

# Reducing Reliance on Imported Feed Trial Update

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This trial is being conducted 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.

## Summary

A farm systems trial has been testing how two farms using all 'home grown' feed (Grass Only farm and Cropping farm) compare to a farm importing Palm Kernel Expeller (PKE farm). Stocking rate averaged 2.6 cows/ha on the Grass Only farm and 2.8 cows/ha on the other two farms. Located in Dargaville, this farm systems trial is now in its third season.

Weather conditions were relatively kind during the first two seasons, resulting in good pasture growth and pasture covers on all farms. Pasture production totalled 17.4 and 18.8 t DM/ha for the 2015/16 and 2016/17 seasons respectively. In contrast, the 2017/18 season has been difficult with very wet conditions from July through to October and then dry conditions through November and December.

Supplement use during the first two seasons was lower than expected on the PKE farm with 469 and 513 kg DM PKE/cow fed during 2015/16 and 2016/17 respectively. Crops were established on the Cropping farm totalling 23% of the farm area in 2015/16 and 21% in 2016/17. Crops sown were turnips (average yield 9.3 t DM/ha), fodder beet (15.6 t DM/ha) and maize silage (19.0 t DM/ha).

In the 2015/16 season milk production was highest on the Cropping farm at 1,049 kg MS/ha compared with 870 kg MS/ha on the Grass Only and 1,028 kg MS/ha on the PKE farm. For the 2016/17 season milk production was highest on the PKE farm at 1118 kg MS/ha compared to 965 kg and 1053 kg MS/ha for the Grass Only and Cropping farms respectively. The current (2017/18) season has proved more difficult. To date (25<sup>th</sup> January), the Grass Only farm milk production is 14% down on the average of the previous two seasons, the Cropping farm 20% down and the PKE farm 1% down. Poor soil structure on ex-crop paddocks led to high levels of pugging damage on the Cropping farm during winter/spring of 2016 and 2017, compromising Cropping farm production. In-calf rates have been relatively good so far with no consistent trend between farms.

Costs were calculated for each of the farms, including differential labour requirements for the 2015/16 and 2016/17 seasons. Over the two seasons farm working expenses/kg MS averaged \$3.73, \$4.27 and \$3.92 for the Grass Only, Cropping and PKE farms respectively. In 2015/16 with a \$3.90/kg MS price, the Grass Only farm had the highest operating profit at \$787/ha followed closely by the PKE farm at \$733/ha and the Cropping farm at \$433/ha. For the 2016/17 season at a \$6.12/kg MS price the PKE farm had the highest operating profit at \$2,887/ha followed by the Grass Only farm at \$2,761/ha and the Cropping farm at \$2,300/ha.

The first two years of this study showed that when all costs are considered a Grass Only farm system may have similar profitability to a farm system importing PKE. To date the use of cropping on heavy clay soils has not proved to be an effective strategy to maintain profitability without importing feed. The results of the third year of this study are likely to contrast with the previous two due to poor pasture production and pasture utilisation compromising milk production on the Grass Only and Cropping farms. This will likely result in higher profitability on the PKE farm. This project is considering a fourth year to ensure treatments have been tested in a range of climatic conditions.

## Background

New Zealand dairy farms have come to rely heavily on importing feed onto the farm. There is widespread concern in the farming community as to the impact if this feed was not available due to lack of supply, market pressures, milk composition requirements or food safety concerns. Increased levels of imported feed have also driven up farm working expenses, making farm systems vulnerable during seasons with lower pay-out.

Removal of imported feed would have significant impacts on the productivity of New Zealand dairy farms in the short to medium term. A farm systems trial was established at the Northland Agricultural Research Farm (NARF), located at Dargaville, to test and demonstrate how dairy systems might maintain production and/or profit without imported feed. The trial started 1<sup>st</sup> June 2015 and is now in its third season.

## Trial Structure

The trial compares three farms:

1. **Grass Only Farm** - No imported supplement, home grown grass silage may be used. Stocking rate of 2.6 cows/ha (approx. 73 cows calving on 28 ha)
2. **Cropping Farm** - No imported supplement, crops grown on farm (turnips, fodder beet and maize silage). Stocking rate of 2.8 cows/ha (approx. 80 cows calving on 28 ha)
3. **PKE Farm** - Importing of PKE as required to fill in feed gaps. Stocking rate of 2.8 cows/ha (approx. 80 cows calving on 28 ha)

This trial is run at the Northland Agricultural Research Farm (NARF) where paddocks are evenly allocated to each trial farmlet.

