DIVERSIFIED FORAGES: An option to manage risk in Northland

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The 'Northland Diversified Forage Production' project is currently undergoing research into diversified forages in Northland.

Why undertake Northland's Diversified Forage Production project?

This project was designed to

- Create opportunities to improve farm system resilience through incorporating diverse forages to de risk on farm feed supplies
- Measure a range of alternative to ryegrass species in a range of different environments

Technical Summaries are available for the research completed in Year One of the paddock scale and plot trials throughout Northland.

Alternative forages currently being assessed include;

- Fescue & Cocksfoot
- Chicory & Plantain
- Annual legumes

The alternative forages are being measured in all areas of Northland, including Kaitaia, Dargaville, Taipuha, Te Kopuru, Kerikeri.

Results between case studies are varied due to different soil types, management, weather and seasonal conditions, contour and location. Irrigation and dryland conditions are also monitored.

Current research is showing some very positive results for the Diversified forages performance. We would like for the most promising options from the plot trials to be tested through modelling and, ultimately, farmlet trials. Testing their ability to supply additional home-grown feed at a competitive marginal cost.

What we know as Northland Farmers:

- We are acutely aware of the balance between feed supply and animal demand
- Northland weather conditions are challenging. Drought has been declared on multiple occasions and extended intervals between rainfalls are not uncommon
- These weather conditions are unlikely to change
- PKE has become a popular tool to mitigate these conditions and improve productivity
- Kikuyu management has also improved, resulting in productivity gains
- The changes signalled by the FEI has the potential to reverse some of these gains and challenge our current farming practices
- Alternative imported feeds are likely to be more expensive

Diverse forages have the potential to offer:

- High cool season growth rates and yields that can then be conserved as silage
- High warm season growth rates. Growth rates increased substantially with targeted irrigation
- Greater drought tolerance compared with standard species
- Extra ability to out compete kikuyu at critical times
- Additional feed at a marginal cost that could potentially replace PKE

The Diversified Forages project has sought to identify a range of home grown feed solutions for a range of soil types in Northland, allowing us to mitigate the impending changes we face with respect to feeding PKE

How does this project relate to the NDDT trial: Reducing Reliance on Imported Feed?

There are strong similarities between Reducing Reliance on Imported Feed, and Diversified Forages Project. Both are exploring strategies to increase home grown feed on farm, however the Diversified Forages Project can look at options outside of the controlled dynamics of a trial.

Risk Management and Mitigation:

Risk management is the Key focus of both trials. The definition of risk management is the identification of factors that can impact on an outcome, combined with an assessment of the frequency with which the event is likely to occur. We are then able to consider whether to ignore the risk or identify a strategy to eliminate or mitigate those factors.

Each individual business has a different risk profile, that is influenced by different factors- including and not limited to debt level, soil type and facilities.

The Challenge for Northland Farmers:

One of the challenges in Northland is that our soil types can vary from being too wet or too dry or both, and within a short frame of time. Our climatic conditions can challenge the balance between feed supply and animal demand throughout or at any time of the year.

The risk of the occurrence of drought or, extended dry periods needs to be realistically considered. As the frequency increases, the more predictable the occurrence of such an event is likely to be.

If we consider our major business risks to be the impending financial penalty under FEI, or that we are relying too heavily on imported feed, then we can consider options to address this and the underlying contributing factors. However, if summer dry is considered our major risk, then we begin to consider a wider strategy to best match on farm feed supply with animal demand.

If we are going to feed less PKE, then we either need to feed more of something else or be prepared to consider changes to our production systems.

What is the potential solution for Northland Farmers?

The Diversified Forages Project has undertaken a series of activities throughout Northland, with the view to identify forage species that can potentially increase home grown feed supply and therefore reduce reliance on imported feed.

These activities have included plot trials to assess the potential of winter active legumes, paddock scale assessment of mixed species, and yield assessment on farms that have a significant contribution from alternative forage species.

The data we have collected supports the view, that there are forages that can contribute commercially. The background data is contained in Technical reports authored by Gavin Ussher and Karla Frost.

