nearing the end. Silage was made on all three farms due to good growing conditions in early summer. Dry late summer conditions led to most of this silage being fed back on the PKE Only and PKE Plus farms while the Pasture Only farm has some remaining. As at 20th March 2019, the PKE Only farm has fed 564 kg DM PKE/cow and the PKE Plus farm 566 kg DM PKE/cow. The PKE Plus farm has also fed 123 kg DM dried distillers' grain (DDG)/cow.

To the 20th March 2019, MS/ha was 907, 1059 and 1096 kg/ha for the Pasture Only, PKE Only and PKE Plus farms respectively. Empty rate was 9%, 11% and 6% respectively. Milk FEI has constrained the amount of PKE being fed on both PKE supplemented farms. Feeding 3 kg DM/cow/day has been too much at times, particularly during the summer months.

Economic analysis has not yet been undertaken to determine profitability, this will occur when the season is complete. To date the relatively high amount of silage made during early summer has buffered the Pasture Only and PKE Only farms.

Background

This project is conducting a farm systems experiment that measures the economic and environmental impacts of three different management strategies for producing milk within a variable climate and constraints of milk fat evaluation index (FEI). The farm systems study is being conducted at the Northland Agricultural Research Farm (NARF) and commenced in June 2018. The study will run for three years.

Data collected will allow examination of the effects of these systems on milk production, profitability, environmental sustainability, cow welfare, labour, and capital requirements. This project will assist farmers in developing more profitable, less vulnerable, and lower impact farming systems.

Farmlet structure

All farms are self-contained farm systems, apart from importing supplements on treatments 2 and 3. Nitrogen use will be common across all treatments so base pasture supply is common. Silage made on farm can be fed on all farms.

The three farm systems are:

1. ***Pasture Only – 2.7 cows/ha***

   A simple pasture only farm system.

2. ***PKE Only – 3.1 cows/ha***

   This treatment will test and demonstrate options to managing feed supply shortages, such as OAD milking, early culling, drying off, etc. PKE use will be constrained so milk fat evaluation index (FEI) stays within the acceptable limits set by Fonterra. PKE will only be used when pasture grazing residuals fall below acceptable pasture feeding levels while maintaining ideal grazing rotation length (not to be used to create a pasture surplus for conservation).

