

The Northland Dairy Development Trust & The Northland Agricultural Research Farm

‘Resilient Farm Systems’ Field Day – 20th June 2019

Project funders

Ministry for Primary Industries
Manatū Ahu Matua



Hine Rangi Trust

Thanks to our sponsors and supporters for their continued support



The BNZ - Northland Dairy Development Trust

NDDT Chair:	Terrence Brocx
NARF Chair:	Sean Bradbury
NDDT & NARF Secretary:	Nicola Peele
NDDT Trustees:	Peter Flood, Kerry Chestnut, Kim Robinson Penny Smart, Andrew Booth
NARF Committee:	Peter Flood, Kerry Chestnut, Michael Rope, Brian Lowe, Gary Watkins
NARF Farm Manager:	Kelvin Horton
NDDT Science Manager:	Chris Boom, AgFirst Northland
NDDT Coordinator:	Kim Robinson, AgFirst Northland

PROGRAMME

10am - Welcome

10:10 – Resilient Farm Businesses – Paul Bird

11am – NARF Trial 2018/19 Results – Chris Boom & Kate Reed

11:30 – Marginal Milk Update – Jane Kay

Noon – Field Walk – Ryan Baxter

- Pasture and Cow Management
- Calving Management
- Diversified Forages

1:20 – Wrap-up and Feedback

1:30 - **BBQ lunch & drinks** thanks to Silver Fern Farms

Visit the Northland Dairy Development Trust website for further information and updates from these projects

www.nddt.nz

See us on Facebook – Northland Dairy Development Trust

Acknowledgements

Thanks to the funders and sponsors who have made this project possible. Special thanks to the NDDT trustees and NARF committee members who have given of their time and energy to make this project happen.

For further information contact:

Chris Boom – chris.boom@agfirst.co.nz or Kim Robinson – kim.robinson@agfirst.co.nz

Resilient Farm Businesses

Presented by Paul Bird – DairyNZ

Resilient farm businesses can withstand shocks that inevitably impact all businesses. Strategies to ensure resilience and reduce risk include, buying insurance, fixing interest rates and milk price, and ensuring there is enough silage in case of a drought or bad spring. Another key strategy, which this paper will focus on, is to operate a profitable business generating high cash surpluses. Resilient businesses can still make small profits or breakeven when several factors turn against them.

Whether you are starting out as a farm worker, contract milker, sharemilker or a farm owner it is essential to establish challenging but realistic cash surplus targets each season. Without these targets money can easily disappear as there is always something to spend it on. A farm that has a projected strong cash surplus can manage when events don't pan out as expected e.g. \$5.00 milk price. The other, equally important aspect to planning is when things are better than expected e.g. \$7.00 milk price. In this case the extra cash above budget should be used wisely to pay off debt or invested rather than being treated as a bonus and there to be spent.

The follow options become more easily achievable when high cash surpluses are generated over time.

- ◇ Not having to borrow when we have the next \$4.00 to \$5.00 milk price
- ◇ Purchase some machinery to enable me to start contract milking (without hire purchase)
- ◇ Ability to employ staff or put a contract milker / sharemilker on the farm
- ◇ Bring family or children into the business as shareholders
- ◇ Reduce debt faster to take the pressure off
- ◇ Enable re-investment in the farm – housing, shed, effluent system etc
- ◇ Increase drawings to spend on myself, or the family
- ◇ Build equity to invest in my first farm or another farm
- ◇ Build equity to purchase of a herd of cows

Northland Farm Owners: Average and Potential performance

Table 1 shows the potential Northland farm owner, based on top 20% operating performance, generates \$123,000 of cash, \$77,000 above the average. This is available for debt reduction or other investments. The difference comes from lower farm working expenses, drawings, and higher milk income.

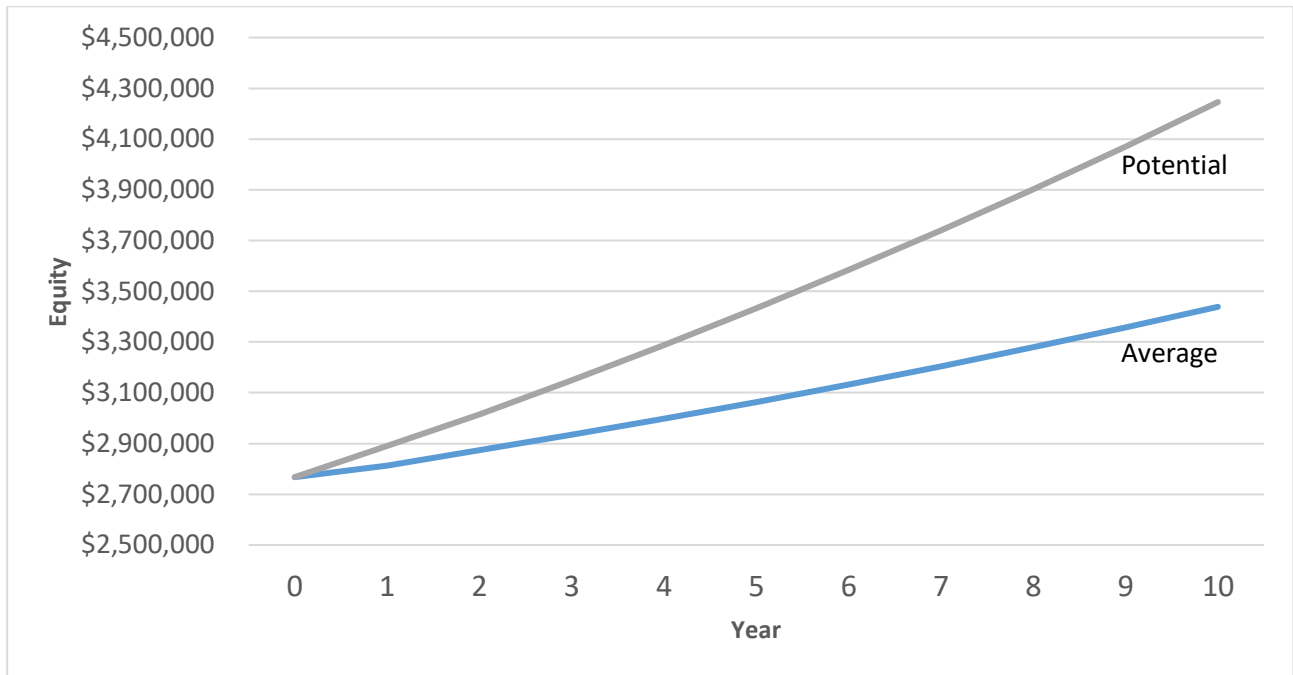
Table 1: Northland Farm Owners: Forecast Budget for 10 year equity projection - Based on DairyNZ Economic Survey and DairyBase

Year 2019/20	Average	Potential
Milk Income (\$/kg MS)	\$6.00	\$6.00
Milk income (\$ Total)	\$759,804	\$768,000
Dividends	\$25,327	\$25,600
Net Livestock Income	\$94,256	\$107,000
Other income (\$)	\$14,359	\$17,000
Total income	\$893,746	\$917,600
Farm working exp (\$/kg MS)	\$3.98	\$3.63
Farm working expenses (\$ Total)	\$504,003	\$464,640
Allowance for new plant + vehicles + other depreciable assets	\$47,495	\$45,000
Rent (\$)	\$13,089	\$9,750
Interest rate (%)	5.50%	5.50%
Total interest paid (\$)	\$165,104	\$165,104
Interest & rent (\$/kgMS)	\$1.41	\$1.29
Tax rate (%)	23%	23%
Drawings	\$80,675	\$68,000
Total Expenses (\$)	\$848,099	\$794,551
Cash surplus available for debt reduction and other investments	\$45,647	\$123,049
Effective dairying area (hectares)	158	158
Peak cows milked	374	380
Milk production (kg MS)	126,634	128,000
Milksolids/ha	801	810
Milksolids/cow	339	337

**Potential has been generated by sorting farms on top 20% Return on Assets. Milk income is based on a 10 year average. Other income and costs are based on a 3 year average. Potential drawings are based on actual drawings from the lowest profit quartile in Northland. To simplify the analysis there is no allowance for increase in milk price, inflation, or capital gain/loss on assets.*

Over a 10-year period the equity graph shows the potential farms accumulate an extra \$800,000 of equity compared to average. These farms have significantly more options over time to reduce debt, invest in the 'next' farm, improve the farms infrastructure or bring in family members as shareholders.