HOW CAN WE INCORPORATE DIVERSIFIED FORAGES AS A STRATEGY FOR RISK MITIGATION ON FARM?

The data to date, indicates the inclusion of diversified forages such as fescue, cocksfoot, Balansa, Persian and Berseem clovers, legumes (Faba Beans), chicory and mixed herbs would give you the potential to grow and harvest a higher yield per hectare, than those who have a high proportion of ryegrass only on farm.

Learnings from diversified forages research year one:

- Irrigated forages grew higher yields than those Non-Irrigated
- Growth rates were typically found to be higher in the diversified forages over the summer dry period than that of ryegrass alone.
- 12-17,000 kg/DM/ha/yr fescue was grown under dryland conditions
- 16-18,000 kg/DM/ha yr fescue was grown under irrigation
- Dryland ryegrass grew 12,000 kg/DM/ha/yr vs irrigated which grew between 15-20,000 kg/DM/ha/yr
- Mixed herb/ chicory in pasture has the potential to grow 17,000 kg/DM/ha/yr in both dryland and irrigation conditions
- Kikuyu struggled with the early summer dry, yet grew well through the winter/spring when the Italians came through, yielding 10-12,000 kg/DM/ha/yr

Detailed research results are available in the Technical Summary Reports published by Gavin Ussher and Karla Frost. The results from year one have allowed the formation of potential strategies. A summary of year one results are found the attached appendix.

Potential strategies identified:

Conserve more silage with the use of diversified forages:

- Pasture Silage is traditionally made if and when we have a spring surplus.
- Diversified forages can be used to generate a higher yielding diversified silage crop.
- A suggested strategy is to ensure that we have a target of 400-500kgDM/cow or 4kgDM/cow/day of silage for 120 days, which is equivalent to 10% of the annual diet for a 500kg cow, producing 400kg/MS/Cow. This is considered an appropriate level of buffer for a resilient farm system. The use of diversified forages to generate silage can help to achieve this due to higher growth rates and yields.
- A diversified forage silage crop can be considered as a component of a summer crop rotation. A significant advantage is that grazing during wet conditions can be avoided.
- To generate a target of 500kgDM/cow, it would be necessary to harvest 10% of the farm area as silage yielding 12tDM/ha.
- This strategy is being considered as it does not require a substitution effect to induce a spring surplus.
- Annual clovers have been measured to produced 14t/ha (April to October inclusive) including Balansa, Persian and Berseem. Detailed results can be found in the Technical Summary. These can be sown in autumn, with grasses or cereal to boost silage yield. However it is unlikely these pastures will respond well to intensive winter grazing.
- Faba bean and oats can similarly yield more than 10tDM/ha from mid April to mid October. It may be difficult to ensile on its own, or without 'mechanical processing' and inoculant. Refer to Technical Summary for further detail.
- Milking fewer cows: NARF as an example, has reduced its stocking rate by 10% on the grass only treatment, with the view to generating a reserve of grass silage, and increasing the available quantity per cow.


Clovers currently being measured and harvested as silage

Irrigation:

- Summer growth rates in irrigated pastures were typically 50kgDM/ha day above non-irrigated pastures. Chicory and sorghum crops under irrigation can double this response without damage from drag hoses. See results from Kerikeri and Kaitaia in Technical summary.
- A reliable irrigation system would require 3500 to 4500 m3 of water or effluent/ha.
- Investing in additional effluent storage capacity allowing for application to summer crops sown late October – early November may also have other benefits.

Dryland and Irrigated Fescue January 2017 Kaitaia

Sow summer tolerant permanent pastures

- The root structure of Tall fescue and Cocksfoot differs from that of ryegrass and kikuyu. These species were found to yield 12-18,000 kg/DM/ha/year in dry land conditions on peat and sandy soils.
- These pastures can produce more feed in dry conditions, and recover more quickly. Although similar total yields were seen in ryegrass pastures, growth rates were measured 10kg + /DM/ha/day higher in the Fescue/Cocksfoot through the summer dry period.
- Include red, white and annual clovers in the mix to suppress weeds, as these grasses may be slower to establish.