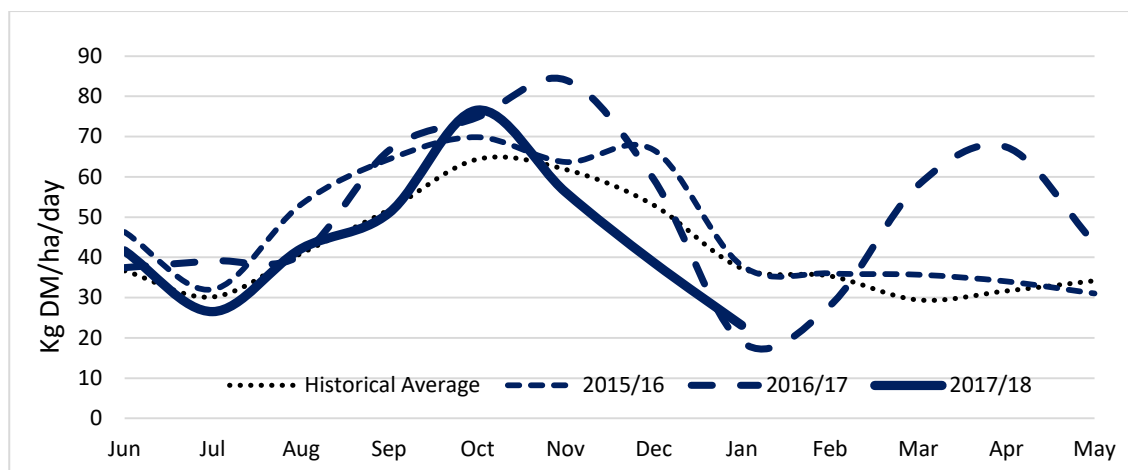
## Pasture Growth

Approximately 60% of NARF pastures are kikuyu based. The Grass Only and PKE farms have a higher proportion of kikuyu pastures than the Cropping farm due to the cropping regime leading to more pastures without kikuyu. All kikuyu based pastures are mulched and under-sown with Italian ryegrass during autumn.

Relatively good pasture growing conditions prevailed through most of the 2015/16 and 2016/17 seasons (see Figure 1). Both winters were relatively dry and pasture utilisation relatively good. This resulted in calculated pasture growth of 17.4 t DM/ha for the 2015/16 season and 18.8 t DM/ha for the 2016/17 season. This compares with a historical annual production of 15.4 t DM/ha.

The 2017/18 season has been a sharp contrast with very wet soil conditions from July through to early October. This resulted in very poor pasture utilisation and high levels of pugging damage which compromised pasture growth. Nitrogen use has been similar between farms.

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



### Supplement and Crop Use

Table 1 shows the crop areas yields and costs. Crops were established on 23% of the land area in 2015/16, 21% in 2016/17 and 25% in this current season. In general conditions were good for growing crops during 2015/16, however wet weather in late spring 2016 followed by a dry early summer delayed establishment and impacted yields, especially on the maize. In both years turnips were fed to the Cropping cows January – March and fodder beet from late February – June.

With relatively good pasture supply during the first two seasons, the use of PKE on the PKE farm has been below what was expected to be used. However, the more challenging early spring 2017 resulted in a higher use of supplement to date.

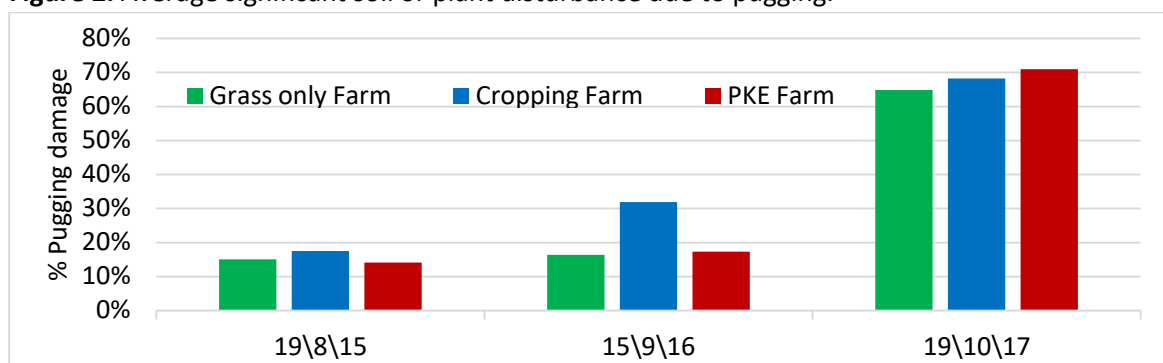
**Table 1.** Crop production, cost and supplement fed (kg DM/cow). 2017/18 numbers are for the season to date (November). Crop costs do not include farm tractor or labour costs.