Figure 1: Northland Farm Owners equity growth from profit



Why is there a such a big gap?

The farmers in the top 20% group generally have a primary focus on a few important financial targets such as Profit/ha, cash surplus, Return on Assets, Operating Expenses/kgMS rather than production targets. Milksolids is important but it is not the primary driver of profit or farm management decisions.

Often in underperforming businesses the goals of the business owners are not clear, not written down or not aligned between partners or family members. When clarity and alignment is achieved results can be dramatically improved.

A sustainable profit target is set at the beginning of the season and this target is locked in.

The biggest single physical difference between these groups is pasture consumption/ha. The higher profit group have higher pasture eaten per hectare. For every extra tonne of pasture eaten/ha farms will generate on average an extra \$300/ha of operating profit.

As well as a small number of high level financial targets there are also small number of high level physical targets that drive farm management decisions such as pasture cover and cow condition at calving and 6-week in calf rate.

Contract Milkers – North Island

We have a limited number of Northland contract milkers in DairyBase so I have used North Island wide data (52 businesses) to show the cash surplus generated from the average contract milking business. After drawings of approximately \$54,000 (*similar to an in-town salary of \$100,000 if you add on tax and house rental*) there is \$29,000 of cash surplus available to pay off debt, save or invest to grow the business.

Table 2: North Island Contract Milker Forecast Budget for 10 year equity projection - Based on DairyBase

Effective dairying area (hectares)	166.4
Peak cows milked	466
Milk production (kg MS)	176,436
Milksolids/ha	1,060
Milksolids/cow	379
Milk Income (\$/kg MS)	\$1.26
Milk income (\$ Total)	\$222,309
Net livestock income	\$14,000
Other taxable income (\$)	\$8,000
Total income	\$244,309
Farm working expenses (\$/kg MS)	\$0.75
Farm working expenses (\$ Total)	\$132,327
Allowance for new plant + vehicles	\$3,666
Rent or lease (excluding support blocks) (\$)	\$131
Total interest paid (\$)	\$3,768
Estimated tax payable (\$)	\$20,884
Drawings	\$54,686
Total Expenses (\$)	\$215,461
<u>Cash surplus available for debt reduction and other investments</u>	<u>\$28,848</u>
Breakeven milk income/kgMS	\$1.10
Total Debt	\$47,097
Total Assets	\$174,505
Equity	\$127,408

Over a 10 year forecast period the contract milkers equity increases from \$127,000 to approximately \$522,000. Given the risks and pressure of running a contract milking business there is some debate as to whether the cash surplus and equity growth is enough. What do you think?

Dairying in a Variable Climate Project – NARF

Chris Boom (NDDT Science Manager, AgFirst Northland) – June 2019

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 conducted at the Northland Agricultural Research Farm (NARF) has been investigating the use of palm kernel extract (PKE) and other supplements on farm production, profitability and environmental measures. This project compares a farm that does not import any supplement (**Pasture Only farm**, 2.7 cows/ha) with a farm that only imports PKE (**PKE Only farm**, 3.1 cows/ha) and a farm that imports PKE and other supplements (**PKE Plus Farm**, 3.1 cows/ha). PKE is fed on the PKE Only and PKE Plus farms when pasture supply is limiting. Other supplements are fed to the PKE Plus farm when milk fat evaluation index (FEI) levels indicate no further PKE can be fed.

The first season of this three-year project is now complete. Climatic conditions were considered average with some challenge from wet conditions during early spring and dry conditions during late summer/autumn.

Milk production was 1,008, 1,238 & 1,314 kg MS/ha for the Pasture Only, PKE Only and PKE Plus treatments respectively. Feeding of PKE was constrained by milk FEI during summer and autumn, but not during spring. PKE fed totalled 748 and 769 kg DM/cow on the PKE Only and PKE Plus farms respectively. In addition to PKE, PKE Plus cows received 228 kg/cow DDG and 54 kg DM/cow baleage (purchased). Comparing milk production and supplementation between farms provides a calculation of the response rate to supplements. This shows a response of 100 g MS/kg DM PKE fed on the PKE Only farm and a response rate of 94 g MS/kg PKE, DDG & baleage fed on the PKE Plus farm.

Preliminary financial analysis for the 2018/19 season has been undertaken. This takes into account labour and other costs associated with each farm. Using a milk price of \$6.35/kg MS, farm operating profit (EBIRT) was \$3,011, \$3,323 and \$3,018/ha for the Pasture Only, PKE Only and PKE Plus farms respectively. These results show a financial advantage to putting PKE into the farm system, however this advantage disappeared when other higher priced supplements were added when milk FEI constrained feeding more PKE.

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. Land area allocated to each farm is 28 ha with paddocks allocated so pasture growth potential is similar across farms. Silage can be made when there is a pasture surplus and fed when pasture supply below feed demand.

The three farm systems are:

1. Pasture Only – 2.7 cows/ha

A simple pasture only farm system. Silage is made when pasture surpluses occur and fed back as required.

2. PKE Only – 3.1 cows/ha

PKE is fed when pasture grazing residuals fall below acceptable pasture feeding levels while maintaining ideal grazing rotation length. PKE is not used to create a pasture surplus for conservation. PKE use is constrained by the need to keep the milk fat evaluation index (FEI) within the acceptable limits set by Fonterra.

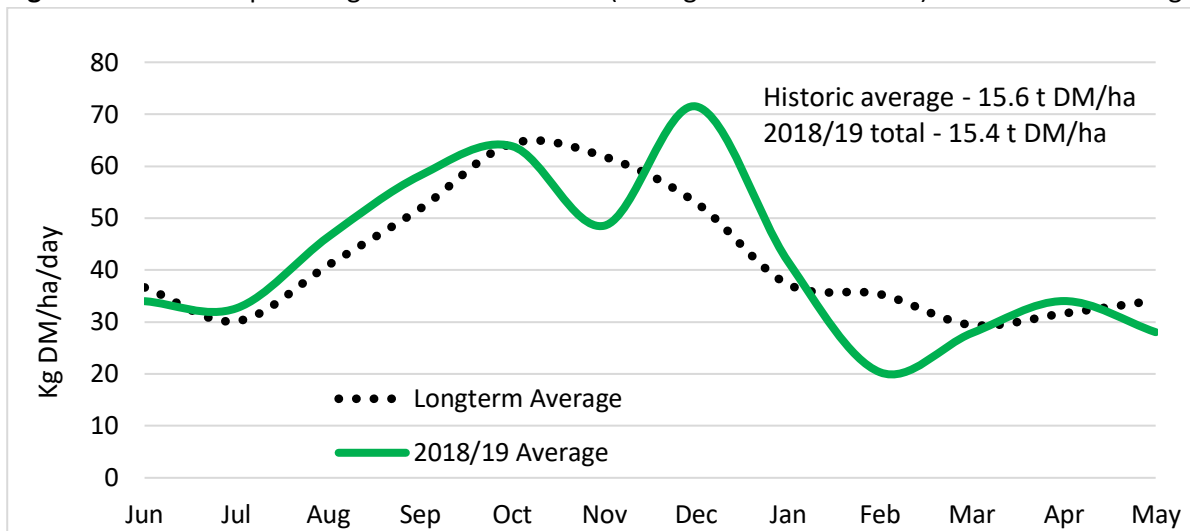
3. PKE Plus – 3.1 cows/ha

Supplements are fed when pasture grazing residuals fall below acceptable pasture feeding levels. PKE is used first until milk FEI limits are reached and then an alternative spot market feed sources are used.

Pasture Growth

Pasture growth during the 2018/19 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 similar to historical average.