Peat 2yr fescue October 16 *June Peat 2 yr fescue Dargaville*

Hybrid Italian ryegrasses with endophyte

- Italian and annual ryegrass grow aggressively in winter and spring. However, they outcompete and suppress kikuyu into early summer. This can exacerbate a deficit triggered by dry conditions in late spring/early summer, as pastures transition back to kikuyu.

- Hybrid cultivars with endophyte have the potential to grow for longer into the season, and if they survive summer, may reduce the amount of kikuyu pasture to be transitioned each autumn

Chicory, Plantain and red clover

- Tolerant of wide range of soil types. (sand, clay, volcanic)
- Very high-quality feed.
- Limited ability to transfer feed
- When established, summer growth rates were superior to ryegrass (+20kgDM/ha /day)
- Efficient use of summer rain, and or irrigation.
- Provides a multi graze alternative to brassicas.
- Chicory can become less palatable in its second year.

Mixed Herb: Taipuha *6th January* *11th June* *2nd October 2017*

Lucerne for dry soils

- Lucerne stands were monitored at 12 and 14 years old
- Aggressively out competing kikuyu
- Can be harvested or grazed in situ (ideally pre-mow to protect crown)
- Will not tolerate wet soils, or block grazing in winter.
- Can produce 12t/ha of high quality, high protein feed.
- Significant contribution to a reliable silage buffer.
- 10% of farm area should generate 500kgDM silage/cow

Monitor pasture cover accurately and frequently

- The diversified forages project has measured and monitored growth rates on over 10 sites across Northland.
- Changes to average pasture covers can be detected 2 – 4 weeks earlier than by eye alone. It has reinforced the value of knowing what has grown, and provides the basis for timely decision making.

The strategies outlined above can be implemented together, or individually, depending on risk profile. For example combined, it would be possible to feed silage (4kgDM/hd/day), and irrigated crop (2-4kgDM/hd/day).

When used in conjunction with summer active pastures, it should be possible to develop feed strategies that are less reliant on imported feed, and provide for a much higher level of insulation from the effect of drought. There are examples of this working on commercial farms across Northland.

Further Questions:

From the previous study conducted at NARF, it was concluded that there was little difference in profitability between ryegrass and well managed kikuyu systems. Given the level of supplement that was used, I think it is valid to ask the question:

'Would the outcome be different if we apply the proposed rules for FEI?'

The impending restrictions would impact on several outcomes, particularly in a dry year. The level of spring production was influenced by PKE use, as were stocking rates. These key factors drive milk solids production.

For the conclusions to remain valid- that there is little difference in profitability between well managed kikuyu and ryegrass, it will be necessary to identify other profitable means by which to fill the respective feed deficits. If we consider this conclusion in the context of risk management and frequency of either summer-autumn drought, or winter-spring wet, we may be required to expand the definition of what constitutes 'well managed'.

The purpose of the NARF current trial is clearly stated: *'reducing reliance on imported feed'*. The advent of FEI further underlines the significance of this purpose, as it is a question of risk management.

John Roche's analysis has generated widespread discussion on the marginal value of milk, and the underestimated costs associated with system change.

It is also fair to state, that if we can determine the marginal value of milk and understand the factors that cause it to vary, we can determine the marginal value of feed, and predict profit. We should be excited by this prospect given that we are in the business of growing feed (as distinct from importing feed), and converting that to milk and into Profit.

What we would like to address is:

Can the marginal value of improved feed quantity and feed quality generated by diverse alternative forages at particular times of the year warrant the additional investment by generating more Profit?

Over the next two years information will continue to be captured. The farms are currently being modelled through Farmax and we anticipate that from modelling the base farm system, we will then be able to generate some 'what if'' scenarios. Then we will be in a position to predict the overall change in performance, and profitability from including diversified forages.