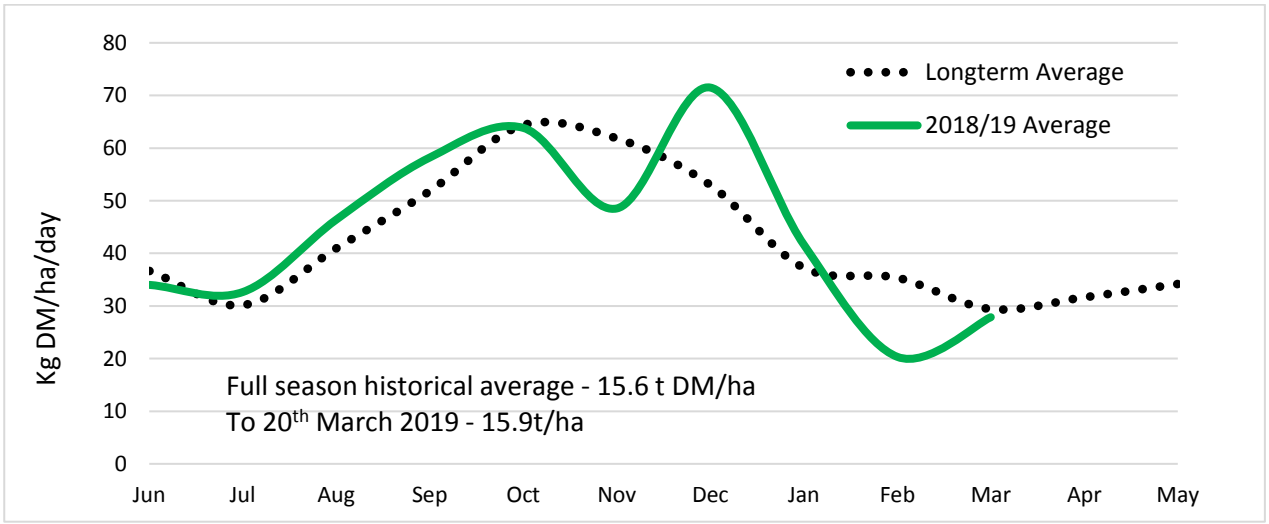
3. ***PKE Plus – 3.1 cows/ha***

   This treatment will test the viability of using PKE and other spot market feeds to fill feed supply shortages. PKE will be used to fill feed deficits until milk FEI limits are reached and then the next cheapest feed source ($/ME) will be used. Spot market feed sources only to be used (no stored maize silage). As with treatment 2, supplement use will be determined by grazing residuals.

Pasture Growth

Pasture growth to date this season is shown in the graph below. It was dry during the first part of November and again during February and March. Overall pasture growth to date has been higher than the historical average.

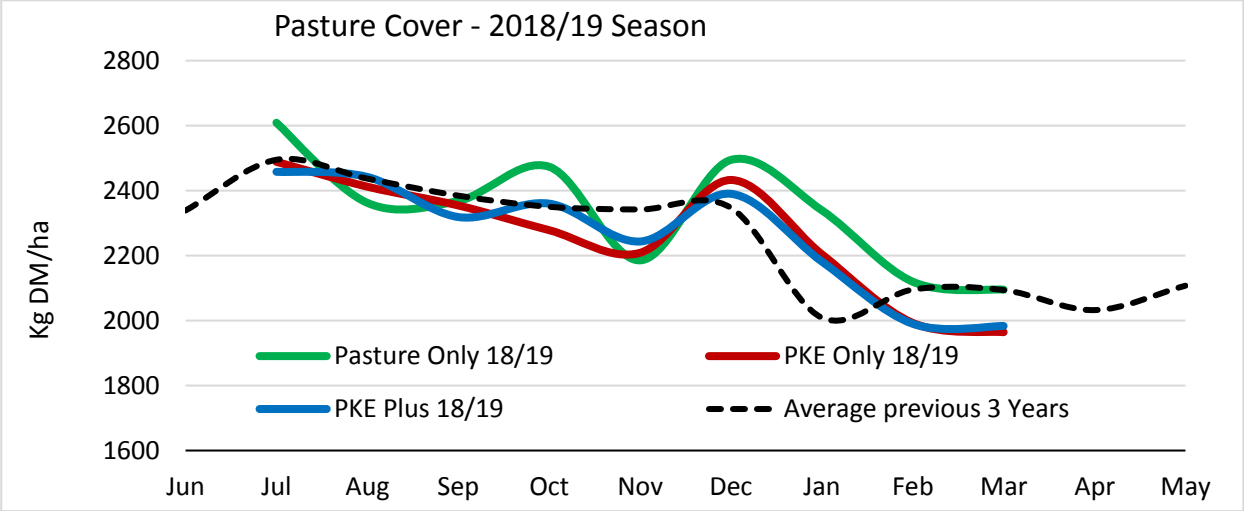
Figure 1. Calculated pasture growth rates at NARF (average of three farmlets) and historical average.



Pasture Covers

Average farm pasture covers are shown in Figure 2. Pasture cover was higher on the Pasture Only farm than the other farms during October and again February - March, likely due to the lower stocking rate. This allowed more area to be closed-up for silage on the Pasture Only farm than the other farms.

Figure 2. Average farm pasture cover for the 2018/19 season compared with the average of the previous 3 seasons.



Supplement Use

Table 1 shows the supplement fed to date and area cut for silage. The PKE feeding level has been constrained by milk FEI through February and March. During this period feeding was generally 2 – 3 kg DM PKE/cow/day.