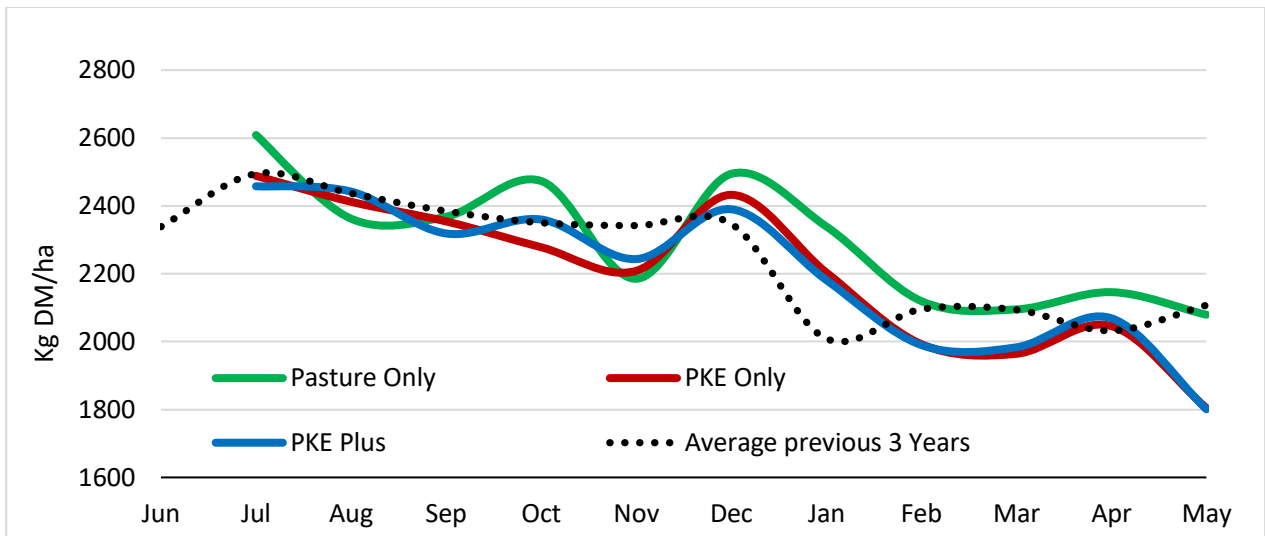
Figure 1. Calculated pasture growth rates at NARF (average of three farmlets) and historical average.



Pasture Covers

Average farm pasture covers are shown in Figure 2. Pasture cover was higher on the Pasture Only farm than the other farms right through summer and autumn, likely due to the lower stocking rate. Higher covers in October also allowed more area to be closed-up for silage on the Pasture Only farm than the other farms. Pasture cover was higher on the Pasture Only farm than the other farms through most of summer and autumn, due to lower stocking rate and earlier drying off.

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



Supplement Use

Table 1 shows the supplement fed to date and area cut for silage. The PKE feeding level was constrained by milk FEI through much of summer and autumn. During this period, feeding was generally 2 – 3.5 kg DM PKE/cow/day.

Table 1. Supplements fed during 2018/19 season (kg DM/cow), price of supplements landed (¢/kg DM) and % of farm cut for silage and calculated pasture eaten (t DM/ha)

	Supplement	Kg DM/cow	Cost of Supplement ¢/kg DM	% of Farm Cut for Silage
Pasture Only Farm	Grass Silage (home-made)	567	14.7	38%
PKE Only Farm	Grass Silage (home-made)	249	14.7	24%
	PKE	748	26.2	
	Total	997		
PKE Plus Farm	Grass Silage (home-made)	166	14.7	26%
	PKE	769	26.2	
	DDG	228	61.9	
	Grass Silage (purchased)	49	31.1	
	Total	1,212		

Milk Production and Mating

Table 2 shows the milk production and mating results. Submission and empty rate differences are not considered significant.

Table 2. Milk solids production per ha and per cow for 2018/19 season, mating 3-week submission and empty rate.

	Kg MS/ha	Kg MS/cow	3-week submission rate	Empty Rate
Pasture Only Farm	1,008	376	93%	9%
PKE Only Farm	1,238	408	84%	11%
PKE Plus Farm	1,314	428	91%	6%

Responses to PKE

Comparing milk production on the two PKE supplemented farms to the Pasture Only farm provides a calculation of response to supplement. This shows a response to PKE feeding on the PKE Only farm of 100 g/kg DM PKE fed. This compares to an average of 122 g/kg DM PKE fed on the previous three seasons. The PKE Plus farm showed a response of 94 g MS/kg supplement (mostly PKE) when compared to the Pasture Only farm, however the response to the additional supplement used compared to the PKE Only farm is only 80 g MS/kg DM additional supplement.

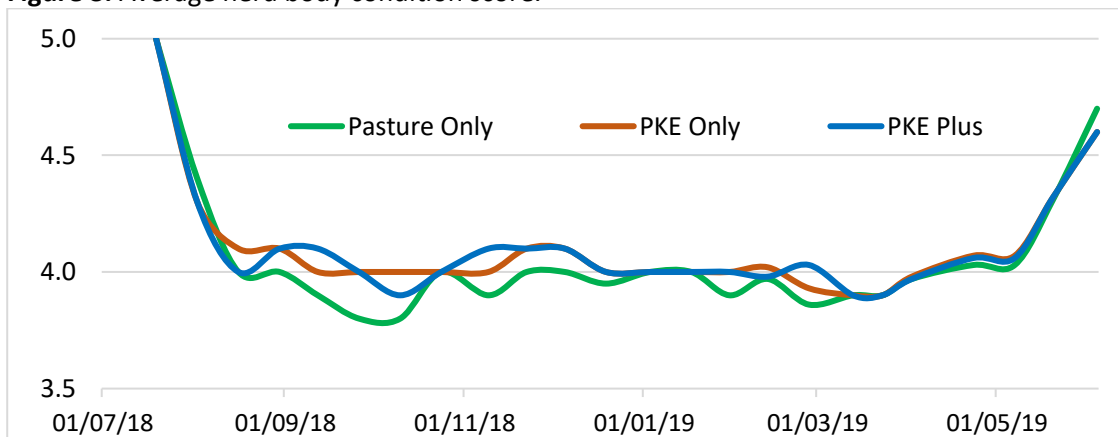
Table 3. Supplement response calculation

	Pasture Only farm	PKE Only farm	PKE Plus farm
Total Milk Production (kg MS)	28,235	34,678	36,789
Total PKE fed (t DM)	-	64.3	66.2
Other purchased supplements (t DM)	-	-	24.7
Supplement Response g/kg DM supplement		100	94

Body Condition Score

Body condition score (BSC) has been assessed fortnightly. The Pasture Only farm tended to have a lower condition score during spring and summer than the other farms. Earlier drying off led to the Pasture Only farm having a higher condition score by the end of the season. Any cows at 3.5 BSC are placed on Once a Day (OAD) milking. Prior and during mating a significant portion of Pasture Only farm cows were on OAD.

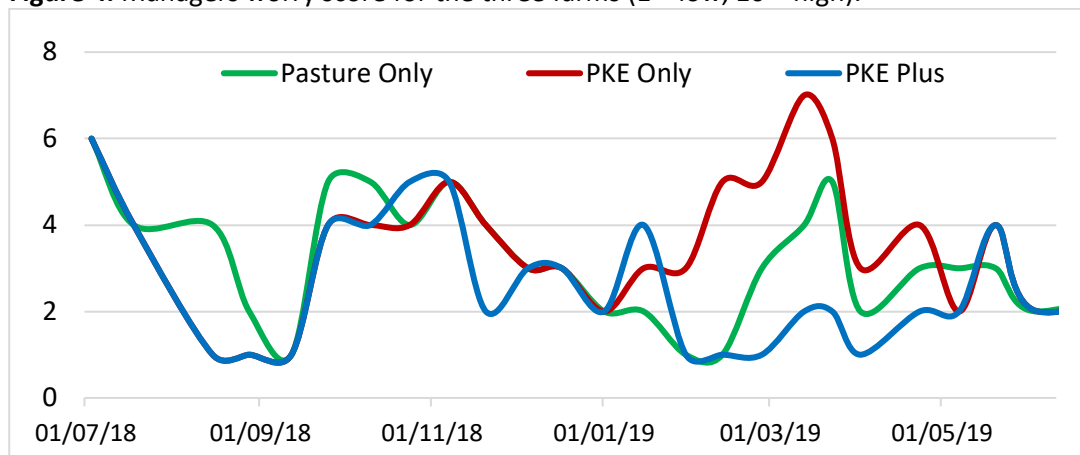
Figure 3. Average herd body condition score.



Worry Score

A worry score has been assessed fortnightly. This relates to the concern the manager has about cows and feed supply. The Pasture Only farm had a higher worry score during late winter/spring when there was no ability to bring in additional feed. In contrast the PKE Only farm had the higher score during summer/autumn due to milk FEI limits constraining feeding of PKE during this period.

Figure 4. Managers worry score for the three farms (1 = low, 10 = high).



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 this additional time required by NARF staff for feeding out, moving cows to and from the feed pad. It should be recognized that additional time spent feeding and shifting cows was based on mobs of 75 – 90 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 each farm for feeding supplements in the 2018/19 season.