	Supplement	% of Farm in Crop			Estimated crop t/ha		Cost c/kg DM		Fed kg DM/cow		
		15/16	16/17	17/18	15/16	16/17	15/16	16/17	15/16	16/17	17/18
<b>Grass Only Farm</b>	Grass Silage	20%	47%	25%			12.1	13.5	99	321	338
<b>Cropping Farm</b>	Maize Silage	9%	7%	9%	22.0	14.5	13.1	30.1	630	536	268
	Turnips	7%	9%	16%	9.0	9.5	7.7	11.9	217	309	
	Fodder Beet	7%	6%		15.5	16.0	26.2	26.4	404	199	73
	Grass Silage			17%							142
<b>PKE Farm</b>	Grass Silage	21%	50%	18%			12.1	13.5	123	278	164
	PKE						28.9	29.7	469	513	469

### Pugging Damage

Soils at NARF are predominantly marine clay which is subject to waterlogging and treading damage (pugging) when conditions are wet. To understand the effect of the different farm systems on soil and plant damage, all paddocks were surveyed for pugging damage. Figure 2 shows how damage levels have been significantly higher this current season than the previous two seasons. The Cropping farm had higher levels of pugging damage than the other farms during winter 2016. This was due to the ex-crop paddocks having very high levels of pugging. The cultivation process has a negative effect on soil structure and provides a challenge for the Cropping farm resulting in paddocks either un-grazable or having high levels of damage when grazed.

**Figure 2.** Average significant soil or plant disturbance due to pugging.



### Handling the wet 2017 spring

The very wet early spring of 2017 impacted the Grass Only and Cropping farms more than the PKE farm. With only grass silage on hand, the Grass Only farm had limited options for feeding. Silage was fed out to the Grass Only cows on paddocks when possible, otherwise on a stand-off area. The Cropping cows had a relatively low level of maize silage available due to poor crop production the previous season. This was used up by the 22<sup>nd</sup> September. With no more supplement and deteriorating cow condition, 25% of the cows were grazed out on a neighbouring farm from 21<sup>st</sup> September. Over half of these cows (15% of the herd) were returned on 24<sup>th</sup> October while the others will remain off for the remainder of the season.

All cows on the Grass Only and Cropping farms were put on once a day milking (OAD) between 15<sup>th</sup> September and 27<sup>th</sup> October to manage low condition score. PKE farm cows remained on twice a day milking throughout apart from young cows and low conditioned cows being put on OAD prior to mating.

### Milk Production

The Cropping farm had the highest milk production and Grass Only the lowest during 2015/16 season, as shown in Table 2. In the 2016/17 season the PKE farm had the highest production while the Grass Only farm had the lowest. To date (20<sup>th</sup> November), the Grass Only farm is 15% down on the average of the previous two seasons, the Cropping farm 21% down and the PKE farm 1% down.

**Table 2.** Milk solids production per ha and per cow.

	Kg MS/ha			Kg MS/cow		
	15/16	16/17	17/18 to 25 Jan	15/16	16/17	17/18 to 25 Jan
Grass Only Farm	870	965	620	347	381	279
Cropping Farm	1,049	1,053	607	384	378	270
PKE Farm	1,028	1,118	785	379	401	326

### Mating Results

Overall, the in-calf rates have been relatively good (table 3). Three week submission rates look good for this current season despite the difficult early spring. Once-a-day milking was utilised for cows with BCS of 3.5 and under from 2 weeks prior to mating. Mating results do vary between farms, though these differences are not considered significant as there is no consistent trend across the seasons.

**Table 3.** Mating results.

	3 Week Submission			Non-return Rate			Empty Rate	
	2015/16	2016/17	2017/18	2015/16	2016/17	2017/18	2015/16	2016/17
<b>Grass Only Farm</b>	96%	79%	89%	83%	72%	79%	6%	10%
<b>Cropping Farm</b>	83%	85%	92%	63%	84%	74%	13%	7%
<b>PKE Farm</b>	87%	79%	85%	78%	80%	71%	9%	1%

## Responses to PKE

Comparing milk production on the PKE farm to the Grass Only farm provides a calculation of response to PKE. In the 2015/16 season the milk response to PKE was 125g/kg PKE DM fed. In the 2016/17 season this was 107g/kg PKE DM.

