Comments on our measured data and statistics :

Data is a scientist's greatest comfort and you can never have enough data, but at some point a commercial reality - and today's need for rapid change - requires a line to be drawn somewhere and to say 'we have enough to start'. Scientific protocols usually require numerous verifications to reach a comfort level. To my knowledge, there's no magic formula for where that comfort line is drawn - it comes down to the personal character of individuals and a willingness to introduce change. Magnify is safe and has been around for 20 years - ample time to show complications or contra-indications. The same can't be said for new products being trialled at present to reduce leaching and nitrous oxide emissions. On top of that, Magnify offers significant financial gains to its farming clients.

A few years ago I read a statement from Dr Ants Roberts (in Ravensdown's newsletter) saying that '… trends in the volume of data collected are more important than the results from a few isolated trials'. I totally agree with this because within a few feet, pastures vary in density, species composition, nutrient history, unseen urine loading, chemical loading - nature is so variable. Replicating trials - for example doing 5 or 7 replicates of the same treatment on the same paddock - goes some way towards reducing the total effect of all the variables. But there will still be situations where the product being tested will give real results, though the statistics may not give 95% confidence levels to the data. For example, the 75 kgUrea/ha responses from our trial sites have shown only one statistically significant response out of 6 sites within the time frame of

measurement - usually 21-28 days! Yet it is widely accepted as always giving results. Magnify at 3 L/ha plus 4 kg of nitrogen has shown 5 out of 6 statistically significant responses. It is for this reason that mathematicians and statisticians are encouraging scientists to think not in terms of absolute proof based on whether the data shows a 95% confidence level in a paired-T test, but rather to look at a series of trial data as a probability continuum. Even data with a $p<0.05$ has a 23-50% chance of rejecting a true null hypothesis (ref : statisticsbyjim.com). Statisticians know that by chance there will be data that doesn't meet the 95% confidence level and data that does - but a product's effectiveness is not represented by either. We are following their wisdom and - **based on a probability continuum, conclude we have reliable, powerful products for reducing nitrogen inputs and increasing pasture / crop growth.**

Our trial sites have been on farms. We haven't had the luxury of fencing off areas for 2 years before starting the trial to negate the influence of urine patches. Farmers stock have sometimes broken onto the first replicates, reducing the numbers down to 4 replicates. In many situations the farmers have chosen the paddocks they want to do trials on. It's often the worst paddocks on the farm where plant growth is poor in spite of fertiliser or Urea applications. In some situations it has gone dry after trial set up. All these factors affect results and the statistical analysis / confidence levels of data collected. This then makes it very difficult to get statistical confidence levels of over 95% all the time. When statistical confidence levels are under 95% it doesn't automatically concur the products under trial haven't produced meaningful responses. Urea would be in deep trouble if it did. But these are the variables that products must face when in the real world. Magnify products have stood up to these challenges better than any others we have tested and far better than we ever imagined possible when we started 20 years ago. In pastural situations they have magnified (enhanced) the response from 4 kgN to growing more than 40 kg nitrogen 85% of the time.

Different grass species may respond differently to different products. There's the biological and nutrient status of the soil, moisture content, temperature which can alter significantly depending on the fertiliser / lime history. Then the kind of soil, organic matter level, compaction, grazing pattern, drainage etc needs to be considered. All these variables affect the response consistency and intensity from all fertilisers, including liquid fertilisers. Urea also gives quite variable responses from 5-20 kg dry matter for every kilo of nitrogen applied (source DairyNZ) and we've even measured negative responses from Urea, sometimes under reasonable growing conditions. Magnify's products are subject to the same multitude of interconnected variables however our studies have revealed that they are more effective than the vast array of products we have tested against under adverse weather conditions.

To comply with the NZ Privacy Act we have not included property names except where we have permission to do so. The pictures do not always correspond to the trials on the page. They are there to break up the monotony of data. Most are from our collection of results or clients' stock.

FIELD TRIALS 2022 : MAGNI-GROW - Fernside, Rangiora

Goal

For the last 100 years NZ agriculture has focused on increasing grass growth beyond natural unfertilised levels. Fertiliser has been used to do that and increase clover production but there is growing pressure to remove or reduce fertiliser. Can Magnify's biostimulants increase the growth on poor-quality stoney riverbed soils that have not been fertilised for over 40 years and are what we might call 'native soils'?

Set Up

6 sprayed areas in diagonal shape across paddock. This is regrowth data since the last grazing in mid July. The inital growth advantage was 400-1200 kg/ha in 5 weeks, depending on dryness of areas measured. The pastures were sown in October 2021 and received an initial application of Magni-Life and Magni-Grow. Red clover had been sown 6 years earlier but not in 2021. It was very dry in Autumn and we were surprised to see as much growth as we did. The neighbour's property was also treated and 1 circle area missed. They are irrigated although it was also dry on their moisture index. They are similiar soils but 9 year old pastures. We got 9 weeks growth before grazing started on neighbours and 5 weeks on Magnify block. The neighbours' was grazed almost constantly until 4 weeks ago. Magnify NZ paddocks were shut up in mid July.

RESULTS

Samples	Control	Magnify 2 L/ha Magni-Life + Cropzest
Growth from 21 March to 18 April	1140 kgDM/ha	1689 kgDM/ha + 548 kgDM/ha + 44% P<0.0001
Regrowth from mid July to 22 Nov 2022	1570 kgDM/ha	2798 kgDM/ha + 1229 kgDM/ha + 40% P<0.0002

SUMMARY

Magni-Grow : in spite of dry weather in the initial 8 weeks (which created a large range in the growth advantages from 60-1200 kg/ha on the stoney dryland blocks), Magni-Grow grew an extra 500 kgDM/ha over 28 days prior to grazing. The irrigated land (although it still showed below-optimum soil moisture) gave an average of 700 kg extra (626 to 808 kgDM) within 28 days and that extended to 900 kg over 58 days prior to grazing. The combined data was an extra 548 kgDM/ha with 10 data points from the dryland and 3 from irrigated. There was little difference in confidence levels for combined or separated data.

Regrowth was significantly better on all areas and the variation smaller (718 -1457 kgDM/ha over 121 days on dryland and 365-949 kgDM/ha over 28 days on irrigated) presumably due to better overall moisture levels over Spring.

Red clover and white clover are noticeably stronger in most treated areas.

FIELD TRIALS 2021 : MAGNI-GROW vs TURBO N - Oxford

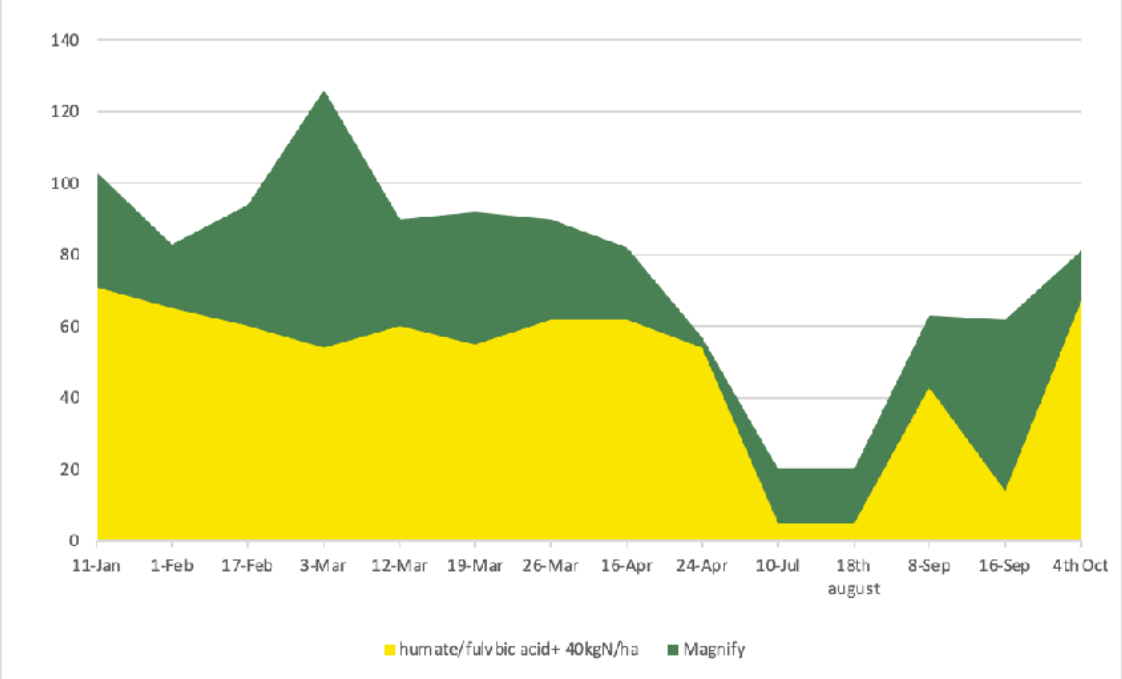
Goal

A farmer established a field comparison of Magnify vs Turbo N - a liquid mix of humates + fulvic acid + minerals + 20 kgN/ha. The farmer had been applying 4-5 applications of Turbo N / season and they had reduced nitrogen use from 300 kgN/ha to 190 kgN/ha. These lighter soils have Olsen P of 14. They received 450 kg/ha of Potash Super in 2 applications over the growing season. Plus ½ ton of lime in May 2021.

Set Up

A dairy farmer was using Turbo N for 2 years 4-5 times per season. On 24 Nov 2020 and March 2022 he replaced the 3rd and 4th Turbo N application with 7 L Magni-Grow and 2 L/ha Magni-Life. Turbo N contained 20 kgN/ha with each application and was applied at 150 L/ha. We started measuring at the end of January after seeing the grazing residuals on the Magnify side were going as low as 900 kg/ha on one paddock and 1200 on the other 2. Residuals on the Turbo N ranged from 1500-1700 kg/ha. We took measurements on the above dates and calculated the daily average growth for treated and untreated paddocks. All paddocks got Turbo N in late April. So the Magnify paddocks had 40 kg less nitrogen than the rest of the farm.

RESULTS



SUMMARY

From the time data was collected - which was 2 months after application - Magnify-treated paddocks were growing 20-72 kg/day more than untreated paddocks in spite of receiving 40 kg less nitrogen from December 2020 to April 2021. Through the Winter months Magnify-treated paddocks grew 15 kgDM/ha vs 5 kgDM/ha and rebounded faster the following Spring.

Similar increases of over 20 kgDM/day were measured on another farm 15 km away from this and on J Tanners' in Leeston.