	Additional Tractor Hours	Additional Labour Hours
Pasture Only farm	55	55
PKE Only farm	90	247
PKE Plus farm	100	338

Financial Results

The financial results for the three farms have been calculated and are shown in the table 5. The income is based on the full milk price of the season being \$6.35/kg MS. Fonterra share dividend is not included. Expenses are based on actual expenses with some adjustments for labour and administration to compensate for extraordinary expenses involved in running the research farm. Records of additional labour and tractor time for each farm has been used to adjust the vehicle, R&M and depreciation expenses.

Farm operating expenses/kg MS were lowest on the Pasture Only farm and highest on the PKE Plus farm. Using a milk price of \$6.35/kg MS the farm operating profit was highest on the PKE Only farm, while being similar on the other two farms. If milk price was below \$5.00/kg MS then the Pasture Only farm would have the highest operating profit. With a milk price between \$5.00/kg MS and \$10.40/kg MS the PKE Only farm would have been the most profitable. Over \$10.40/kg MS the PKE Plus farm would have been the most profitable.

For the PKE Only farm, for each dollar spent on purchasing PKE an additional \$0.83 was added to farm expenses. On the PKE Plus farm this was \$0.70 on top of each dollar spent on purchasing supplement.

Financial results from the 2018/19 season indicate that there was an advantage to putting PKE into the farm system, however this advantage disappeared when PKE was substituted with higher priced supplements due to milk FEI constraining PKE feeding levels.

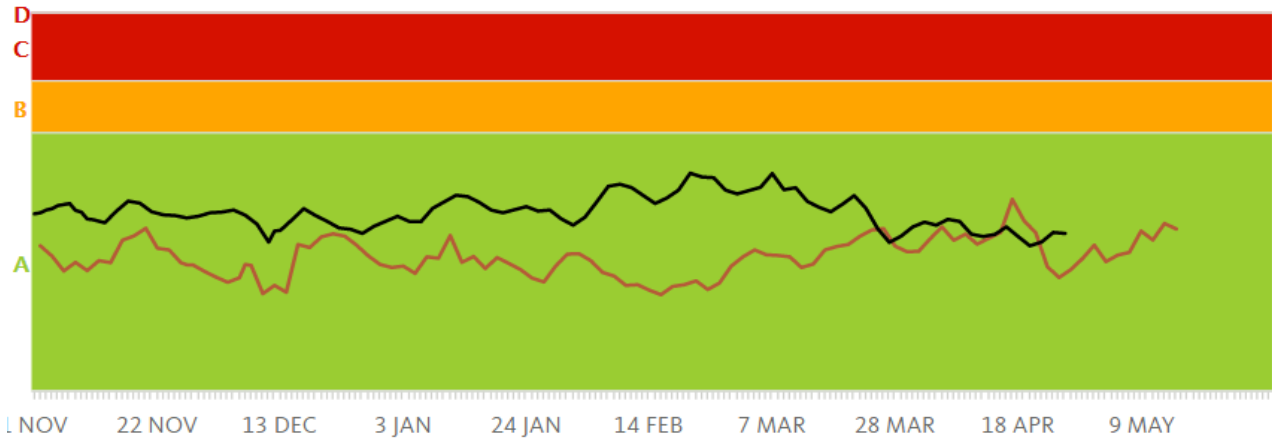
Table 5. Income, expenses and operating profit for the three farms with alternative milk pricing.

Financial Summary 2018/19	Pasture Only Farm	PKE Only Farm	PKE Plus Farm
Income	\$/ha	\$/ha	\$/ha
Income from milk (\$6.35/kg MS)	\$6,403	\$7,864	\$8,343
Dividends	\$34	\$34	\$34
Income from stock sales	\$587	\$666	\$674
Total Income	\$7,024	\$8,564	\$9,051
Expenses			
Wages	\$1,221	\$1,427	\$1,638
Animal Health	\$201	\$225	\$227
Breeding Expenses	\$226	\$255	\$258
Shed expenses	\$92	\$101	\$102
Electricity	\$203	\$226	\$228
Grazing	\$420	\$476	\$482
Calf rearing	\$121	\$137	\$138
Silage Making	\$185	\$109	\$100
PKE		\$671	\$690
DDG			\$444
Purchased Silage			\$51
Nitrogen/Fert	\$195	\$207	\$207
Regrassing	\$93	\$93	\$93
Weed and Pest	\$64	\$64	\$64
Vehicle Expenses	\$156	\$210	\$225
Depreciation	\$330	\$445	\$476
R&M General	\$146	\$197	\$210
R&M Effluent	\$52	\$82	\$82
Administration	\$129	\$132	\$132
Rates and Insurance	\$180	\$185	\$185
Total Operating Expenses	\$4,014	\$5,241	\$6,033
Operating Expenses/kg MS	\$3.98	\$4.22	\$4.59
Operating Profit			
Operating Profit at \$6.35	\$3,011	\$3,323	\$3,018
Alternative Milk Prices			
Operating Profit at \$4.00	\$607	\$379	-\$104
Operating Profit at \$6.00	\$2,624	\$2,856	\$2,524
Operating Profit at \$8.00	\$4,641	\$5,333	\$5,152

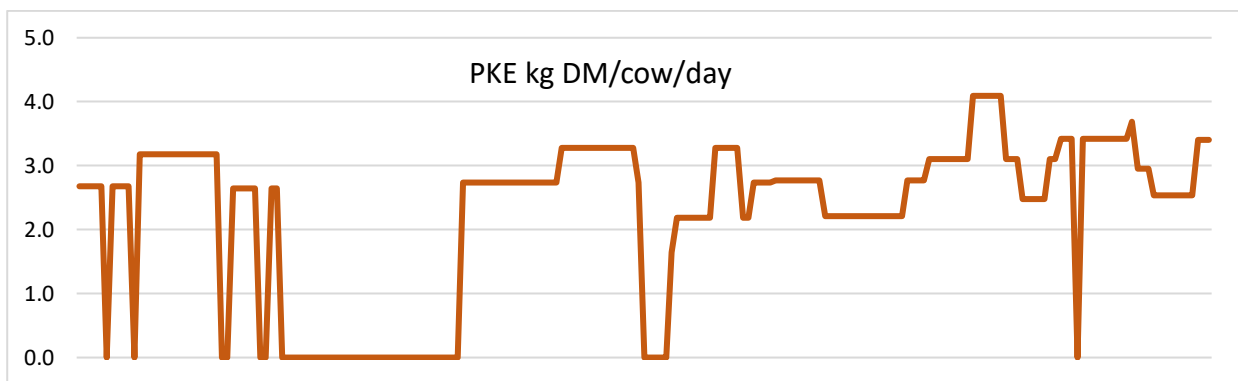
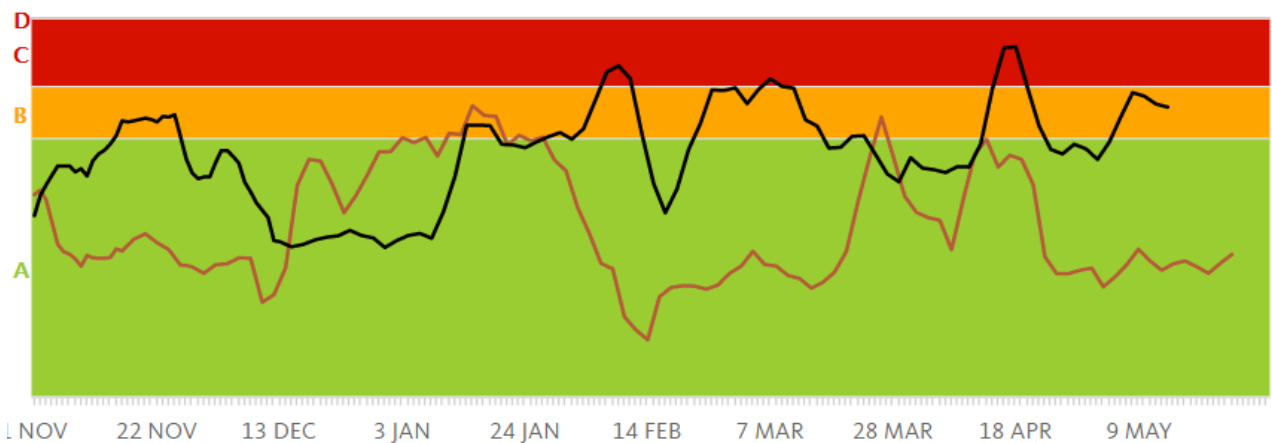
NARF Milk FEI Graphs

The graphs below show the milk FEI and the associated PKE feeding level. At times 3 kg DM/cow/day was 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.