Appendix:

Summary of Northland Diversified Forages Project results Year one:

Table 1: Kaitaia Summary

KAITAIA: Summary of Results 2016- 2017					
	Dates Measured:	**Number of Days Measured**	**Average DM%**	**Total Yield Kg/DM/ ha**	**Average Growth Rate Kg/DM/ha/day**
Irrigated High Density Fescue	28th October 2016 -28th October 2017	365	17	18,993	59
Irrigated Low Density Fescue			18	16,261	52
Dryland Fescue			20	12,012	36
Irrigated Ryegrass Control			16	15,929	51
Irrigated Lush Tetraploid Italian ryegrass			15	21,079	69
Dryland Kikuyu			22	14,164	46

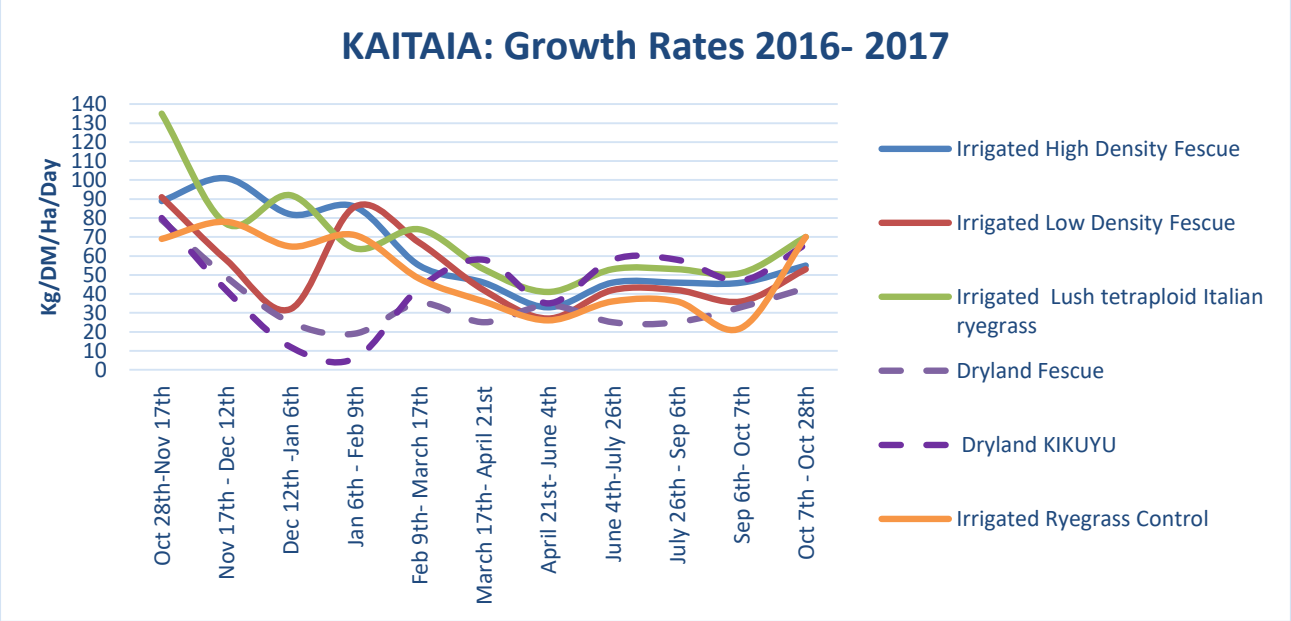

Figure 1: Kaitaia Growth Rates Graph 2016- 2017

Table 1 above summaries the results from Kaitaia which was measuring fescue in dryland and irrigation conditions. Ryegrass, and kikuyu were measured as a control/ comparison. Lush a AR37 Tetraploid Italian ryegrass was also measured.

Key findings from the Kaitaia case study were:

- All species under irrigation grew better than those in dryland conditions. (Due to the summer dry conditions)
- The Lush harvested the highest yield at 21,000 kg/DM/ha
- Irrigated fescue yielded higher than the irrigated ryegrass
- Dryland kikuyu (With Autumn Italians) had a higher harvested yield than the dryland fescue
- ME was constantly found to be lower in the dryland pastures than those under irrigation.