Table 1. Supplements fed this season to 20th March 2019 (kg DM/cow) and % of Farm Cut for Silage

	Supplement	Kg DM/cow	% of Farm Cut for Silage
Pasture Only Farm	Grass Silage	**491**	**38%**
PKE Only Farm	Grass Silage PKE	**212** **564**	**24%**
PKE Plus Farm	Grass Silage PKE DDG	**139** **566** **124**	**26%**

Milk Production and Mating

Table 3 shows the milk production and mating results to date. Submission and empty rate differences are not significant.

Table 3. Milk solids production per ha and per cow to 12th March 2019 and mating 3 week submission and empty rate.

	Kg MS/ha	Kg MS/cow	3-week submission rate	Empty Rate
Pasture Only Farm	907	334	93%	9%
PKE Only Farm	1059	345	84%	11%
PKE Plus Farm	1096	353	91%	6%

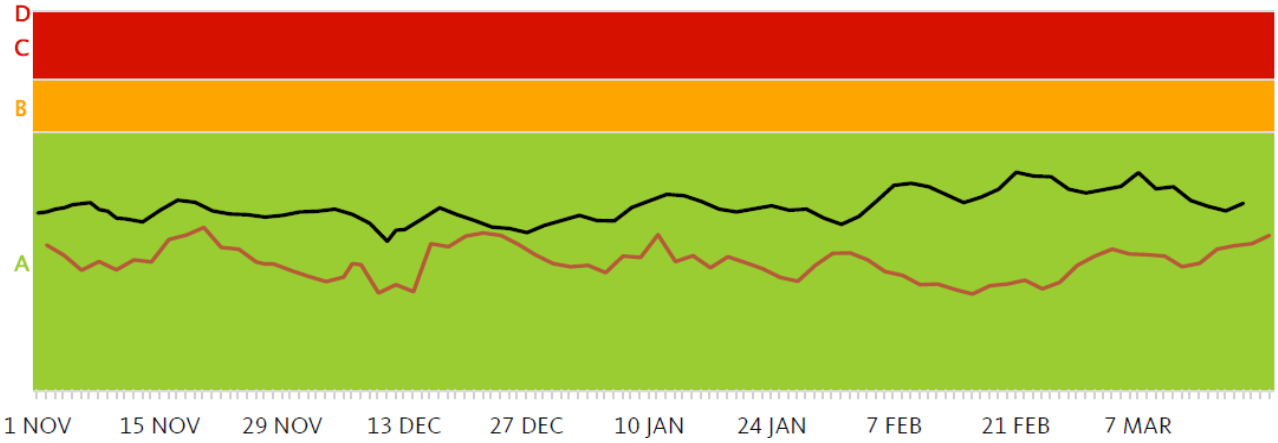
Farm Profit

Full financial analysis of the three farms will be undertaken at the end of season to determine the economic returns for the three farms. This will be undertaken and presented at the upcoming field day at NARF in early June.