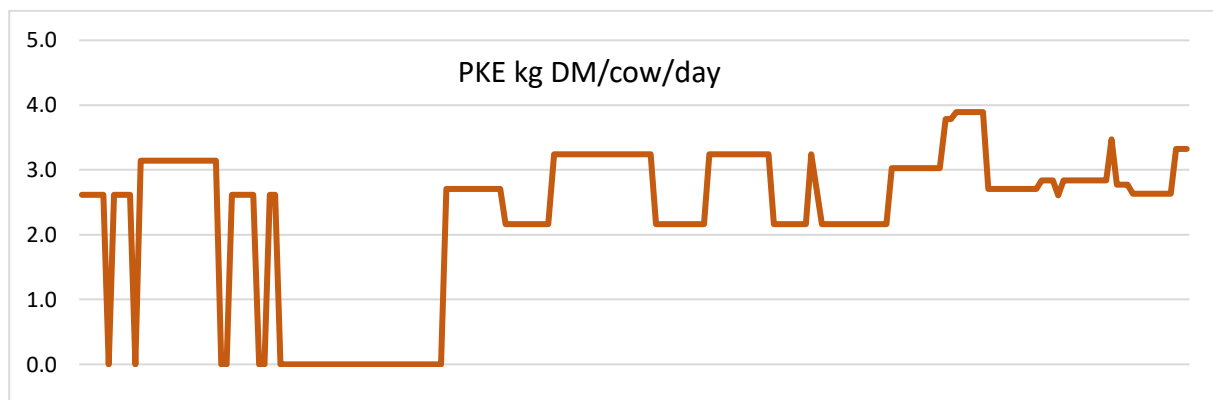
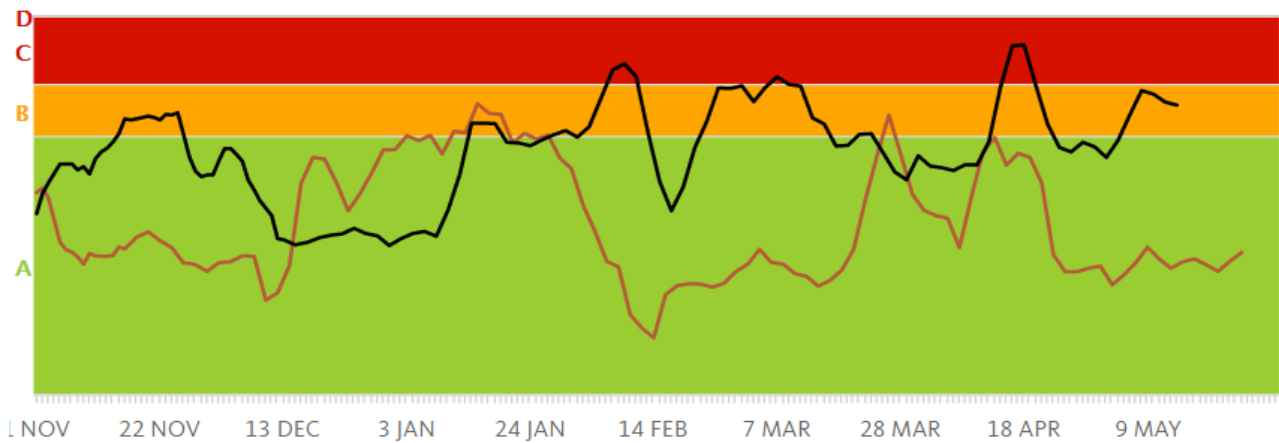
Milk FEI graph - Pasture Only farm



Milk FEI graph – PKE Only farm



Milk FEI graph – PKE Plus farm



Thanks to the NARF staff for making this project happen, being Kate Reed, Kelvin Horton and Johan Van den Berg. Special thanks to NDDT trustees and NARF committee members for their support and commitment to propose and oversee this project.

Supplement use in a variable climate

Jane Kay, Senior Scientist, DairyNZ

Main points:

- Marginal milk is the additional milksolids produced when changes are made to a farm system (e.g. increased stocking rate or more supplementary feeds fed).
- The cost of the marginal milk produced determines whether the changes made to the system generate more profit
 - If the cost of the marginal milk is less than the milk price – they ARE increasing profit
 - If the cost of the marginal milk is more than the milk price – they are NOT increasing profit
- The cost of the marginal milk depends on:
 - The milksolids response to the system change(s)
 - The costs associated with the system change(s) For example: buying and feeding supplement, increasing cow numbers, AND additional system-level costs that are rarely accounted for in incomplete marginal analyses.
- In 2018/19 at NARF increasing stocking rate and feeding supplements increased milk production by:
 - 231 kg MS/ha for the PKE farm compared with the Pasture Only farm
 - 306 kg MS/ha for the PKE PLUS farm compared with the Pasture Only farm
 - 75 kg MS/ha for the PKE PLUS farm compared with the PKE farm
- The milksolids response was:
 - 100 g MS/kg DM PKE for the PKE farm compared with the Pasture Only farm
 - 94 g MS/kg DM supplement for the PKE PLUS farm compared with the Pasture Only farm
 - 80 g MS/kg DM supplement for the PKE PLUS farm compared with the PKE farm
- The cost of the marginal milk was:
 - \$5.33 /kg MS for the extra milk produced in the PKE farm compared with Pasture Only farm
 - \$6.61/kg MS for the extra milk produced in the PKE PLUS farm compared with the Pasture Only farm
 - \$10.51/kg MS for the extra milk produced in the PKE PLUS farm compared with the PKE farm

Summary:

Supplement use in a variable climate is a three-year research programme funded by DairyNZ and the Ministry for Primary Industries through their *Sustainable Food and Fibres Futures* programme. The project will compare three farm systems with different supplement use on production, profit and environmental impact. The three farm systems are:

1. **Pasture-Only Farm** - No imported supplement - 2.7 cows/ha
2. **PKE Only Farm** - PKE fed to fill feed deficits within milk FEI limits - 3.1 cows/ha
3. **PKE Plus Farm** - PKE fed until milk FEI limits and then alternative supplements fed to fill feed deficits - 3.1 cows/ha.

Preliminary results from the 2018-19 season (Year 1) have been collated to provide preliminary estimates for the milksolids response to supplementary feeds, the cost of marginal milk, and the profitability of feeding PKE to within the FEI limits or feeding PKE to within the FEI limits and then feeding alternative supplements. The alternative supplements included pasture silage and Dried Distillers Grain (DDG).

Milksolids response:

For the 2018/19 season, the Pasture Only treatment produced 1,008 kg MS per ha (Table 1).

Increasing stocking rate from 2.7 to 3.1 cow/ha and feeding PKE to fill feed deficits resulted in:

- greater per cow production (32 kg MS/cow) and
- greater per ha production (231 kg MS/ha; Table 1).

Increasing stocking rate from 2.7 to 3.1 cow/ha and feeding PKE plus alternative supplementary feeds (pasture silage and DDG) to fill feed deficits resulted in:

- greater per cow production (52 kg MS/cow) and
- greater per ha production (306 kg MS/ha; Table 1).

Maintaining stocking rate at 3.1 cows/ha but increasing the allowance of supplementary feed/cow by purchasing alternative supplements (pasture silage and DDG) in addition to PKE resulted in:

- greater per cow production (20 kg MS/cow) and
- greater per ha production (75 kg MS/ha; Table 1).

Table 1. Milksolids production for 2018/19 season for the Pasture Only, Pasture and PKE, and Pasture and PKE PLUS alternative supplements farms.

	Pasture Only	PKE	PKE PLUS
Per hectare (kg MS/ha)	1,008	1,239	1,314
Per cow (kg MS/cow)	376	408	428

The Pasture Only farm harvested silage but did not purchase any supplements.

The PKE farm fed 2.3 t DM PKE/ha (748 kg DM/cow or 813 kg PKE fresh/cow).

The PKE PLUS farm fed 2.4 t DM PKE/ha (769 kg DM/cow or 836 kg PKE fresh/cow), 0.7 t DM DDG (228 kg DM/cow or 251 kg DDG fresh/cow) and 0.2 t DM pasture silage (49 kg DM/cow).

Based on these feed inputs, the milksolids response to the increased supplement fed in the PKE and PKE PLUS farms compared with the Pasture Only farm was 100 g MS/kg DM for the PKE farm, and 94 g MS/kg DM for the PKE PLUS farm (Table 2 and Figure 1). When we compare the milksolids response of offering additional supplements in the PKE PLUS compared with the PKE farm, the milksolids response was 80 g MS/kg DM (Table 2 and Figure 1).