FIELD TRIALS 2002 : FIRST GRASS TRIAL AGAINST 60 & 100 KG UREA - Lincoln

Farm Brief

Cropping farm on good parent soil but with moderate structure. Two year old pasture. Was to be cut for balage. Good, ideal growing conditions.

Goal

This was our very first trial on pasture growth against Urea. Back then most people were applying 60 kg of N per dairy round. We also added 100 kgUrea/ha for an upper limit. Growth conditions were almost perfect by chance. New pasture on moderate fertility cropping farm with irrigation in Spring.

Set Up

Set up with 5 replicates, each 3 m long by 1 m wide. However on the day of cutting the Urea looked 2 inches taller and I said 'I might as well see how far behind the Magnify products were', so - to save time - I cut all five replicates into one catcher. After measuring fresh weights I kicked myself. I still dried samples and calculated dry matters but couldn't do statistical analysis.

RESULTS

0-8 weeks	MAGNIFY PASTURE GROW 3 L/ha	MAGNIFY PASTURE GROW 3 L/ha + 4 kgN/ha	UREA 60 kg/ha 27 kgN/ha	UREA 100 kg/ha 46 kgN/ha
Extra drymatter per hectare after 8 weeks	1152 kgDM/ha + 11%	2508 kgDM/ha + 24%	379 kgDM/ha + 4%	947 kgDM/ha + 9%

SUMMARY

Under ideal sunny conditions the first Magnify products showed great potential as a Urea replacement.

FIELD TRIALS 2003 : SECOND GRASS TRIAL AGAINST UREA - Christchurch

Farm Brief

A farmer leased block by Sunnyside in Christchurch. Low fertility and un-irrigated. Plot went brown for months after second cut so abandoned the trial.

Goal

To see if nitrogen efficiency could be increased from solid Urea by alternating Magnify's Pasture Grow + 4 kgN.

Set Up

Replicated with 5 replicates, each 3m long by 1m wide. Mown and dried. Treatments were applied on 6 October and again on 5 November. One group had one of each treatment, ie Magnify in October and Urea in November.

RESULTS

	Control (a)	MAGNIFY PASTURE GROW 3 L/ha + 4 kgN/ha twice (b)	MAGNIFY PASTURE GROW 3 L/ha + 4 kgN/ha then 80 kg Urea/ha (c)	UREA 80 kg/ha twice (d)
November cut 0-4 weeks	1056 kgDM	1136 kg + 80.5 kg p<0.45	1206 kg + 150 kg p<0.04	1116 kg + 60 kg p<0.375
December cut 4-8 weeks	589 kgDM/day	646 kg + 57 kg p<0.15	796 kg + 207 kg p<0.0049	703 kg + 114 kg p<0.0556
0-8 weeks	1646 kg **abd**	1783 kg + 137 kg p<0.33 **abd**	2003 kg + 357 kg p<0.014 **c**	1819 kg + 174 kg p<0.11 **abd**

SUMMARY

The dry conditions affected growth throughout the trial until it destroyed it. Over 8 weeks there was no statistical difference in growth between 2 applications of 80 kg Urea and 2 applications of Pasture Grow + 4 kgN (p>0.8 of there being a 37 kg difference). The combination of Magnify in the first round and Urea in the second produced the greatest response and was statistically ahead of all the others. This trial also showed that Urea response is not a given.

FIELD TRIALS 2009 : AGAINST UREA - COMBINATION EFFECT - Geraldine

Farm Brief

Farmer - Ken Pierce - runs a 160 ha mixed cropping farm with good soils, irrigation and moderate fertility near Geraldine. He has 50 years' experience on the property. Farm already had 2 years of Magnify products.

Goal

Farmer set up 1/3 paddock trial to compare pasture growth with Magnify's third upgrade (CM3) against the 2nd upgrade (Pasture Plus v2) and Urea.

Set Up

A half paddock was done with 80 kgUrea/ha one week prior to spraying and the remainder split in two for Magnify products. It's a 5 ha paddock. A true test machine was calibrated with mown areas and was within 20 kgDM/ha accuracy. 80-120 samples/plot. Measurements are within the grazing round. When we got a negative reading for Urea, we re-measured 3 times to check for consistency before accepting the reading plus a visual assessment. After 5 weeks another application of Urea was applied across all treatments. Paddock was grazed 2 weeks after first application and again after first 5 weeks measurement. The growth conditions were hot and drier than ideal, which is why the farmer put a second Urea application across the whole paddock.

RESULTS

Competitive Product	MAGNIFY PASTURE GROW 3 L/ha + 4 kgN/ha (kgDM/ha)	MAGNIFY CM3 7 L/ha + 4 kgN/ha (kgDM/ha)	Urea 80 kg/ha (kgDM/ha)
0-5 weeks	+ 300 drier end + 300 wetter end	+ 440 drier end + 700 wetter end	200 200
5-9 weeks after Urea application	+ 276 drier end + 574 wetter end	+ 452 drier end + 1279 wetter end	- 400 - 400
0-9 weeks after 2 grazings	+ 576 drier end + 874 wetter end	+ 892 drier end + 1974 wetter end	- 200 - 200

SUMMARY

Subjected to the farmers normal cattle grazing management and rotation, Magnify's CM3 showed superior performance to the original Pasture Plus formula and the advantage was accentuated by better moisture conditions at the far end of the paddock. CM3's large advantage over the previous formula was consistent with other trials being conducted in Southland and North Canterbury.

Both Magnify options showed good overall growth against Urea in spite of being applied one week later when heat was reducing natural growth. Interestingly Urea started well, growing an extra 400 kgDM in the first 2 weeks however it went backwards after the first grazing. The pastures started to visually open up, ie get less dense. The second application of Urea grew tall grass but again the density got worse after grazing. Re-measuring several times didn't change the outcome. So we have presented exactly what happened against the control.

FIELD TRIALS 2007 : PASTURE PLUS VERSION 2 - Fernside, North Canterbury

Farm Brief

Many farmers might apply one application of Urea to boost silage paddocks per year. These paddocks were low fertility native or poor species. Dry land. Sometimes when fertiliser is applied the expected rain doesn't happen. Liquid nitrogen can volatilise giving solid N an advantage because it's usually applied in greater amounts.

Goal

To see if we had made an improvement to the original product and take the opportunity to compare against 80 kg Urea on low fertility native pastures - Browntop, Sorrel, Sweet Vernal, Subclover. Both Magnify products contained 3 litres of Magnify and 4 kg liquid Nitrogen from Urea.

Set Up

Five replicates with Pasture Plus (4 kgN/ha), Pasture Plus Version 2 (4 kgN/ha) and 80 kgUrea/ha. Mown and samples dried. Was set up 26 February 2007. Measured for first time 11 November 2007. There was no rain from February until July so we let the trial go into Spring to see what would happen over time. It took until November to get enough grass to cut.

RESULTS

Samples	Control	Magnify Pasture Plus	Magnify Pasture Plus Version 2	Urea 80 kg/ha
February to November	0 kgDM/ha	+ 150 kgDM/ha + 5% P<0.55	+ 284 kgDM/ha + 10% P<0.05	- 38 kgDM/ha - 3% P<0.85

SUMMARY

The only significant result over the control was Magnify Pasture Plus Version 2 after 8.5 months of waiting for enough growth to cut.

The statistical difference between Urea and Pasture Plus Version 2 was P<0.24.

FIELD TRIALS 2005 : LONGER TERM EFFECTS - Johns Road, Christchurch

Farm Brief

Dryland soil around Johns Road, Christchurch. These had been lifestyle properties. Soil tests unavailable.

Goal

To investigate the affects over a longer time period say, for example, a sheep farm with a single silage cut. Liquid fert traditionally had short term effects. Could this be different?

Set Up

15 September : 5 replicates. Mown and samples dried. 10 small samples from each replicate for drying purposes. It snowed 3 days after setup. 7 plots got wrecked by stock, at one end of trial, for the December cut.

RESULTS

First cut 0-40days 21 Oct 2005	Magnify Pasture Grow 2 L/ha + 1 L Microlife	Magnify Pasture Grow 4.5 L/ha	Magnify Pasture Grow 3 L/ha + 4 kgN/ha	Urea 80 kg/ha 36 kgN/ha
CONTROL	+ 505 kg p<0.02	+ 534 kg p<0.01	+ 858 kg p<0.05	+ 109 kg p<0.74
Magnify Pasture Grow 2 L/ha + 1 L Microlife		+ 29 kg p<0.63	+ 353 kg p<0.35	- 395 kg p<0.16
Magnify Pasture Grow 4.5 L/ha			+ 323 kg p<0.36	- 424 kg p<0.20
Magnify Pasture Grow 3 L/ha + 4 kgN/ha				- 748 p<0.11

2nd cut 40-105 days 28 Dec 2005	Magnify Pasture Grow 2 L/ha + 1 L Microlife	Magnify Pasture Grow 4.5 L/ha	Magnify Pasture Grow 3 L/ha + 4 kgN/ha	Urea 80 kg/ha 36 kgN/ha
CONTROL	+ 505 kg p<0.02	+ 534 kg p<0.01	+ 858 kg p<0.05	+ 109 kg p<0.74
Magnify Pasture Grow 2 L/ha + 1 L Microlife		+ 29 kg p<0.63	+ 353 kg p<0.35	- 395 kg p<0.16
Magnify Pasture Grow 4.5 L/ha			+ 323 kg p<0.36	- 424 kg p<0.20
Magnify Pasture Grow 3 L/ha + 4 kgN/ha				- 748 p<0.11

TOTAL 0-196 days 28 Mar 2006	Magnify Pasture Grow 2 L/ha + 1 L Microlife	Magnify Pasture Grow 4.5 L/ha	Magnify Pasture Grow 3 L/ha + 4 kgN/ha	Urea 80 kg/ha 36 kgN/ha
CONTROL	+ 505 kg p<0.02	+ 534 kg p<0.01	+ 858 kg p<0.05	+ 109 kg p<0.74
Magnify Pasture Grow 2 L/ha + 1 L Microlife		+ 29 kg p<0.63	+ 353 kg p<0.35	- 395 kg p<0.16
Magnify Pasture Grow 4.5 L/ha				- 424 kg p<0.20
Magnify Pasture Grow 3 L/ha + 4 kgN/ha				- 748 p<0.11

HERBAGE TESTS

A herbage test was taken from control and Pasture Plus at the final cut. The main differences that stood out were the nitrogen content in the Magnify + 4 kgN plot was 2.6% vs 3.1% for the control - and the soluble sugars 2.2 versus 1.8 for the control. Less nitrogen had not restricted growth.

SUMMARY

All 3 Magnify options showed statistically significant growth advantages over the control after 196 days and all three continued to grow extra dry matter after a dry period. Growth gains were continuing when we lost the trial site.