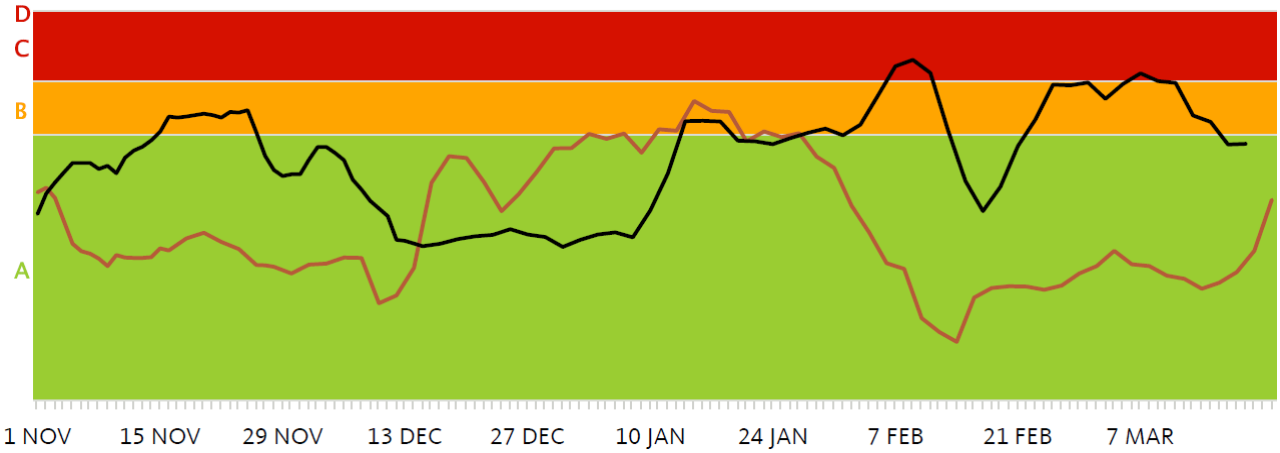
Milk FEI graphs

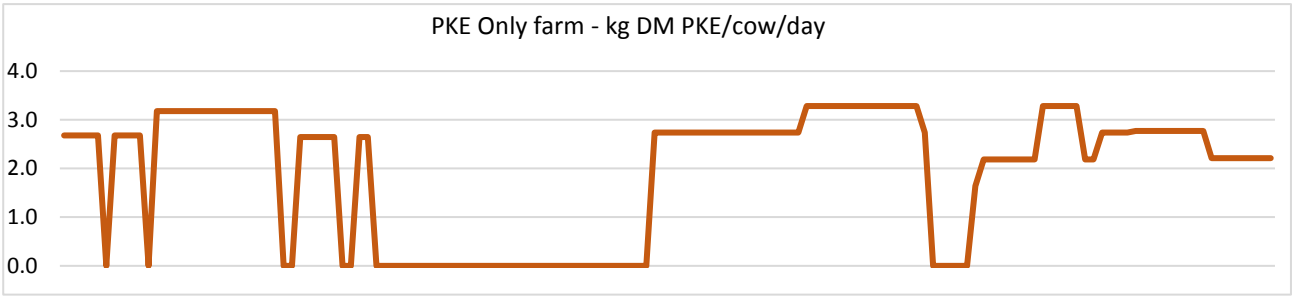
The graphs below show the milk FEI and the associated PKE feeding level. At times 3 kg DM/cow/day being too much to keep milk FEI under the C grade. Variation in milk FEI levels despite constant PKE levels are likely due to changes in pasture availability.