Table 2: Dargaville Summary

DARGAVILLE: Summary of Results 2016- 2017					
Pasture Species	**Dates:**	**Days Measured**	**DM%**	**Yield Kg/DM/ ha**	**Growth Rate Kg/DM/day**
Peat Fescue 2yr +	15th Sep 2016 - 15th Sep 2017	365	16.9	17,027	52
Peat Fescue 1 Yr		365	18.3	13,594	42
Sand Fescue 1 Yr		365	19.5	14,453	43
Sand Fescue 2yr +		365	19.7	15,445	47
Sand Kikuyu	6th Jan 2017- 15th Sep 2017	209	17.9	5,888	31

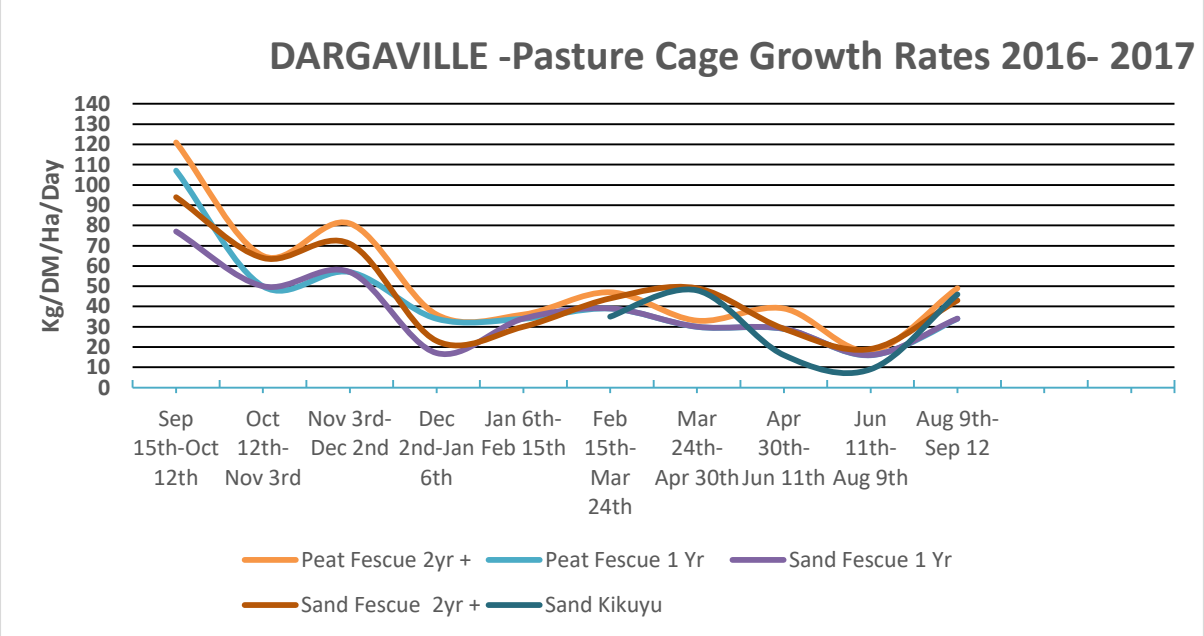

Table 2 above summaries the results from the Dargaville case study, which was measuring fescue in dryland conditions on peat and sandy soils.

Key findings from the Dargaville case study were:

- Total yields for the 365-day period ranged from 13,000 to 17,000 Kg/DM/ha/yr
- 2yr+ fescue on peat soils had the highest yield of 17,027 kg/DM/ha/yr
- Overall the 2yr + old fescue performed better than the 1yr old fescue
- Growth rates for the year period averaged between 31-52 kg/DM/ha/day.