Table 2. Milksolids response to additional supplement fed in the PKE and PKE PLUS farms.

	PKE vs. Pasture Only	PKE PLUS vs. Pasture Only	PKE PLUS vs PKE
Milksolids response to supplement (g MS/kg DM)	100	94	80

Cost of marginal milk

Operating expenses per hectare increased when supplementary feeds were incorporated into the system.

- The Pasture Only farm had operating expenses of \$4,014 (\$3.98/kg MS).
- Feeding 2.3 t DM PKE to the PKE farm increased operating expenses by \$1,226/ha to \$5,241/ha (\$4.25/kg MS).
- Feeding the alternative supplements to the PKE PLUS farm increased operating expenses by an additional \$792/ha to \$6,033/ha (\$4.63/kg MS).

The cost of the additional (marginal) milk can be calculated from the extra milk produced divided by the extra cost of producing this milk.

- For the PKE farm, the average cost of the marginal milk was \$5.33, so at a milk price of \$6.35, the extra milk produced from increasing stocking rate and feeding PKE to fill feed deficits returned approximately \$1/kg MS.
- For the PKE PLUS farm, the cost of the marginal milk produced compared with the Pasture Only farm was \$6.61, so at a milk price of \$6.35, the extra milk was not adding to profit.
- When we compare the marginal milk produced by the PLE PLUS farm above that produced by the PKE farm, the cost was \$10.51/kg MS. This means at a milk price of \$6.35, the extra milk produced from feeding the alternative supplements (PKE, DDG and pasture silage) was not adding to profit and actually cost the business \$4.16 for every kg MS produced. For this additional milk to be profitable (i.e. cost less than \$6/kg MS), it would require a milksolids response of greater than 140 g MS/kg DM, almost double what was achieved in this study.

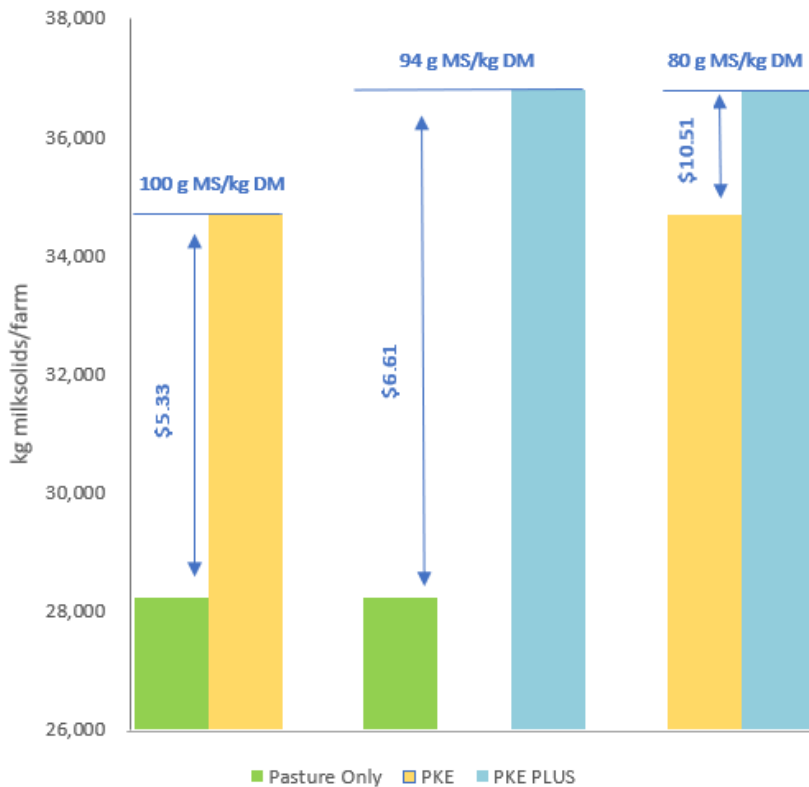


Figure 1. Milksolids response (kg MS/kg DM fed) and cost of marginal milk (\$/kg MS) for Pasture Only vs. PKE, Pasture Only vs. PKE PLUS and PKE vs PKE PLUS.

Summary:

The 100 g MS/kg DM response to increased stocking rate and feeding PKE in 2018/19 is less than previous years at NARF, which ranged from 106 g MS/kg DM to 140 g MS/kg DM, and averaged 122 g MS/kg DM. These high milksolids responses (compared with a national average from the last 12 years of DairyBase of 80 g MS/kg DM supplement) are potentially due to greater responses from feeding supplement when pastures are kikuyu-dominant (i.e., lower energy) compared with ryegrass-dominant systems, and due to very good decision rules being followed in the farms (i.e., no pasture wasted).

The lower MS response with the additional supplement fed; 80 g MS/kg DM in the PKE PLUS farm, is consistent with a diminishing response to supplements, as more supplementary feeds are incorporated into the system without increasing stocking rate. The high cost of the marginal milk in the PKE PLUS farm reflects the lower milksolids response and the high cost of DDGs, making this system the least profitable of the three farms

At a \$6.35 milk price, and with a higher than average MS response of 100 g kg DM, the PKE Only farm was slightly more profitable than the Pasture Only and PKE Plus farms (\$3,323/ha vs. \$3,011/ha and \$3,018/ha respectively).

Northland's Diversified Forage Production



NORTHLAND'S DIVERSIFIED FORAGES

PROJECT OVERVIEW

Our objective has been to increase the profit and resilience of Northland farmers through identifying and exploiting forage solutions that demonstrate advantages in yield, feed quality and/or time of growth.

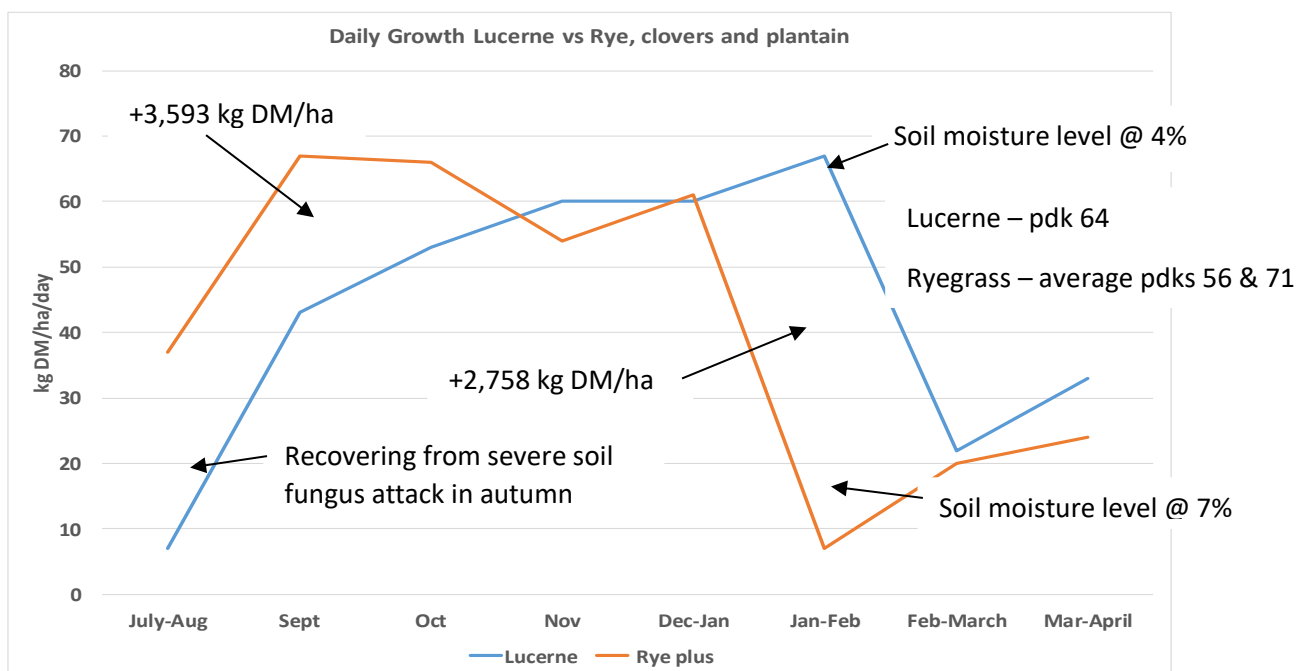
KEY POINTS

- Perennial ryegrass has limited persistence in Northland, especially on very dry soils.
- There are a number of species that offer yield advantages at times of the year when that additional pasture is very valuable:
 - Annual clovers August to December
 - Red clover December to April
- Plantain is very complimentary to a range of systems and soils in Northland
- It is critical to use high quality seed
- We have observed tremendous variation in yield results from forages, across farms – due to all the factors that make farms different.