80 kg Urea made an initial growth burst (although not statistically significant) then went backwards as it dried out and - even when it rained again some months later - it went backwards further, resulting in no statistically significant growth over the control.

At 0-15 weeks only the Magnify + 4 kgN was showing statistically significant growth over the control, however the other 2 Magnify options without added N were getting close to the 90% confidence level or better. We only had 3 replicates for the control, Pasture Grow + Microlife and 4 replicates for the remaining options due to stock break-in on trial site. So much harder to get valid P test data with less replicates.

Trial was closed in late March as the land was required again for development.

FIELD TRIALS 2003 : MAGNIFY PASTURE PLUS vs 75 KG UREA - Mid Canterbury

Farm Brief

Dryland sheep and beef farm with history of 100 wt/acre super phosphate every 3 years. Olsen P was 14 and pH 7.4.

Goal

We expected Urea to perform very well short term on this property and we were curious to see how our first product at 3 L/ha with 4 kgN/ha would perform.

Set Up

16 November : 5 replicates. Mown and samples dried. 10 small samples from each replicate for drying purposes.

RESULTS

First cut 0-32 days 12 Dec 2002	MAGNIFY PASTURE GROW 3 L/ha + 4 kgN/ha	UREA 75 kg/ha 34 kgN/ha
Control	+ 49 kg p<0.04	+ 71 kg p<0.0003
Magnify Pasture Grow 3 L/ha + 4 kgN/ha		22 kg p<0.16

Totals 16 Nov 2002 to 26 Mar 2003	MAGNIFY PASTURE GROW 3 L/ha + 4 kgN/ha	UREA 75 kg/ha 34 kgN/ha
Control	+ 34 kg p<0.56	+ 57 kg p<0.17
Magnify Pasture Grow 3 L/ha + 4 kgN/ha		23 kg p<0.55

SUMMARY

There was early growth with both treatments giving small gains over the control (greater than 95% confidence), but no confidence in differences between treatments. After 1 month the dry conditions saw no further gains between any treatments or the control. Trial was closed in late March as it was still dry.

FIELD TRIALS 2007 : AGAINST OTHER LIQUID FERTILISERS - Maruia & Canterbury

Farm Brief

Spray contractor set up when spraying liquid fertiliser for the farmers. Although not particularly scientific, they do represent what farmers consider trials in their reality. Every bit of data adds to the probability continuum, plus it's independently set up.

Goal

To test what products were growing the most for the contractors knowledge.

Set Up

Set up by independent spray contractor - Liquid Fert Ltd. A true test machine that we have found reliable for comparison purposes was used to measure these trials. 80-120 sample average/plot. Measurements are within the grazing round.

RESULTS

Competitive product	Time from application to measuring (in weeks)	Competitor product growth	MAGNIFY PASTURE GROW 3 L/ha + 4 kgN/ha	Details
Clovertone	6	+ 544 kgDM	+ 877 kgDM	3 paddocks - 2 with control. 3 x 10m strips mown and weighed.
Reaction high analysis seaweed base	4	- 120 kgDM - 4 kg/day - 8%	+ 360 kgDM + 12 kg/day + 7%	Went on bone dry grass. Ungrazed. Measured 10 days after rain. True test measuring device.
Reaction high analysis seaweed base	4	+107 kgDM + 9%	+ 134 kgDM + 11.5%	Went on bone dry grass. Magnify grazed 4 cm lower than control or seaweed. This is regrowth 10 days after rain.
Reaction high analysis seaweed base	3	63 kgDM/day	+ 483 kg 86 kgDM/day + 36%	2 paddock average.
20 L fish Biomarinus + 40 L liquid Urea	3	54 kgDM/day + 136 kg + 12%	67 kgDM/day 420 kg + 42%	2 paddock average. Dairy farm in Selwyn district.
Reaction high analysis seaweed base	4		+ 350 kg and + 554 kg	Two half paddocks. No separate control.
Biobrew 2011	4	- 250 kgDM No sun	+ 250 kg (no sun) + 400 kg (half sun) + 800 kg (full sun)	Good soil. Biobrew applied in shade of trees which we've called 'no sun'. Some areas were partly in sun and some in full sun. Obvious growth differences.
Biobrew	4	0	+ 400 kg DM	

SUMMARY

Magnify's original Pasture Grow formula @ 3 L/ha + 4 kgN gave consistently strong responses and was ahead of what might be categorised as 'competitors products' 100% of the time - by a large margin.

FIELD TRIALS 2007 : AGAINST NITROGEN - Maruia, West Coast

Farm Brief Independently set up. Multiple dairy farms with standard fertiliser applications.

Goal To begin field testing in real conditions against typical farm Urea rates.

Set Up Set up by independent spray contractor - Liquid Fert Ltd. Spray contractor (liquid fertiliser spreading) set up with farmer applying Urea to half paddock. Farms had Urea following the cows except 3-6 paddocks per farm were treated with 3 L/ha Magnify's original formula + 17 kg liquid Urea delivering 4 kgN/ha. Every bit of data adds to the probability continuum. A true test machine that we have found reliable for comparison purposes was used to measure these trials. 80-120 sample average/area. Measurements are within the grazing round. Urea was the control. Daily growth calculated from a 1500 kg grazing residual assumption.

RESULTS

	Time from application to measuring in weeks	Magnify original 3 L/ha + 4 kgN	Urea 70-80 kg/ha	Details
Farm 1	5	38 kgDM/day + 17% + 595 kgDM	21 kgDM/day	Heavy waterlogged soil. Dry for 3 weeks then 6 inches rain.
Farm 2	3	60 kgDM/day + 3%	57 kgDM/day	Against 120 kg ammonium sulphate.
	10 days post grazing	70 kgDM/day + 30%	40 kgDM/day	Against ammonium sulphate. Grazed 11 days after application due to a lack of feed. This was regrowth.
Farm 3	3	60 kgDM/day + 20% + 210 kgDM	50 kgDM/day	
Farm 4	3	30 kgDM/day + 50% + 210 kgDM	20 kgDM/day	Poor paddocks. Lime applied over treatment.
Farm 5	3	18 kgDM/day + 80% + 168 kgDM	10 kgDM/day	Very poor paddock in spite of Urea use.

	Time from applica-tion to measur-ing in weeks	Magnify original 3 L/ha + 4 kgN	Urea 70-80 kg/ha	Details
Farm 6	4	47 kgDM/day + 247 % + 588 kgDM	19 kgDM/day	
Farm 7 sheep farm	3	10 kgDM/day	13.6 kgDM/day + 3.6 kg + 75 kgDM	Paddock was new grass but cropped for 2 years without fertiliser. Worst paddock on the farm. Farmer said after 6 months Magnify was a long way ahead.
	3	60 kgDM/day + 25 kg + 525 kgDM	35 kgDM/day	Same farm as above but an average paddock.
Farm 8	4	37 kgDM/day	19 kgDM/day	Against 100 kg Urea.
Farm 9	10 days	37 kgDM/day + 370 kgDM/ha	15 kgDM/day + 147 kgDM/ha	Paddock cut for silage. We measured regrowth after 10 days. Lawn mower used.
Average growth across 8 different farms		42 kgDM/day + 14 kgDM/day +50% p<0.002	28 kgDM/day	

SUMMARY

Magnify's original Pasture Grow formula @ 3 L/ha + 4 kgN gave consistently stronger responses than Urea 70-80 kg/ha (32-37 kgN/ha) across 9 different farms.

Measuring in the field is never perfect with regard to timing as farmers make decisions that they don't start off saying they will do, eg cutting for silage. The general trend is most important and the consistency of the positive responses.

Some of the older scientists I know have had discussions in the past with well-experienced older Ruakura scientists over grass trial replication. They have said that half paddock trials repeated in an area with similar soils would meet the criteria for a replicated trial. These farms above would fall into that bracket.

FIELD TRIALS 2008 : AGAINST BIO MARINUS and VITALIFE - Maruia

Farm Brief

A Maruia dairy farm using NZ fertilisers on an area against Magnify on another area.

Goal

Independent contractor wanted to see what was better. He also compared United Fisheries' Bio Marinus.

Set Up

Spray contractor split 6 paddocks on a river terrace into 3 and sprayed Bio Marinus, VitaLife and Pasture Plus (Magnify's original product) at 3 L/ha plus 4 kgN/ha). All had 4 kgN/ha. 21 days later we measured using true test machine : 80-120 samples each the length of the paddock. There were no untreated areas as a control. Total growth was measured. Growth was very poor due to dry conditions.

RESULTS

0-21 days	Magnify original 3 L/ha + 4 kgN (a)	United Fisheries Bio Marinus (b)	VitaLife (c)
1	221	171	82
2	143	140	202
3	371	122	217
4	505	369	426
5	576	22	436
6	501	311	313
Average	386 **a**	189 **bc**	279 **bc**

SUMMARY

Magnify's first products were statistically greater than both VitaLife and United Fisheries' Bio Marinus ($P<0.05$ and $P<0.03$ respectively). The percentage gain was 100% and 38% over Bio Marinus and VitaLife respectively.

Natural growth had been very poor for the 21 days. Our best guess is the grazing residuals were around 1000 kg/ha at the start.

FIELD TRIALS 2005 : MIXED WITH LIME PELLETS - Fernside, Rangiora

Farm Brief

Pastures 40 years old, mostly browntop and sweet vernal, subclover. No fertiliser history for 35 years. Very stoney shallow riverbed soils. Olsen P 14.

Goal

To see if adding Pasture Grow at 3 L/ha to lime flour pellets would add value.

Set Up

2 x 0.5 ha treated with 300 kg/ha of lime pellets with and without 3 L/ha Pasture Grow added. Four strips 16 m long x 1 m apart mown and weighed. Assumed same dry matter percentage. Soil test values were pH 5.5, OlsenP 31, ResinP 31, sulphate-S 1 mg/kg, Organic Sulphur 7 mg/kg. Base saturation Ca 44%, Mg 9.4%, K 4.8%, Na 1.3%.

RESULTS

Final cut 0-84 days November 2006	Lime pellets	Lime pellets + Pasture Grow 3 L/ha
	4639 kg	5332 kg + 693 kg/ha freshweight or + 15% + 241 kgDM/ha P<0.0969

SUMMARY

In spite of very poor growing conditions on poor pastures, a 13 cents/kg response was obtained, albeit with weak statistical significance.

Another cut with a 432 kg FW advantage would have created a p<0.035. So our decision to cut 4 instead of 5 strips was short sighted.

FIELD TRIALS 2007 : AGAINST 75 KG UREA - Southland

Farm Brief

Independently set up dairy farm conversion 2 years prior. Typically applied 2 applications per year of 75 kgUrea/ha.