Table 3: Taipuha Summary

TAIPUHA: Summary of Results 2016- 2017					
Pasture Species	**Dates:**	**Days Measured**	**DM%**	**Yield kg/DM/ ha**	**Growth Rate kg/DM/day**
Mixed Herb 1 yr 2015	7th Oct 2016- 7th Oct 2017	365	16	17707	51
Mixed Herb 2yr 2016			16	17311	50
Ryegrass			17	12766	37

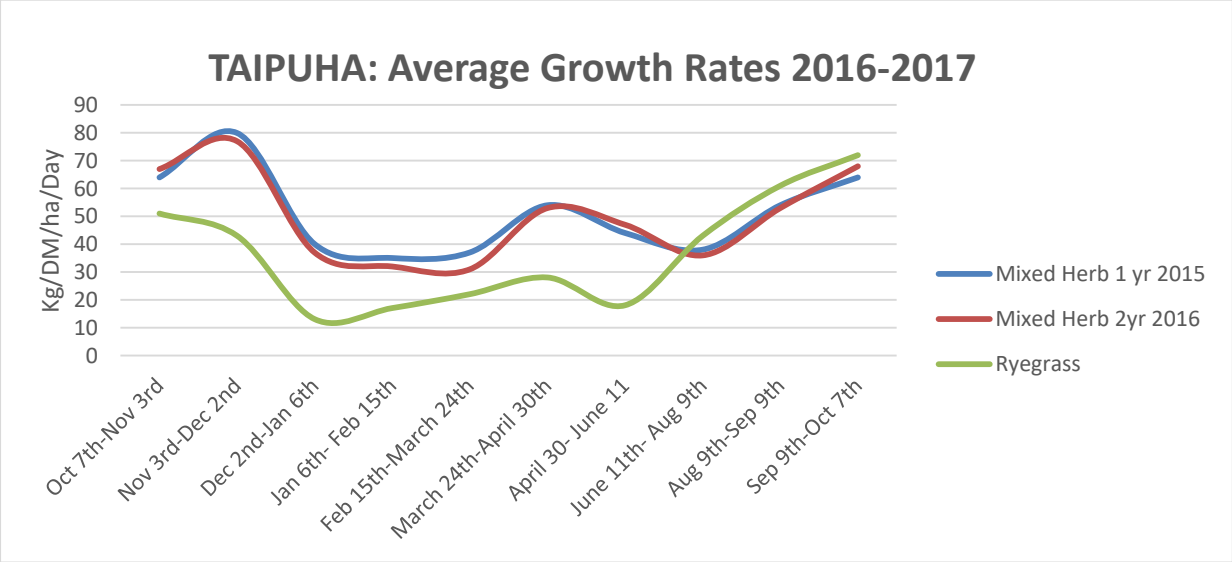

Table 3 above summaries the results from the Taipuha case study, which was measuring mixed herbs in dryland conditions. The mixed herb was made up of 1.5kg Chicory, 1.5kg Plantain, 3kg Red clover, 3kg White clover + One50 Ar27 to make up 25kg.

Key findings from the Taipuha case study were:

- 1yr Mixed herb had the highest yield of 17,707 kg/DM/ha/yr, followed closely by the 2yr old mixed herb with a yield of 17,311 kg/DM/ha/yr
- The ryegrass paddock had the lowest yield of only 12,766 kg/DM/ha/yr.

- Average growth rates for the 1yr old mixed herb and 2yr old mixed herb pastures were 51, and 50 kg/DM/ha/day respectively. While the ryegrass only averaged 37 kg/DM/ha/day
- Ryegrass growth rates were constantly lower than that of the mixed herb Oct-June, however lifted above the mixed herb June-September
- The ryegrass pasture yielded a lot lower than the mixed herb through the summer months, yet grew better during late winter/spring

Table 4: Te Kopuru Summary

TE KOPURU: Growth Data		
	Paddock 71	**Paddock 56**
Year sown	2006	2004
12 month production kg/DM/ha/yr	16,347	11,349
Lucerne (% of harvest)	40	40
Growth per day kg/DM/ha		
Nov-Dec 2016	106	77
Dec 2016/Jan 2017	50	21
Jan/Feb	37	19

Table 4 above summaries the results from the Te Kopuru case study, which was measuring lucerne in a diversified pasture system.