RESULTS

Lucerne

- A long-term legume in the “right” situation and with the required management
- Ability to grow very well under dry to very dry soil conditions
- Producing medium to high energy levels and very high protein during the summer.



Annual Clovers

- Short-term legumes (7-8 months)
- Persian, balansa and berseem annual clovers can grow in difficult situations, e.g. wet Northland clay soils
- Capable of high growth rates in August to November and is earlier in this growth than white or red clover: Timing of growth is a strength
- Are capable of growing 4-12 tonne of dry matter in mixes with grasses and other clovers, and can produce up to 50% of the year's total pasture production
- For 2016/17 and 2017/18 results: Across 9 sites, Persian clover cost @ 1.7 – 2.2 cents and Berseem @ 14 cents per kg DM grown.

Whole-Paddock Sowing Results

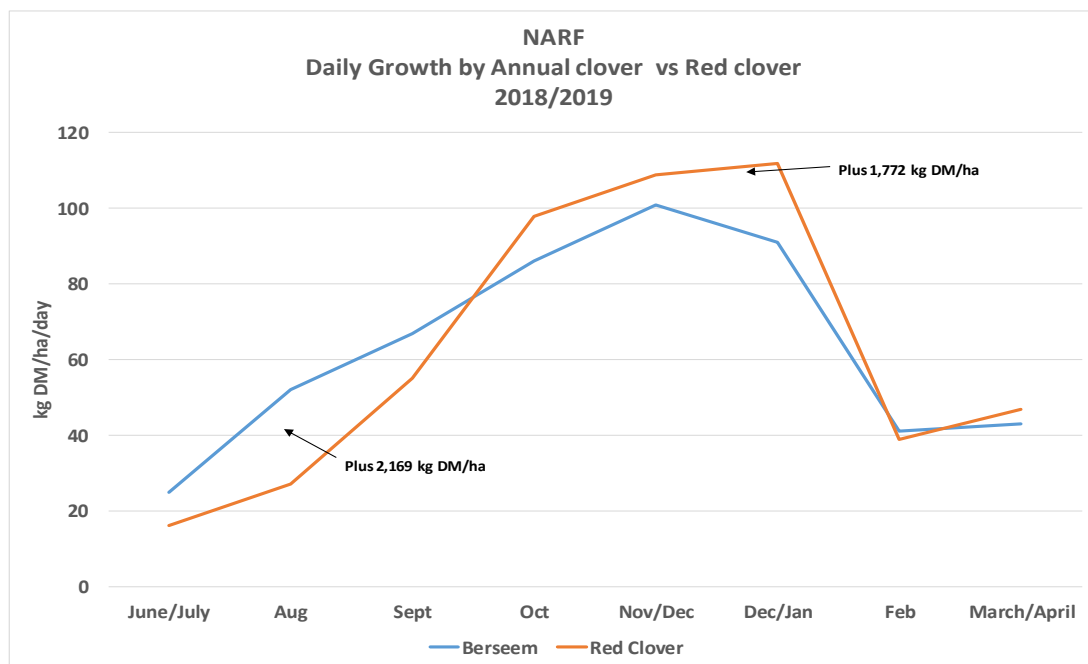
- Exploring a range of companion species that are compatible with annual clovers
- Potential of very high 12-month pasture production.

2017/18 Ryegrasses, perennial clovers, annual clovers			
	Total Yield t DM/ha	Annual Clover Production	
		t/ha	%
Average of 9 paddocks	16.0	4.5	28
Highest producing paddock	20.9	6.1	29
Highest annual clover production	15.4	10.5	68

Timing of annual clover production makes it a valuable addition for most farm systems: growth in August to December is very valuable.

Red Clover

- A short to medium-term legume (1-3 years) when sown in mixes
- Timing of growth compliments ryegrass, other grasses: Maximum yields for the red clover is achieved after ryegrass goes to flower
- Sowing rate @ 4 to 6 kg/ha
- Requires some summer soil moisture for maximum growth rates and persistence.



Berseem result is the average of the ryegrass, tall fescue, cocksfoot that had berseem as the annual clover. The red clover is the average of all treatments that had no annual clover sown.

The major points from the NARF results for 2018/19:

- 20.1 tonne DM/ha as average yield across all treatments

Clover Yield by Total yield and Percentage		
	t DM/ha	As % of total yield
Persian and berseem clovers	10.2	51
Red clover – In mixes that included Persian & berseem clovers	7.0	35
Red clover – In mixes excluding Persian and berseem	12.7	63
“Combined” clover yield	17.3	86

Controls and Companion Species: A comparison between rye, cocksfoot and tall fescue

- Highlights the poor persistence of perennial ryegrass within Northland, especially on very dry soils
- In Year one with a “wet summer”, being 2017/18, total yields were very similar, with tall fescue being 6% higher than ryegrass or cocksfoot treatments
- In Year two, a dry summer/autumn, there was a substantial decline in total pasture yield.
 - Ryegrass declined by 24%
 - The growth from the tall fescue and cocksfoot grasses showed no decline but their overall treatment yield dropped with white clover “dropping out” of all three grass species
- As at May 2019, at 24 months of age, there is a major difference in the growth of the sown grasses:
 - Ryegrass has declined to being just 24%,
 - Tall fescue grass making up 86%,
 - Cocksfoot made up 100% of the plant material in the growth cuts.
- Yields of 16.0 tonnes DM/ha in Year One.

HERBS - Results

Pasture growth for full 12-month period				
Comparison of treatments – with or without herbs				
	Plantain & Chicory present		No Plantain or chicory present	
Total pasture Growth Kg DM/ha	15,987		13,637	
Growth by species – kg DM/ha & percentage	Growth	%	Growth	%
Annual clovers	4,453	28	5,474	40
Grasses	693	4	3,093	23
White clover	356	2	923	7
Red clover	1,343	8	3,567	26
Plantain	5,715	36	0	
Chicory	2,735	17	0	
Other	692	4	580	4

- A net growth advantage over the first 12 months of 2.4 tonne DM/ha from adding plantain and chicory into a tall fescue, cocksfoot, clover pasture mix
- Plantain and chicory grew 5.7 & 2.7 tonnes DM/ha respectively
- Net cost of adding herbs @ 1.6 cents kg DM
- The mixes sown with no herbs, grew more annual clover, grass and both red and white clover, but this growth did not balance out the herbs production
- Herbs are complimentary to Italian ryegrass and kikuyu management, and also with other grasses
- Yields of 16 tonnes DM/ha with the addition of herbs
- To allow for weed control, do not include chicory with plantain.

Management Factors

Establishment – Seed quality has to be high

- Uncertified seed is a major gamble and has a high risk of a poor outcome
- Do not attempt to store seed on-farm in Northland
- Species selected must be “fit for purpose”
- When sowing seed
 - Trash is the enemy
 - Slug control is good insurance
 - Depth is governed by seed size – sow to the same depth as the size of the seed
- Balanced and good levels of soil fertility, especially potash.

Grazing Management

- Rotation: “slow is best”
- Suggested rotation length:

Aug/Sept	40-45 days
Oct	35 days
Nov-Dec	25-35 days
- Grazing residual – “high is better”, ideally the clover base has a residual of above 1500 kg DM/ha as distinct to the grass component being 1500 kg DM/ha.

What does a diversified pasture system look like? Based on our results and observations to date, a 3-year programme is as follows:

- In Spring, Year 1: Chicory established for the first summer
- Autumn, Year 1: Sow a mixture of Italian ryegrass, plantain, red clover and annual clovers
- Autumn, Year 2: Sow a deep-rooting grass species such as tall fescue or cocksfoot, plus red clover, annual clovers, white clover and plantain
- Lucerne could be added on suitable soils
- By Christmas in Year 3, there may be a significant portion (30-40%?) of the farm in non-kikuyu species.