Goal

To begin field testing in real conditions against typical farm Urea rates with farm grazing patterns.

Set Up

Spray contractor and farmer applied Urea to half paddock (over 8 paddocks) all with same soil and grass species. 3 L/ha Magnify's original formula + 17 kg liquid Urea, delivering 4 kgN/ha, was applied to the other half. Grazing occurred as usual so some paddocks were grazed 10 days after treatment and we measured regrowth of 20 days. Some were grazed after 20 days and the farmer measured regrowth with a plate meter 29 days later. 3 x 10m strips were mown and samples coded by others for drying. Urea was the control.

RESULTS

	Magnify original 3 L/ha + 4 kgN	Urea 70-80 kg/ha
Growth to 17 April :		
Pdk 2 mown	341 kgDM	256 kgDM
Pdk 3 mown	553 kgDM	501 kgDM
Pdk 4 mown	646 kgDM	557 kgDM
Averages	513 kgDM + 75 p<0.02	438 kgDM
Regrowth from 17 April to 5 May using a plate meter done by farmer		
Pdk 4	816 kgDM	880 kgDM
Pdk 5	628 kgDM	740 kgDM
Pdk 6	404 kgDM	516 kgDM
Pdk 7	432 kgDM	320 kgDM
Averages	609 kgDM + 39 p<0.50	570 kgDM

SUMMARY

The average growth of Magnify's first pasture stimulant + 4 kgN/ha was ahead of 75 kgUrea/ha for paddocks grazed after 10 days and given 20 days regrowth.

The regrowth in 3 out of 4 paddocks was higher and across those 3 paddocks the average difference of 89 kg/ha carried a $p<0.02$.

I think we could safely conclude that the overall results were strongly in favour of an advantage to Magnify + 4 kgN/ha over 34 kgN/ha and it didn't run out of steam due to a lack of nitrogen being applied.

HERBAGE TESTS

One of the assistants noticed the Magnify grass was warmer to handle than the Urea grass. A herbage test showed a difference in ME levels : 11.4 vs 9.7 MJME/kg for Magnify and Urea respectively.

SOIL TEMPS

Soil temperatures were taken on 5 May across all 14 treatment areas and supplied to us. Magnify-treated areas averaged 12.5 degrees C vs 11.4 degrees C for Urea areas (difference of 1.1 degrees or 9.6% $P>0.0001$). This is expected after Magnify treatment and is a most common observation over many years.

FIELD TRIALS 2014 : THROUGHOUT DROUGHT - Cheviot

Farm Brief

Dr John Field-Dodgson - a semi-retired agronomist who has headed up the science divisions of horticultural organisations both in NZ and Australia - did some large cage trials in North Canterbury through the worst droughts in history in that region. Some areas that normally get 40 inches of rain got 4 inches for the year. The farmers did not want John on the property during lambing, which meant the best conditions for growth were not able to be well recorded or utilised as treatment went on the ground when dry conditions were already affecting response rates and growth. The drought persisted for 2 years and sometimes we had to wait 12 months to get enough grass to measure.

Goal

To see if applying Magni-Life and a former Magnify product called Terrazone (which is now incorporated into Magni-Grow) would improve pasture growth on hill country blocks. There were no nutrients in these products. Farm 1 (in Cheviot) had a good history of fertiliser and Farm 2 (in Omihi) was unknown. Farm 2 was 45 km away from Farm 1 and the soil was much drier overall.

Set Up

The control was simply an untreated area. There were 4 cages on one property across 2 paddocks. Cages were made out of reinforcing steel mesh. They were 2.4 m x 2.4 m. This allowed for a big enough area to get 27 measurements using a true test machine - enough for a reliable average. After each measurement the cage was moved to freshly grazed pasture. Cages occasionally got knocked over creating zero measurements, which reduced total growth figures and advantages. Product was applied in a 28 metre line through the paddock with 2 rosette nozzles by Liquid Fertilisers Ltd.

RESULTS

	FARM 1 : TOP BLOCK better fertility / two paddock	FARM 2 : LOWER BLOCK 1 paddock only
Untreated growth	1171 kgDM	890 kg
Treated per application	1720 kgDM + 548 kg + 46% p<0.01	1298 kgDM + 408 kg + 45% p<0.005
Moisture 5.5 / 10 separated by pdk *** missing 1 measurement	+ 2148 kg/ha + 49.5% and + 1404 kg/ha *** + 40%	+ 978 kgDM
Moisture 2/10 separated by pdk * the control was ahead for one reading	+ 953 kgDM pdk 1 + 23% and 146 kgDM pdk 2 * + 3%	+ 408 kgDM + 45%

All data is on pages 50-52

SUMMARY

Several things came out of this data provided by Dr Field-Dodgson :

The main message was that overall combined data for each farm showed Magnify produced significant gains on both farms and under 3 different situations.

When conditions were poor for growth the overall dry matter gained was naturally less, so percentage gains are perhaps a better appraisal method. The percentage gains were very large in spite of missing measurements from cages being knocked over, the weather patterns and the fact we had to apply late in Spring when conditions were already well below optimum moisture levels.

The data suggests that significantly better results may have been obtained if Magnify could have been applied earlier in Spring when growing conditions were more favourable.

There was a 4th area sprayed in unimproved pasture on top of a hill at 300 m elevation on Farm 2. It showed gains of 628 (18.5%) and 477 kg (+22%) from individual applications, however there were several missing data points from this area so we chose to not include it in the above appraisal. It didn't enhance or detract from the main message of the study.

Moisture differences between paddocks over time created large changes in the growth rates and the kilograms of extra dry matter grown between measurements reflected this.

The long term gains were seen in every plot when it rained again. Even 19 months after 1 application, gains of 246-1142 kgDM were measured. In my 25 years of measuring grass, I have never seen fertiliser give gains past 4-5 months after application (I've measured over 40 trials with fertiliser).

Clover growth was obviously better in treated areas.

Economics - the cents per kilo of dry matter grown by Magnify products was mostly between 4-11 cents/kgDM/application. However one was 13.5 and another 23 cents/kg. This excludes application. By comparison 20 kgN from Urea would probably have produced a 5:1 response under the same conditions. That would give 100 kg extra at a cost of ~60 cents/kilo. Balage would be 80 cents/kilo.

FIELD TRIALS 2022 : MAGNI-GROW + ½ GIBB + 9 kgN - Banks Peninsula

Farm

The farm has 280 ha of improved pastures with moderate fertility. Magnify had been applied to some paddocks in Autumn with observable results. However Winter was poor for growth due to rainy, windy weather and there was a huge feed pinch across the whole of Banks Peninsula. Mr Hobbs needed grass quickly to feed 20% more lambs than they usually had (170% scanned).

Goal

To see what combinations of 5L Magni-Grow + 9 kgN/ha + half rate of Gibb-Gro would produce as a short term boost to a Banks Peninsula sheep farm when growth conditions were warmer and under the typical grazing pressure of Spring.

Set Up

Client sprayed 5-7 year old cocksfoot / prairie grass / clover pastures beginning on the second-time paddocks and left some undersprayed areas as controls. Magnify client applied 9 kg of liquid N + 5L Magni-Grow + 10 gm ProGibb (half rate). A helicopter applied to native blocks on 15 August. Client had 3 paddocks with unsprayed areas. Client applied to improved pastures with tow & fert on 21 March and again on 15 October.

RESULTS

Samples	Control	Magnify + 10 kgN + ½ ProGibb
18 days growth from 30 Aug to 17 Sept 2022	196 kgDM/ha 11 kg/day	810 kgDM/ha +614 kgDM/ha extra 45 kg/day + 413% P<0.001
14 days after spraying 15 Oct to 1 Nov 2022	258 kgDM/ha + 18 kgDM/day	1168 kgDM/ha + 910 kgDM/ha extra 83 kgDM/ha/day + 452% P<0.01

SUMMARY

Magni-Grow - 1st measurement - early September growth :

The improved pastures grew an extra 31 kgDM/day ($p<0.001$) for 18 days giving an extra 614 kg on average. That was 413% faster. Some paddocks were grazed after this measurement but 2 were not - and measurements 32 days after application showed extra growth of 1200 and 1600 kg over the control. That's a 120-160 kg response to every kilogram of nitrogen applied.

A full rate of ProGibb is expected to give a 30:1 nitrogen response but this farm only had a half rate of ProGibb so one would expect maybe less than 20:1 response. At this rate the expected growth from the nitrogen would be 205 kg over 32 days, well short of the 1600 kg produced by adding Magni-Grow.

Although not shown in the data above, the native grew an extra 18 kg/day (or plus 213%) extra for 47 days, giving an extra 850 kg on average.

Magni-Grow - 2nd application - later part of October growth :

The improved pastures grew an extra 65 kgDM/day (p>0.001) kg/day for the 14 days up to measuring giving an extra 850 kg on average. This equated to 910 kgDM/ha (p=0.01) with 4 paddocks available for measuring. That's a 100 kg response to every kilogram of nitrogen applied in just 14 days.

A full rate of ProGibb is expected to give a 30:1 nitrogen response over 28 days but this farm only had a half rate of ProGibb so one would expect maybe less than 20:1 response. At this rate the expected growth from the nitrogen would be 90 kg over 14 days, well short of the 910 kg produced by adding Magni-Grow.

The native ridge was very dry and this showed up in growth rates. The control was 863 kgDM/ha total. A single sprayed area was 988 kgDM/ha (an extra 9 kgDM/ha/day) and a double sprayed area was 1277 kgDM/ha (an extra 30 kgDM/ha/day).

White clover was noticeably stronger than farmer was used to seeing in spite of it being cold conditions throughout Spring.

Stock had shown a grazing preference for the treated areas as well. Some paddocks had to be grazed 4-10 days after the first application. We measured 100% better regrowth in treated areas.

It is not normal for farmers to apply Magni-Grow and Urea on sheep farms as often as this farmer is doing, however the astounding growth rates he has been getting is considerably cheaper feed than he can purchase, so it's proving extremely economic to do so until the soil moisture becomes a limiting factor for gains.

To break even financially, we calculated that an extra 75 kg dry matter per hectare per application was required. He's had a minimum of 1200 kg.

It costs $120 for a bale of baleage delivered to this property. So even in September there was $546 worth of feed grown in just 18 days.

FIELD TRIALS 2013 : MAGNI-GROW + GIBBERELIC ACID, LATE AUTUMN - various

Farms

Four farms with low-to-good soil fertility - Olsen P 14-30. Two dairy farms (one at 1500 feet above sea level) and two sheep farms.