Key findings from the Te Kopuru case study:

- Yields for the season reached 11-16,000 kg/DM/ha/yr
- Highest growth rates were seen in the November- December period reaching 77-106 kg/DM/ha/day
- Lowest growth rates were seen in July, with growth rates as low as 11 kg/DM/ha/day

Table 5: Kerikeri Summary

KERIKERI: Summary of Results 2016-2017					
Pasture Species	**Dates:**	**Days Measured**	**DM%**	**Yield kg/DM/ ha**	**Growth Rate kg/DM/day**
Irrigated Chicory broadcasted into Pasture	**3rd Oct 16 - 3rd Oct 17**	365	17	17,490	54
Irrigated Ryegrass			18	20,332	62
Dryland Kikuyu			21	12,893	35
Dryland Chicory Crop- Drilled	**15th Sep 16- 17th March 17**	183	13	6,412	49
Irrigated Chicory			11	12,504	92

Crop- Drilled					

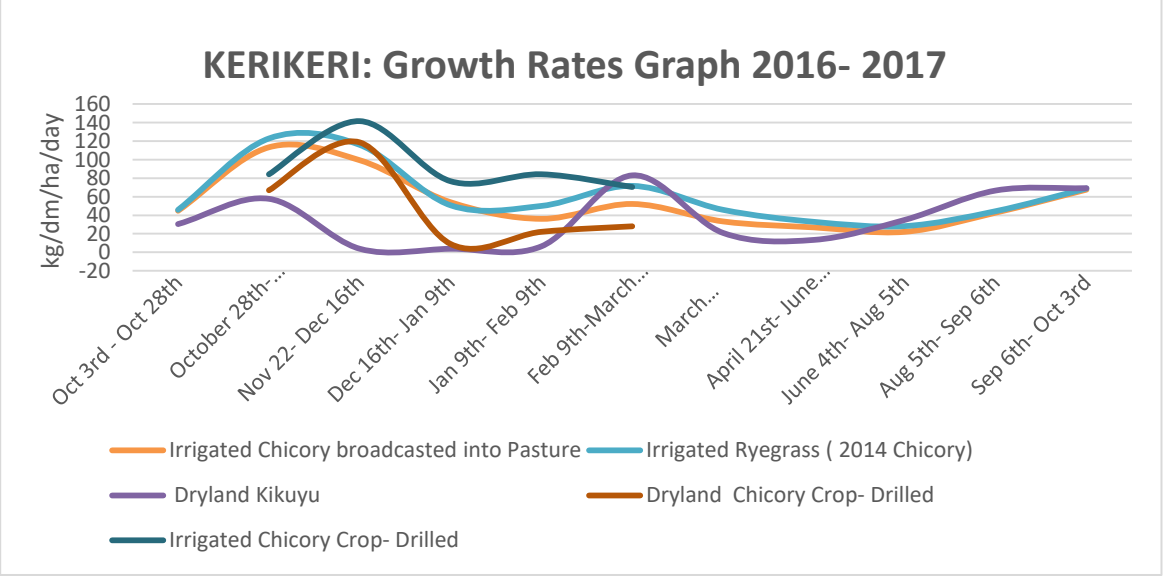

Table 5 above summaries the results from the Kerikeri case study, which was measuring the use of chicory:

Key findings from the Kerikeri case study

- Irrigated ryegrass had the highest yield for the year period
- Irrigated chicory broadcasted into pasture had a 3,000 kg/DM/ha lower yield of 17,470 kg/DM/ha/Yr and an average growth rate of 54.
- The dryland kikuyu had the lowest yield and a higher dry matter of 21%
- The chicory crops were measure from 15th September (Planting) till the 17th of March giving a 183 day period. The irrigated chicory crop had almost double the yield of the dryland crop in this time, with yields of 12,504 and 6,412 respectively.
- Highest growth rates were seen in the irrigated crop chicory during the November Period
- Lowest growth rates were seen in the dryland kikuyu in the summer period Dec-Feb
- Due to the summer weather conditions both the dryland crop chicory and dryland pasture paddocks struggled