FUTURE:

Seed Mixes

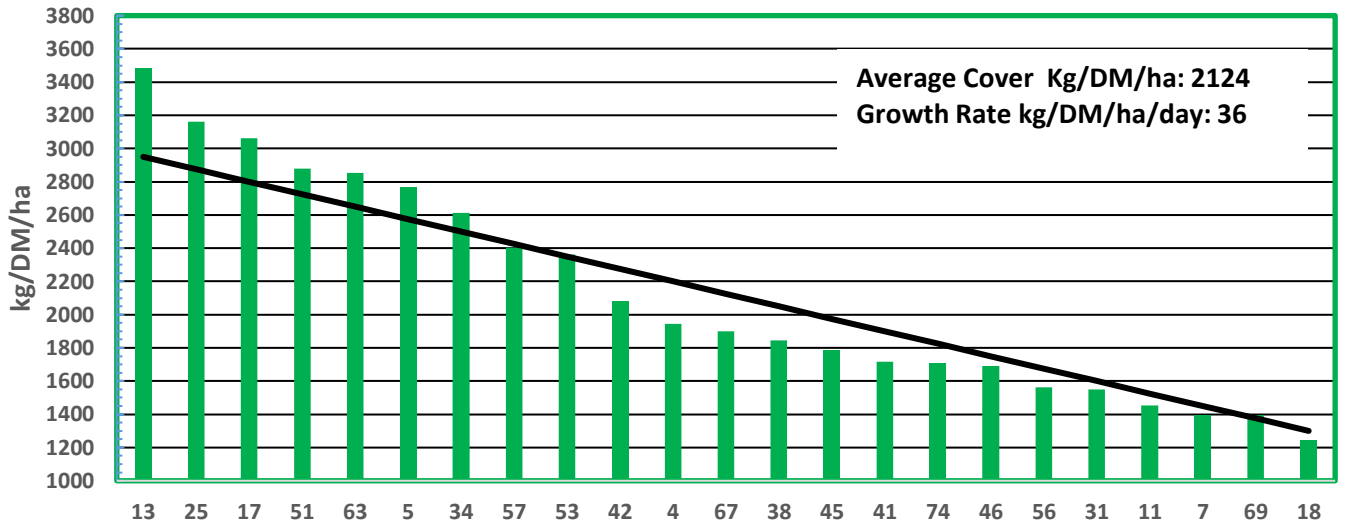
Part of the “fit for purpose” is selecting species that will grow and produce in the target site or paddock. But part of it is also whether the objective is a “short-term, highly-productive” pasture versus a potentially lower-producing pasture in the short term, but being far more persistent, e.g. a short term (1-2 year) pasture may have a high content of annual clover, red clover and minimal white clover. In contrast, a “persistent” pasture may have a much lower sowing rate of the very productive species, being the annual clovers, red clover.

This project has identified that there is potential for other species to be complimentary to Northland’s current kikuyu management. Work needs to evolve looking at best practice establishment and management for various sites, various farm systems and differing pasture types.

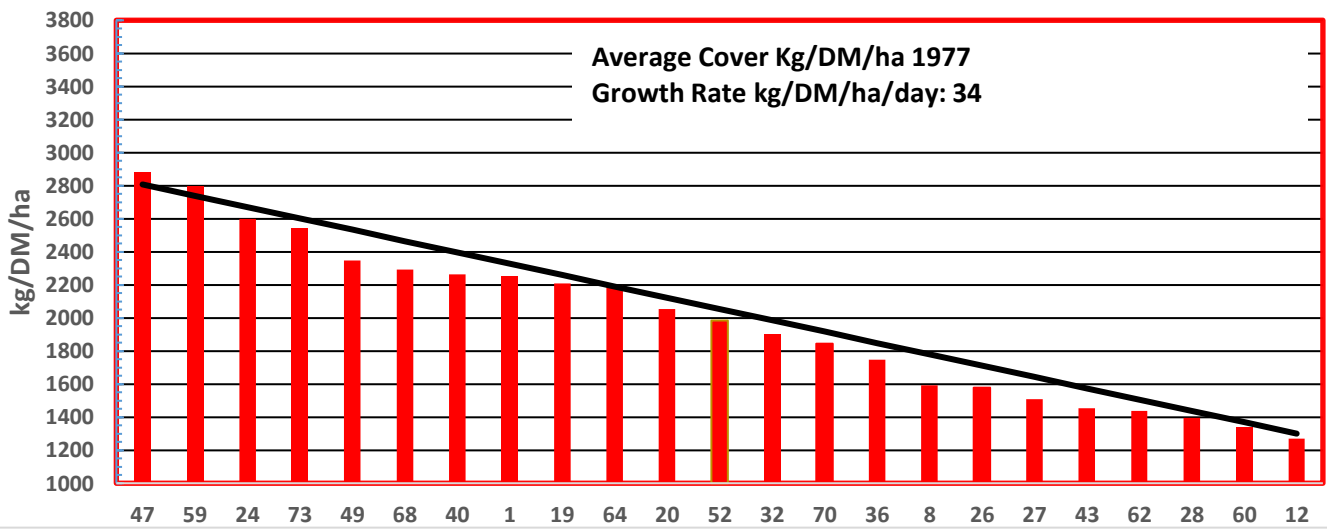
Northland’s Diversified Forages project is funded by Ministry of Primary Industries.

Co-funding support is provided by Hine Rangi Trust, T R Ellett Agricultural Research Trust, Ballance Agri-Nutrients, Northland Dairy Development Trust, Sweetwater Farms, Agricom, Foundation of Arable Research, Clover Consultancy, Eurofins, Northland Seed & Supplies, PGG Wrightson Seeds.

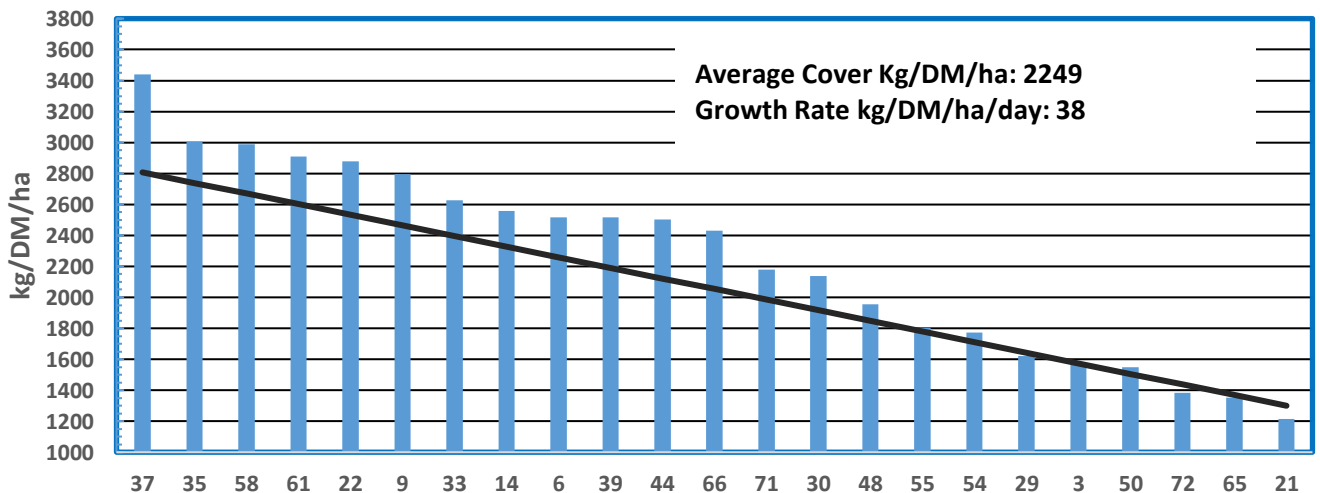
18/6/19 Pasture Only Farm - Feed Wedge



18/6/19 PKE Only Farm - Feed Wedge



18/6/19 PKE Plus Farm - Feed Wedge



Feedback Form

‘Farm Systems for Profit’ Field Day

20th June 2019

Are you a:

Farm Owner		Share Milker/Manager		Farm Staff	
Rural Professional		Tutor/Student		Other	

How did you hear about this event - tick one or more

Email		Text messaging		Website	
DairyNZ staff		Word of mouth		Other	

	No	Slightly	OK	Pretty good	Highly
Was the day beneficial?					

	No	Not really	OK	Pretty good	Yes
Was the day well run?					

	No	Probably not	Maybe	Yes	Definitely
Will you recommend other NDDT days?					

	No	Slightly	Somewhat	Yes	Definitely
Are you motivated to put in place messages from today’s event?					

Things you will change as a result of coming today:

Any comments and recommendations you can make?

Research ideas that NDDT could undertake?

Thanks for coming - NDDT Trustees and NARF Committee