Milk FEI graph - Pasture Only farm

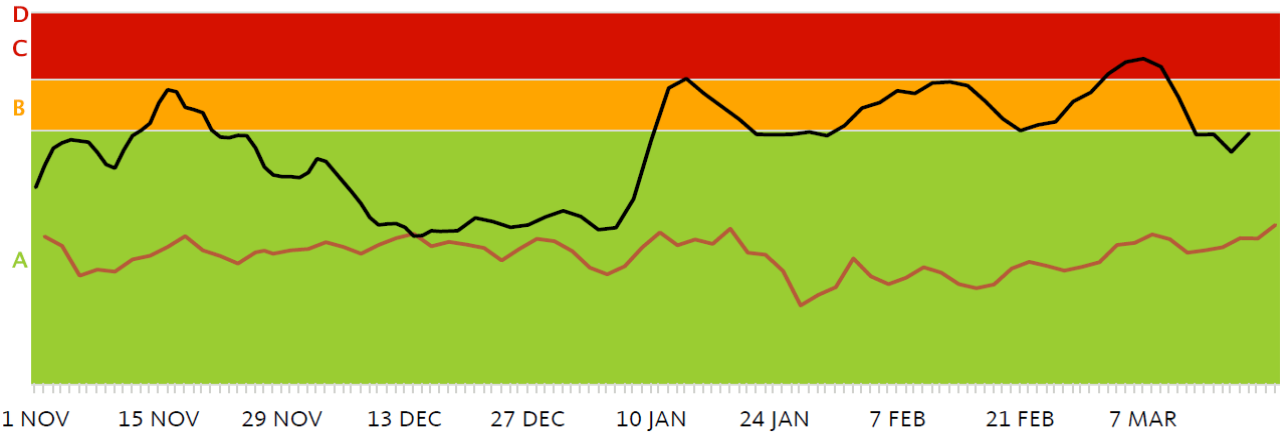


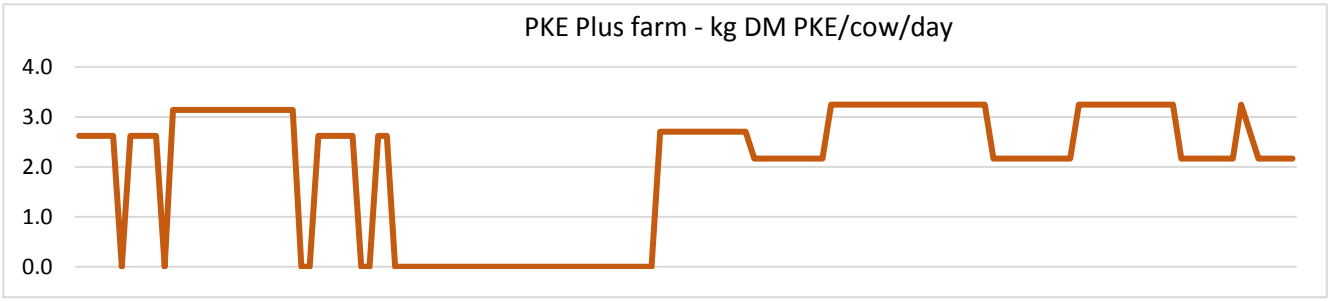
Milk FEI graph – PKE Only farm





Milk FEI graph – PKE Plus farm





Special thanks to NDDT trustees and NARF committee members for their support and commitment to running this project.

Farm Systems Modelling Results

Physical and Financial Results

The predicted milk production, pasture & crop eaten (home grown feed) and Economic Farm Surplus (EFS) for each farmlet and pasture scenario are summarized in the tables below.

Table 4: Predicted Milk Production (kg MS/ha) by Farmlet and Scenario:

	Predicted Milk Production (kg MS/ha)		
	Average Climate	**Wet Winter**	**Dry Summer**
Pasture Only	883	817	750
PKE Only	1,093	1,042	894
PKE Plus	1,209	1,193	1,162

Table 5: Predicted Pasture & Crop offered (t DM/ha) by Farmlet and Scenario:

	Pasture & Supplement Offered (t DM/ha)		
	Average Climate	**Wet Winter**	**Dry Summer**
Pasture Only	13.8	14.0	12.6
PKE Only	16.7	17.0	15.3
PKE Plus	17.6	18.1	17.4

Table 6: Predicted Economic Farm Surplus ($/ha) by Farmlet and Scenario based on a $6.00 milk price:

	Predicted EFS ($/ha)		
	Average Climate	**Wet Winter**	**Dry Summer**
Pasture Only	$1,737	$1,359	$ 937
PKE Only	$1,742	$1,274	$ 493
PKE Plus	$2,049	$1,713	$1,230

Sensitivity Analysis

Table 7: Farm Working Expenses/kg Milk Solids (FW Ex $/kg MS) and Economic Farm Surplus ($/ha) sensitivity to milk price (Average Climatic Season)

		Milk Price		
Farmlet	**FW Exp $/kg MS**	**$4.00/kg**	**$6.00/kg**	**$8.00/kg**
Pasture Only	$4.01	-$ 29	$1,737	$3,502
PKE Only	$4.43	-$ 444	$1,742	$3,927
PKE Plus	$4.28	-$ 370	$2,049	$4,467

Table 8: Economic Farm Surplus ($/ha) sensitivity to PKE price* (Average Year)

	PKE Price* ($/t PKE)		
	$200	**$300**	**$400**
Pasture Only	**$1,737**		
PKE Only	$2,064	**$1,742**	$1,420
PKE Plus	$2,371	**$2,049**	$1,888

** Price for PKE landed on farm 'as fed'*