Goal

To see what combinations of Magnify + 4 kgN/ha + 9 gm/ha Gibb-Gro would produce in late Autumn. At the start for North Canterbury, properties were 9 degrees C - and 11.5 degrees C for Fairlie dairy farm.

Set Up

Fairlie dairy farm : Client sprayed ½ paddocks lengthwise, ryegrass / clover pastures on 17 April 2013. Each side Magnify CM3 Original + 4 kg liquid N. One side had 20 gm/ha ProGibb added. Soil temperatures were 11.5 degrees C at 10am on 1 May. It was very dry for first 10 days with virtually no growth. There were 5 grey, wet days over Anzac weekend 25-28 April. We measured on 1 May. One paddock had just been grazed to 1050 kgDM/ha. We assumed 1200 kg for other paddocks. One paddock was grazed 24 April. Soils were Balmoral (Sib 29) - shallow, well-drained silt.

North Canterbury dairy farm : One side 5 L/ha Magnify CM3 Original + 4 kg liquid N + 20 gm/ha ProGibb added. A 100 sqm area had 120 kgUrea/ha. Trial established on 11 May 2013. Soil temps were 9.5 degrees C at 10am on 11 May 2013. Measured 1 July. This paddock is extremely wet in Winter and usually grows nothing until October. Soils were Utuhina - moderately deep, very poorly drained peat over skeletal. Olsen P 22.

Fernside block : Each side Magnify CM3 Original + 4 kg liquid N. One side had 20 gm/ha ProGibb added. Soil temperatures were 9.0 degrees C at 10am on 1 May. Pastures were broom, prairie grass, clover, fescue. Soils are Darnley 1 - shallow silt, stoney, always low in moisture. Olsen P 31.

Timaru : Sheep farm with history of high fertiliser inputs then Magnify for 4 years. Soil Tumaru (Sib 1) - moderately deep, imperfectly drained silt. Olsen P 24.

RESULTS

		Magnify + 4 kgN/ha	Magnify + Gibb-Gro + 4 kgN/ha	Urea 120 kg/ha
Magnify Blocks	4 paddock average	+ 400 kgDM/ha 9.5 kg/day	+ 1000 kgDM/ha 24 kg/day + 252%	
Usshers 2013			+ 750 kgDM/ha 18 kg/day + 300%	250 kgDM/ha 6 kgDM/day
Fairlie Dairy farm 17 April to 1 May 2013 (1500 ft above sea level)	1st pdk grazed 26/4	110 kgDM/ha/day	+ 660 kgDM 154 kgDM/ha/day + 40%	
	2nd pdk drier end	37 kgDM/ha/day	+ 300 kgDM/ha 57 kgDM/ha/day + 54%	
	2nd pdk full moisture for last 4 days in hollow	118 kgDM/ha/day	+ 135 kgDM 127 kgDM/ha/day + 8%	

Samples	Control	Gibb-Gro	Gibb-Gro + ½ rate of Magnify + 4 kgN/ha	Gibb-Gro + ½ rate of Magnify
Timaru 2011 Sheep farm end of May 7 weeks later	1020 kgDM/ha	1350 kgDM/ha + 320 kgDM + 6.7 kgDM/day	1520 kgDM/ha + 500 kgDM + 10 kg/day	1605 kgDM/ha + 585 kgDM + 12 kgDM/day

SUMMARY

Magni-Grow + Gibb in late Autumn :

These exploratory trials done in 2011 and 2013 on different properties showed further growth could be obtained from the use of Gibb-Gro by adding Magnify. Note : In 2011 and 2013 Magnify was less potent and applied at 3 L/ha. So we expect greater results today as the Banks Peninsula trials in 2022 have shown.

We were surprised at the amazing growth rates on the Fairlie dairy farm given the dry weather and short time from rain to measuring. The drier parts of the paddock showed up strongly with significantly lower measurements. This farm had used average amounts of Urea throughout the season (100 kgN/ha) plus 2 applications of Magnify.

Today in 2023 it costs $120 for a bale of baleage so all of these results would be very economically favourable.

Leachable soil nitrogen would also be absorbed in the extra growth - 20 kgN for 600 kg of growth.

Even with Magnify's old products, this data showed it was highly probable to grow an extra 500-1000 kg of drymatter at the end of Autumn / early Winter by applying Magnify and Gibberelic acid.

FIELD TRIALS 2012 : MAGNI-LIFE WITH GRASS GRUB ISSUES - Te Anau

Note : Microlife has been rebranded to Magni-Life. Write up supplied by McDonald Agrifert rep from Te Anau, G Bacon.

CONNEMARA MICROLIFE DATA

26th August 2012 - 3lt Microlife applied to 3 ½ paddocks these are approx 4 years old, large grass grub population, paddocks appeared run out and cultivation was being considered.

3rd October 2012 - paddock had, had weaners removed that day, we observed treated side to be grazed to lower residual, upon digging soil was beginning to "free" up good root structure still large grub population. Untreated side had been left with cover, soil not as "free" however low grub population.

05 November 2012 - paddock had stags in it, treated side showed good clover and rye cover, soil free, root structure strong, very little grub, soil temp 13.6 C, untreated also showed good clover and rye cover soil still hard very little grub, soil temp 12.1 C. Outside car temp 8 C.

JIM'S MONIOTRING

Paddocks were plate metered prior to grazing kg Dry Matter/day

Dates Grazed	Treated	Untreated
04/10/12	17kg	7kg
12-19 Oct	37kg	25kg
19Oct-6th Nov	71kg	64kg

Over 34 days treated pasture produced 11kg more grass and weaners gained an extra 80gm/day live weight. Venison @ $4.00/kg weaners grazed @ 10/ha. Therefore and extra 27.2kg live weight gain per hectare over 34 days. At $4.00/kg = $108.8/ha EXTRA gain. Product cost $66.48/ha (plus application costs) this equals $42.32 EXTRA /ha over 34 days.

SCOTT HOBSON'S THOUGHTS

Microlife has made a large improvement on these paddocks, and in a short time. This is not normal it usually takes up to five months for Microlife to make substantial improvements to the soil. Scott thinks that the grass grub population in these paddocks has had the most production impact. IE these paddocks in June had a huge grub population and now

FIELD TRIALS 2016 : STAN WINTER REPORT - Northern Southland

In September 2016 Five sites were selected for trials and treatments applied by Scott.

I requested to not be advised as to the materials applied to ensure unbiased observation.

The Five Sites were as follows:

1/ Bullmore. Lamb raising dry land farm set stocked.

2/ Currie. Dry land Sheep farm as a fenced mowing trial.

3/ Day. Irrigated silage paddock.

4/ Wilkins. Irrigated Dairy Farm.

5/ Bowmar. Chemical Free Beef rearing farm using TECHNO system. Dryland.

No Urea application was agreed by all participating farmers.

Executive Summary.

From establishment to March 2017 all sites responded Positively to the Biohelp applications.

All showed a diminishing return in the last half of the first 5 months.

Yield increases over farmer practice controls have ranged from 6% to 24%

Table 1. Summary of results.

Site	Kg DM/ha Cover at Grazing	% Increase over control
1	650	6 – 8
2	1000	20 – 24
3	2200	8 – 12
4	2400	18 – 22
5	3200	13 – 17

Site 1 has been abandoned due to farmer requirements.

Due to very cold conditions in winter and widespread drought since late September 2017 through to the present time no additional data has been collected from Curries site 2. It has also had some spray drift from cycle trail maintenance.

Site 3 Irrigated Silage continues but has had Potash Sulphur Super applied prior to direct drilling in late March. 2017

Site 4 Irrigated Dairy is abandoned as dairy shed effluent is now applied to the site.

Site 5 Beef Unit continues.

I can say with some certainty that the Biohelp treatments were effective at increasing yield and palatability for at least the first 3 months but this effect is now much less apparent 12 months on within the uncertainty factor of +/- 5% of yield as a precision of estimate for the measuring methods used.

Cropping

FIELD TRIALS 2004 : MAGNI-LIFE WINTER WHEAT PRODUCTION - Timaru

Farm Brief

The cropping farm just outside Timaru. McDonald Agrifert wanted to test Magni-Life on Winter wheat production. They had used Cropzest (a former Magnify product which has now been superseded by Magni-Grow) with very good success - 1.5 to 3 tons/ha in previous years.

Goal

To see if adding Magni-Life in addition to Cropzest would add to wheat yield.

Set Up

The trial was established in conjunction with the farmer. The standard method was treating half a paddock. Data was supplied by McDonald Agrifert. They collected 4 samples for control and treated, each 0.5m2 in size. Head numbers and total weights were obtained and forwarded to Magnify.

RESULTS

Samples	Magnify 2 L/ha Magni-Life + Cropzest	Control with Cropzest alone
Heads per ½ m2	202.5 + 32% P<0.008	152
Total weights	11.83 tons/ha + 2.19 tons/ha + 23% P<0.06	9.64 tons/ha

SUMMARY

2 L/ha Magni-Life added 2.19 tons per hectare to this Winter wheat crop in addition to Cropzest, which was the control.

FIELD TRIALS 2004 : MILLING WHEAT TRIAL - Lincoln, Canterbury

Farm Brief

Wheat trial done on tired cropping farm. Paddock had been in onions, broad beans, potatoes then wheat. In November 2003 the soil was very hard and compacted (lacking structure). Magni-Life had been applied at 6 L/ha/yr and by October 2004 the soil was deep, soft and binding together nicely. Our question at the time was could we add further value with Magnify's old Pasture Grow product at 3 L/ha?

Goal

To see if adding Pasture Grow at 3 L/ha would increase / enhance wheat yield when added to farmer's normal management practice (which was 150 kg Urea/crop).

Set Up

A half paddock was sprayed 3 weeks after emergence with 3 L Pasture Grow mixed with Cougar herbicide. Wheat variety was Vanquish.

By 15 October the treated plants were noticeably taller and stronger. A sample of 20 plants revealed an increase of 48% more leaf weight and 29% more root weight. Treated plants averaged 7 tillers per plant and untreated 5 tillers per plant.

7 x 1.0 m2 plots were harvested from both treated and control, staying opposite each other and about 4 metres apart to ensure as few variations from external factors as possible. Total head weight + number of heads was measured.

RESULTS

	Control total weight kg/ha	Head count control/plot	Treated total weight kg/ha	Head count treated/plot
Average for 7 test samples	6364	150	7501 + 1137 kg + 18% p<0.159	171 + 20.71 + 14% P<0.19

SUMMARY

Statistically significant differences weren't obtained but the harvested yield difference per hectare was around 1.37 tons/ha - and total crop yield of 9.2 tons/ha. This shows to us the methods traditionally used for crop measurement by Ag Research (which we copied here) are not perfect. The treated area also absorbed about 25 kg of applied nitrogen more than untreated areas.