## Differences in Labour & Machinery

Time spent doing tasks on each individual farm has been recorded, over and above farm operations that are common to all farms. The table below shows the additional time required by NARF staff for feeding out, moving cows to and from the feed pad or crops, and crop establishment. It should be recognized that additional time spent shifting cows was based on mobs of 70 – 80 cows, this may be different with larger mobs. These results have been used to adjust the allocation of labour and vehicle expenses within the financial analysis.

**Table 4.** Additional labour and tractor time for cropping and feeding of crops and supplements.

	Task	2015/16 Hours	2016/17 Hours
<b>Grass Only Farm</b>	Tractor Hours	13	51
	Man Hours	13	63
<b>Cropping Farm</b>	Tractor Hours	98	101
	Man Hours	216	211
<b>PKE Farm</b>	Tractor Hours	45	88
	Man Hours	86	120

## Financial Results

The financial results for the three farms have been calculated for the 2015/16 and 2016/17 seasons and are shown in the table 5. The income is based on a milk price of \$3.90/kg MS for 2015/16 and \$6.12/kg MS for 2016/17, plus actual income from livestock sales. The expenses are based on actual expenses with some adjustments for labour and administration to take out extraordinary expenses involved in running the research farm. The financial analysis reported here has been altered slightly from earlier reports as season information is finalised.

In both years farm working expenses/kg MS have been lowest on the Grass Only farm and highest on the Cropping farm. The Grass Only farm was the most profitable in 2015/16 season, while the PKE farm was the most profitable for the 2016/17 season. Milk price has been the variable that has made this difference between years. If a constant milk price of \$4.00/kg MS is used across both years then the Grass Only farm would have been the most profitable both seasons. Likewise, if we use \$6.00/kg MS then the PKE farm would have been most profitable in both years. The Cropping farm was the least profitable both years.

Additional capital is required to develop infrastructure, machinery and additional cows for more intensive systems. Assumptions were made and adjusted operating profit is shown in the table below based on

servicing the additional capital required for the Cropping and PKE farms. Taking into account the cost of servicing this additional capital further favours the Grass Only farm.

**Table 5.** Summary of 2015/16 and 2016/17 income, expenses and operating profit for the three farms with alternative milk price and adjustment for additional capital required.

<b>Financial Summary</b>	<b>Grass Only Farm</b>		<b>Cropping Farm</b>		<b>PKE Farm</b>	
<b>\$/ha</b>	<b>2015/16</b>	<b>2016/17</b>	<b>2015/16</b>	<b>2016/17</b>	<b>2015/16</b>	<b>2016/17</b>
\$/kg MS used in analysis	\$3.90	\$6.12	\$3.90	\$6.12	\$3.90	\$6.12
	<b>\$/ha</b>	<b>\$/ha</b>	<b>\$/ha</b>	<b>\$/ha</b>	<b>\$/ha</b>	<b>\$/ha</b>
Income from milk	\$3,391	\$5,908	\$4,071	\$6,446	\$4,013	\$6,845
Other Income	\$707	\$381	\$754	\$418	\$754	\$418
<b>Total Income</b>	<b>\$4,098</b>	<b>\$6,289</b>	<b>\$4,825</b>	<b>\$6,863</b>	<b>\$4,766</b>	<b>\$7,262</b>
FWE/kg MS	\$3.81	\$3.65	\$4.21	\$4.33	\$3.92	\$3.91
<b>Total Working Expenses</b>	<b>\$3,311</b>	<b>\$3,528</b>	<b>\$4,392</b>	<b>\$4,563</b>	<b>\$4,033</b>	<b>\$4,375</b>
<b>Operating Profit</b>	<b>\$755</b>	<b>\$2,761</b>	<b>\$433</b>	<b>\$2,300</b>	<b>\$733</b>	<b>\$2,887</b>
<b>Alternative Milk Price Analysis</b>						
<b>Operating Profit at \$4.00</b>	\$874	\$707	\$537	\$60	\$836	\$438
<b>Operating Profit at \$6.00</b>	\$2,613	\$2,645	\$2,625	\$2,173	\$2,894	\$2,753
<b>Operating Profit at \$8.00</b>	\$4,352	\$4,569	\$4,713	\$4,273	\$4,952	\$4,912
<b>Adjustment for Cost of Additional Capital Required</b>						
Additional Capital Required	\$500		\$2,242		\$2,483	
Cost of Capital at 6.5%	\$33		\$146		\$161	
<b>Adjusted Operating Profit</b>	<b>\$755</b>	<b>\$2,728</b>	<b>\$287</b>	<b>\$2,154</b>	<b>\$572</b>	<b>\$2,726</b>

## Acknowledgements

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