FIELD TRIALS 2023 : MAGNI-LIFE vs FUNGICIDE on BARLEY - Marlborough

Farm Brief

A cropping farm up the Waihopai Valley, Blenheim. These clients had been using Magnify for over 10 years. They plant 200 ha in Barley. In 2020/21 they had started doing 3 fungicides as per Wrightsons' recommendations. In the 2020 season they replaced the first fungicide with 3 litres Magni-Life across 40 ha. There was noticeably less disease on the Magni-Life area than on the fungicide-treated plants, which was acknowledged by the Wrightsons rep. In 2021/22 season all three fungicides were replaced with Magni-Life on a 16 ha paddock. At harvest there was no visual disease difference between treatments.

Goal

Replace fungicides with Magni-Life.

Set Up

Everything except yield sampling was done by the farmer. All treatments received the same fertiliser and 1 application of Magni-Grow. The first ring of a centre pivot received Magni-Life 2 litres/ha for first application and 5 litres/ha for second application. The second and third rings of the same centre pivot received fungicide twice. The timings of all treatments were within 24 hours of each other. Plantings were within 7 days of each other. The inner ring of a centre pivot (40 ha) was treated with Magni-Life twice. For yield comparison the heads from 7 x 0.25m2 samples were taken from rings 1 and 2 approximately 10-15 metres opposite each other, eliminating soil differences. Visual assessments noted. Our purpose was to get a percentage difference and previous trial work like this suggests it will be close to total harvested percentage differences.

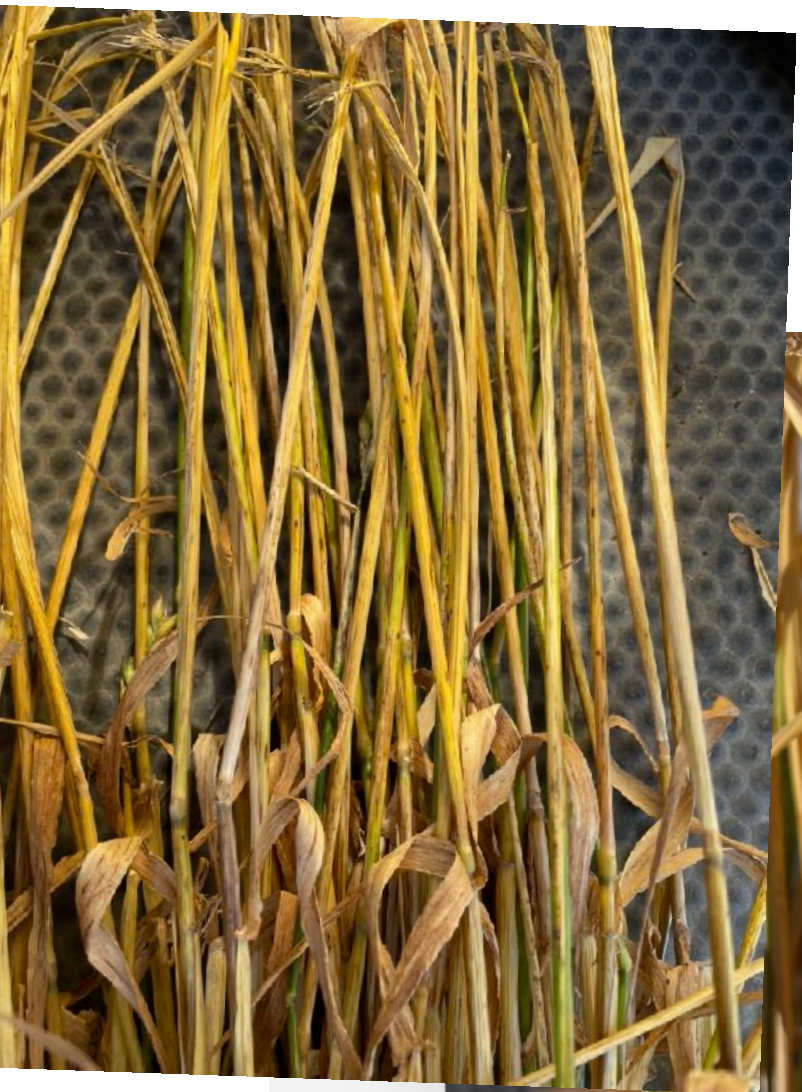
RESULTS

Samples	Magnify Magni-Life	Fungicide
	447 gm	307 gm
	450 gm	292 gm
	414 gm *	277 gm *
	454 gm	297 gm
	412 gm *	282 gm
	495 gm	324 gm
	442 gm *	372 gm
Total weights	444 gm/0.25m2 15.5 tons/ha 4.8 tons + 31% P<0.0001	307 gm/0.25m2 10.7 tons/ha

SUMMARY

Magni-Life, for the third successive season, had shown it was as good as fungicides at controlling fungal disease on barley in the Blenheim area. It was visually ahead as seen in below photos. The farmer had commented he couldn't see any difference in disease which was the main aim of the trial and consistent with the 2 previous trials. In the area of the paddock measured, Magni-Life added 31% (or 4.8 tons/ha) to yield, which included the whole unthrashed ear 3 weeks prior to harvest. This may be a high-yielding part of the farm so may not occur across the other 40 ha treated with Magni-Life.

Visual assessment : The farmer had commented he couldn't see any difference in disease which was the main aim of the trial. On closer inspection there was significantly less disease in Magni-Life plants but it wasn't perfect. There were signs of fungus at the top of plants - the odd blotch patch and a little greying in patches. Both treatments were too low in disease to be able to get meaningful comparison data. Magni-Life treated plants were noteably taller and the soil had a more 'earthy, full smell'. The fungicide-treated plants frequently pulled out of the ground when the tillers were bunched and heads pulled on mass. The root systems just weren't good enough to hold them in the soil. That happened only a couple of times on the Magni-Life treatment.



Typical observed difference in disease. Magni-Life plants are below. Fungicide plants are pictured to left of the page.

FIELD TRIALS 2022 : MICROLIFE + MAGNI-GROW ON WHEAT - Timaru

Farm Brief

A Timaru cropping farmer had trialled 3 L/ha of a former Magnify product called Cropzest with great success. The reps at McDonald Agrifert wanted to know if adding Magni-Life would increase things further.

Set Up

Farmer sprayed half paddock with 2 L Magni-Life + Cropzest and half with only Cropzest. 4 x 0.5m2 data was collected by the late Kevin Wilson who worked at McDonald Agrifert back at that time. The crop had laid over with rain so they collected heads in place of the planned measurements.

RESULTS

Samples	Magni-Life	Control
Head numbers	202 + 33% P<0.01	152
Average weight	591 gm + 22.6% + 2.1 ton/ha P<0.06	482 gm

SUMMARY

Magnify's former version of Magni-Life increased head numbers by 33% and total yield. Given the small number of samples, a P test level of 0.06 was pretty close to significant based solely on these samples but, given previous trials, adds to the probability continuum.

FIELD TRIALS 2016 : MAGNI-GROW ON BARLEY - Balclutha

Farm Brief

A sheep and beef farm grew Barley for Winter feed. They had never done better than 10 ton/ha. They applied 400 kg potash super fertiliser and 400 kg Urea. Soil minerals were in moderate range and any difficiencies usually addressed by the farmer.

Goal

To replace 100 kg Urea with Magni-Grow for the same price to try to break the 10 ton limit for this farmer. Effectively the 2 trial paddocks used 300 kg of Urea plus Magni-Grow and the control was just 300 kg of Urea.

Set Up

Everthing except yield sampling was done by the farmer. The farmer left a boom-width untreated with Magni-Grow, one boom-width from the outside round. All treatments received the same fertiliser and 1 application of Magni-Grow. For yield comparison, the heads from 7 x 0.25m2 samples were taken from the railway paddock. Another paddock had been set up but it got waterlogged, leaving greatly diminished yields throughout the treated and untreated areas. We had no confidence on what differences were due to treatment vs waterlogging so we measured the paddock that was not waterlogged. Samples were taken 5 metres apart from both sides of the central control strip to avoid bias. Our sampling occurred about 4 weeks prior to actual harvest when we were in the region. Our purpose was to get a percentage difference and previous trial work like this suggests it will be close to total harvested percentage differences.

RESULTS

Samples	Head numbers control	Head numbers Magni-Grow	Head weights control/0.25m2	Head weights Magni-Grow/ 0.25m2
	168	214	370	590
	178	197	384	504
	160	214	390	541
	200	202	366	591
	172	205	454	415
	196	192	466	465
	179	196	417	516
Total weights	179	202 + 12% P<0.026	406	517 + 111 gm/0.25m2 + 27% P<0.027

SUMMARY

From our sampling methods, the overall difference between treated and untreated was a 27% advantage to Magni-Grow treated Barley. The farmer reported a harvest between 12.5-13 tons/ha which was 2.5-3 tons better than they had ever done. They also contracted for other farmers and said the district was actually lower than normal.

More Cropping Results

Described in brief from a 2004/2005 newsletter to our clients :

WINTER WHEAT YIELDS 18 AND 22% UP

Two different farmers have run trials on Winter wheat trials at Lincoln and Timaru. Final results were an increased yield of 18% (+ 1.37 ton/ha variety - Vanquish milling wheat, average 9.2 ton/ha) and 22% (2.2 ton/ha) for Lincoln and Timaru respectively. Big net returns! In addition, treated soil at Lincoln averaged 5 cm deeper and had much better structure. Very positive for the next crop. The Timaru soil, treated for the first time with Biohelp, averaged 15% softer but was still hard overall. More work is needed on this soil but the process has started positively.

GRASS SEED YIELDS UP 52%

Timaru district**.** An indicator trial (control vs treated but without replicates) showed a 52% increase in the grass seed yield on trials at Timaru. The germinations were not able to be tested. Another client in the Lincoln district committed to our full grass seed programme and increased his yields by 100% this season. His average yield was 2.5 ton/ha with export grade germinations. Another Waimate client grew 2.8 tons/ha with export-grade germinations. He had previously not been above 2 tons/ha and lost germination quality at that yield. These were all ryegrass.

SEED POTATOES UP 22%

Methven district. 4 ha was treated in an 8 ha paddock. 4 x 3m samples were collected and graded from both treated and untreated areas. The total yield increase was 22%. The grading was also significantly better with a 17% (wt basis) increase in 28-50 mm sizing. We estimated a net return of $1491 / ha (based off prices supplied by the client as at 24 April 2005). Soil depth (5%) and temperature (10%) had also improved and the client commented on improved friability.

CHIPPING POTATOES UP 10%

Timaru district. A part paddock was treated. 4 x 3m samples were collected and graded. The net increase in yield was 7.3 ton/ha or 10%. Grading was also superior in the treated area giving a higher proportion of potatoes in the high price bracket. Estimated net return (based off $125 / ton) was around $700 / ha.

PEAS UP 19%

Methven district. An exploratory count was done between treated and untreated, collecting 70 pods from each area. Treated pods yielded 19% more and tasted noticeably sweeter.

BARLEY YIELDS UP 22%

Oamaru district. Direct drilled. Sown in August. 5 x 1m2 samples were collected from control and treated. Plant comparisons at 10 weeks showed marked increase in size and tiller strength but was visually obvious from a distance. Final yield increase was 1.64 ton/ha or 22% ($p<0.05$) (total yields around 9.2 ton/ha). The net profit increase was over $300 / ha. Soil also improved. Terrazone was used on another paddock as an additional trial. The early plant vigour was significantly superior to simply using Cropzest alone as was soil improvement. Unfortunately the crop was exposed to prolonged rain at the wrong time and was flattened. We couldn't measure the yield improvements. We had every indicator that we would have got another 6-8% improvement by including Terrazone as part of the pre-plant programme.

ONIONS

Lincoln district. We successfully trialled the complete removal of fungicides and insecticides (the main problem being thrips) on 2 ha of export onions. Our aim was to investigate viable options for the replacement of Mancazeb spray which is coming under increasing pressure to be removed (or have restricted use) in Europe. We were very pleased with yields and our client's onions were selected as the first choice by the buyers. We only wish the prices were considerably higher.

Common Cropping Diseases that have been controlled when Magni-Life was introduced

* Sclerotia on Sunflowers
* Fusarium in Yams
* Take-all in Wheat
* Scab in Potatoes
* Blight control in Potatoes

The principle is to provide good competition against the diseases and then support the growth of that competition. So the disease suppression builds with time and season. It doesn't work like a chemical but it can provide solutions where chemicals aren't working and/or there is a desire to remove chemicals.

Microbes can spread through the soil 3 metres within a crop's growth cycle. This can make small replicated trials very inaccurate. It's why we measure larger areas for trial purposes.

Soil Conditioning

Magni-Life also conditions soil rebuilding structure and nutrient dynamics. Better structure - along with organisms that encourage disease control and higher yields - allows for significant transformations in water use, overall crop yield and chemical use, cultivation times and man-hour reductions. The speed of transformation varies between paddocks and farms over 3-10 years. As a guideline over 3 years use we have seen 2-3 tons extra in grain, 15-30% extra in peas and beans and 10-20% in potatoes and onions.

LEACHING AND NITROUS OXIDE

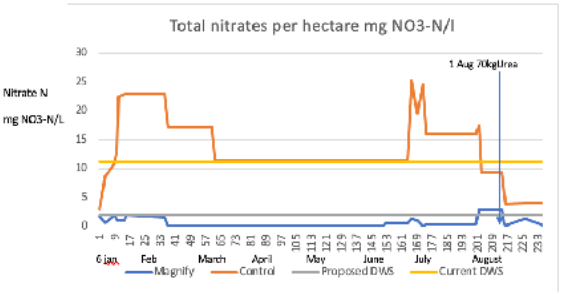
Effects of a microbial-based soil conditioner on nitrate leaching in comparison to historic nitrification inhibitor dicyandiamide (DCD) responses.

S.H. Hobson, J.F. Field-Dodgson and L.A. Waldron

Abstract

Lysimeters were set up to measure the effect of microbial-based products (MagnifyNZ) on nitrate leaching on a dairy farm in Canterbury (2.5 cows/ha). MagnifyNZ Ltd fermentation products establish an effective soil microbiome, creating opportunity for high output-low input agriculture/horticulture. The soils were stony shallow silt loams (400 mm deep), classified as Ruapuna and Darnley (medium and high leaching). Fertiliser was applied monthly to provide 190 kg of N/ha/yr. A twotreatments were used (soil conditioner and plant biostimulant) in September 2022, January and August 2023 using Magni-N-Enviro (9 l/ha), with and without stored urine to mimic cow N contributions (600 kg N/ha). The untreated control was Ruapuna soil using the same fertiliser and urine applications. Lysimeters were used to generate 3-4 drainage collections monthly, as reported by Beale *et al.* (2021). Statistical analysis used ANOVA (Excel v.16.78) and the GLM procedure of Unistat (v.10) with Magnify and urine application as factors. Non-urine soil leaching averaged 0.77 mg NO3-N/l for the Magnify samples compared to 3.98 mg NO3-N/l (P<0.0001) for the control. There was no significant difference in drainage volumes between treatments, which was 325 mm from 901 mm rainfall plus irrigation over 12 months. Urine patch N lasted 40 days in Magnify soil *versus* 215 days for the control. Total nitrate loss was 1.18 and 15.04 mg NO3-N/l for Magnify and control, respectively (P<0.0001). For the year starting September 2022, estimated total leaching was 3.1 kg N/ha for the treated soils *versus* 48.99 kg N/ha for the control, compared to 17.15 kg N/ha for the calculated DCD response (Di and Cameron, 2007). There was a 91% reduction in total nitrate leaching from soils treated with MagnifyNZ, attributed to a more stable microbiome, which allowed rapid use and absorption of available N by pasture and soil microbes. Modelling the results for DCD (Di and Cameron, 2007) using 600 kg N/ha urine, DCD's would have given 65% reduction in leaching.

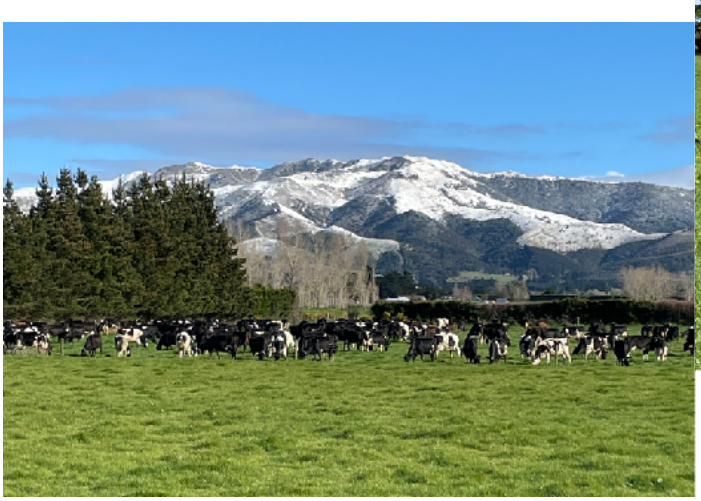
Graph 3. Total nitrate nitrogen per hectare (Nitrates from Urine patches + urea treatment proportioned for the respective paddock coverage area). X axis is days after urine application on 6 January



Days after 6 January	Urea fertiliser applied
1	30 kgN/ha
21	30 kgN/ha
42	30 kgN/ha
107	10 kgN/ha
New season 213	35 kgN/ha

Average total nitrate nitrogen were 1.18 (SE 0.266) and 15.04 mg NO3-N/l (SEM 1.88) for Magnify and Control respectively (P<0.0001)

Full report on
www.magnifynz.co.nz



COW URINE STUDIES

FIELD TRIALS 2017 + 2019 : URINATION ANALYSIS - Fernside, Rangiora

Goal

To gather data on urination events on a Canterbury dairy farm using Magnify and 30-50 kgN/ha/year. The 2019 study was in response to a Lincoln University professor suggesting there may be a diuretic effect.

Set Up

In 2017, urine was collected from 8 cows during the afternoon and morning milkings. Samples were sent for analysis to Hill Labs. We assumed 14 urinations per day based off the 2019 study.

In 2019 the first 10 cows in for milking were individually isolated by fenced off areas in the paddock. The number of urinations from dawn to dark recorded and urination length timed and given a visual assessment of low, medium or high flow. When the cows entered the shed for milking in the morning and evening, urine was collected from any cow in the herd that urinated (and we had time to get to). Many cows urinated only 200 mm and we couldn't collect these. These small urinations also frequently occurred in our paddock observations. This made the volume of urination in the shed a higher number than in the paddock. The timing plus flow assessment method was used in conjunction with true collection in 5 litre container. Our simple paddock method was within 200 mls/urination accuracy. All collected volumes were sent for analysis to Hill Labs. The dung from the 10 isolated cows was collected, weighed and sent for nitrogen assessment. Water intake was measured for each cow. The cows had about 2-3 kg of carrot pulp as part of the diet. Nitrogen in dung, milk - plus an assumed body maintenance amount - allowed for cross-checking of urine N volumes.

RESULTS

The effect of urinations

The paddock area urinations covered were tested on 2 Jan 2023. Soil was slightly damp from rain at time of testing. Turmeric was used to colour the water. On Ruapuna soils using 0.8 litres, 1.3 litres and 2.5 litres. The areas covered were 0.1 m2, 0.16 m2, 0.36 m2. The urination volumes were based off previous urine collection studies for cows grazing Magnify-treated pasture vs cows on solely Urea-treated pastures.

The control property lysimeters received liquid Urea equivalent to 700 kgN/ha on 23 December 2022. We assumed an industry standard volume of 2.5 litres/urination. This covered 0.36 m2. 12 urinations per day x 280 days = 1209 m2/cow/year. This is 192 gmN/day which is common with most other research.

Magnify client's lysimeters received liquid Urea equivalent to 200 kgN/ha. There was 1.3 L/ urination covering 0.16 m2/urination x 14 urinations per day x 280 days = 623 m2/cow/year. This is 44.8 gmN/day in urine. 77% lower N/pee and 51% less area covered per hectare.

We have applied conservative rates of N per hectare to the treated lysimeters. A urine study in 2016 at John Tanner's on light soils had 100-150 kgN/ha. These numbers are in accordance with Kebreab *et al* 2001 data when dietary nitrogen inputs are down at 2.5%. Herbage test in Autumn last year showed just 2.4% N on this property.

We collected urine from 5 cows in afternoon milking for application to the large lysimeters in May 2022 and had just 6 gm/urination (1.5 litres/urination average volume).

Reference material for comparison purposes

On low to medium leaching soils Silva *et al* (1999) found 1-5 mgN/L from dairy effluent + 200 kgN fertiliser (non-urine areas). They calculated 33-66 kgN/ha leached, assuming 25% paddock coverage with urine. Soils were Templetons with medium risk of leaching. **There was 10-17 mg/ L average nitrate concentration from urine and non-urine patches combined**.

Over the 2019/2020 dairy season, Ngai Tahu leaching study at Eyreton showed over 6-10 mgN/L coming from non-urine patches and this looked to be increasing steadily each year from the forestry conversion.

ECAN summary of research indicates 9-11 mgN/L from non-urine patches.

Dijkstra *et al* summarised 66 peer reviewed papers for a Greenhouse Gases and Animal Agriculture Conference in 2013. I quote "… in cattle, the mineral load that needs to be excreted largely determines the volume of urine. Animals fed high-protein diets consume more water and excrete more urine (Van Vuuren and Smits, 1997; Table 2). In addition to N, urine production is particularly affected by the intake of Na and K."

When we have lower nitrogen intake we expect to see lower volumes of urine and our studies support this research.

An article titled 'Impact of dairy farming on Canterbury water Unsustainable' on Stuff, 7 March 2023, quoted a paper as follows ... 'The research, published in the Australasian Journal of Environmental Management, found Canterbury groundwater drinking supplies were on a trajectory to extreme levels of nitrate contamination of 21mg/l – nearly double the allowable value for drinking water of 11.3mg/l – rendering much of it “undrinkable”.' The untreated lysimeter in our study using 190 kgN/ha/yr is currently showing a combined N loading of 22 mg/l. The treated lysimeter is showing 6.5 mg/l.

Herbage test results showing the percentage of nitrogen in the pasture

Samples	Medium quality pasture DNZ	High quality pasture DNZ	Usshers 2017	Usshers 2019
Intake kgDM/cow/day	15	17.9	16	14
Crude Protein %	18 (2.9%N)	29 (4.6%N)	23.4 (3.7%N)	18.75 (3%N)
Milk solids kg/cow/day	1.4	2.2	1.7	1.7
N Intake gm/cow/day	420	831	608	350
N in urine gm/cow/day	162	831	109	81
Volume/urination during milking	2.2	3.3	1.3	1.1
Volume of urination in paddock				670 +-200 ml/urination 10.3 urinations during daylight
N concentration gm/L	6	10	6	5.31
KgN/ha				169

A Comparison study on Nitrogen leaching and impact on Carbon Emissions between 'Biohelp NZ' biological treatment of pastures and conventionally fertilised pastures - Leeston

S Hobson B.Agr.Sc. **22 October 2019**

Summary of key points

This field study compared the effect of Biohelp NZ's biotechnology products (CM3 and Microlife), against conventional fertiliser practices on urine nitrogen (N) leaching from lactating dairy cows grazing ryegrass/clover pastures. Note : data collection (within a low budget) was the primary motive of the study, not the reasons for any observed differences. It was not intended to be a published scientific report.

The results of this study strongly suggest the use of Biohelp NZ products will significantly reduce the amount of nitrogen leaching and nitrous oxide emissions from urine patches.

Cow urination samples were collected throughout Spring 2018 and Autumn 2019 from a 320 cow mixed-Fresian herd on very light (Eyre) soils. Samples were sent for lab analysis (Hill Laboratories). The cows only had 24 hours on the Biohelp-treated grass, giving little time for adjustment or differences to show up. In spite of this, the results showed the total nitrogen loading per urination (volume x concentration) was 5.47 vs 8.17 gmN/urination ($p<0.022$) for Biohelp and conventional fertiliser respectively. This is a 33% reduction in urine nitrogen output within 24 hours of grazing the Biohelp treated area. The area covered per urination was 0.3, 0.6, 0.9 m2/urination for 1, 2, 3L volumes respectively. This was much higher than the 0.25 m2 area often assumed by many other studies. As a result of the larger area, the average nitrogen loading per urination was less than 120 kgN/ha on the Biohelp treatment. As leaching is correlated with the overall volume of nitrogen excreted per urination, similar drops in leaching are expected. When cows were grazing the Biohelp-treated paddock there were consistent reductions in the concentration of nitrogen per urination (4.4 vs 3.3 gmN/Litre, $p<0.1$) and the volume of urinations (2.1 vs 1.7 L/urination, $p<0.09$).

The results showed consistency with other unpublished studies done by Hobson (2017, 2018 and 2019). Three unpublished studies on lactating cows grazing Biohelp-treated ryegrass/clover pasture with 3.1-3.8% N showed the total urine output per day to be 12-14L with average urine concentrations of 5-6 gmN/urination. The average urination volume was less than 1L per urination. There was no evidence of a diuretic effect from grazing Biohelp pasture as was postulated by a peer. In another unpublished study, dairy heifers grazing kale treated with Biohelp over Winter also had an average of just 1L per urination and very low nitrogen concentrations averaging 0.6 gmN/L. In these unpublished studies, the cows had many weeks of grazing -treated areas to allow for more complete diet adjustment.

During this study, the total fertiliser used on the conventionally treated pasture was 144 kg Nitrogen, 112 kg Sulphur and 61 kg Phosphorus per hectare. In comparison, the Biohelp-treated 'Paddock 20' received 90 kg Nitrogen, 17 kg Sulphur and 25 kg Phosphorus + 2 applications of Biohelp per hectare.

Certificate of Analysis

Client:	H Ussher	**Lab No:**	2248038 shvpv1
Address:	6 Egans Road RD 1 Rangiora 7471	**Date Received:** **Date Reported:** **Quote No:** **Order No:** **Client Reference:**	25-Sep-2019 30-Sep-2019
Phone:	03 313 7735	**Submitted By:**	S Hobson

Sample Name: Poo Trial (Usshers: Lease Pdk) **Lab Number:** 2248038.1
Sample Type: Mixed Pasture (P1)

Analysis		Level Found	Medium Range	Low / Medium / High
Nitrogen*	%	3.0	4.0 - 5.0	
Phosphorus	%	0.28	0.38 - 0.45	
Potassium	%	2.5	2.5 - 3.0	
Sulphur	%	0.28	0.30 - 0.40	
Calcium	%	0.40	0.60 - 1.00	
Magnesium	%	0.14	0.20 - 0.30	
Sodium	%	0.123	0.150 - 0.300	
Iron	mg/kg	139	100 - 250	
Manganese	mg/kg	103	60 - 150	
Zinc	mg/kg	24	30 - 50	
Copper	mg/kg	5	10 - 12	
Boron	mg/kg	8		
Grass Staggers Index*	me	2.1	(<1.8 recommended, >2.2 increased risk)	
K/Na Ratio*		20	(<10 recommended, >20 increased risk)	
Ca/P Ratio*		1.4	(>1.5 recommended, <1.2 increased risk)	

The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information. IANZ Accreditation does not apply to comments and interpretations, i.e. the 'Range Levels' and subsequent graphs.

Pasture production figures were supplied by the farmer for Spring 2014, one year after starting Biohelp treatment. They showed that in spite of the Biohelp-treated paddock receiving 80% less nitrogen fertiliser (25 vs 125 kgN/ha for Spring 2014), grass production on the Biohelp-treated paddock was superior to the conventionally fertilised paddocks (61 vs 45 kgDM/ha/day). Growth rate comparisons over May 2018 and May 2019 indicate even greater advantages in favour of the Biohelp treatment areas (over 100%).

Based on the results collected in this study with only 24 hours for cows to show change, carbon emissions improved by 11-15% when cows were grazing Biohelp-treated pasture. These reductions were a result of lower fertiliser inputs and less projected nitrous oxide emissions, due to less urine nitrogen being excreted compared to the conventionally fertilised area. On the conventional pasture treatment, reducing cow numbers from 4.4 cows/ha to 3.5 cows/ha did not prove to be a better alternative as this only improved CO2 emissions by 11% (tool used : Farm Carbon Footprint Calculator developed by Lincoln University).

The urination data results of the Usshers' dairy cows are noticeably different to the accepted norms for farms using Urea to bolster feed quality and production - like the DairyNZ figures represent.

The calculated 81 grams of N output per day are within the limits established in graphs from Kebreab *et al* 2001, Hobblelink 1999, Cameron and other studies correlating dietary nitrogen intake to urine nitrogen output.

The 169 kgN/ha is well below the 500-1000 kgN/ha typically assumed in modelling. The overall nitrogen output per day is well below the expected 200 gm/day of other research. This impacts leaching and nitrous oxide calculations.

	NITROGEN % IN PASTURE	MEDIUM RANGE FOR COUNTRY FROM HILL LABS TEST	ME MJ/kgDM
Nov 2017 Urea pdk 3	3.8	4-5	na
Nov 2017 Magnify pdk 20	2.8	4-5	na
Dec 2018 pdk S1	3.4	4-5	12.2
Dec 2022 pdk 10	3.65	4-5	12
Dec 2022 pdk U	3.34	4-5	12.5
Dec 2022 pdk 3	3.43	4-5	11.6
Dec 2022 pdk 18	3.44	4-5	11.6

FIELD TRIALS 2018 : WINTER KALE URINE COLLECTIONS - Leeston

Summary : Importance - roughly 25% of leaching comes from Winter grazing. In addition, a significant chunk of the nitrous oxide emissions have been linked to the nitrogen volume in the urine. This small-scale simple pilot study showed it is possible to reduce urine nitrogen by maybe 16 times on Winter feed, affecting both leaching and nitrous oxide emissions. Kale was grown with chicken litter and 'magnifies' plant boosters to produce enough volume to feed 16 cows/ha but with only 1.5% of nitrogen in the plant, rather than the usual 2.4%.

Winter grazing of cows on Kale showed urine N concentrations of 0.6 mgN/L (range 0.32-1.09 gmN/L) with 1.2 L/urination creating a theoretical leaching of 1.9 kgN/ha. This is drastically different to Rivera's study where there was 4.89 mgN/L, 2.39 L/urination and 44 kgN/ha leached from urine.

Previous data : Ravera developed a urine collection harness while at Lincoln University. As part of her comprehensive study she showed average urine volume for cows fed Kale *(grown with 215 kg/ha DAP and 102 kgN/ha as Urea)* was 2.39 L and area coverage of 0.47 m2. Their average Urine N concentration was 4.89 gm/L. They ran 16 cows/ha and calculated leaching losses to be 53.79 kgN/ha. Approximately 44 kgN/ha was from the urine. An individual cow's urine volume ranged from 1L - 5.5 L/pee throughout the day. At the time of day our collection was done, Ravera's cows were slightly above average of 3 L/urination. In Ravera's study at around 5pm it was 2 urinations within a short time span of 1-1.5 L/pee. Across the herd the number of urinations ranged from 6-21/24 hrs. Average Urine N concentration for her study was 4.02 gmN/L at that time of the day. So we acknowledge there is significant variability over the day.

John Tanner's : 12 July 2018 – Leeston

Paddock history : The block is 2 years out of trees, sandy in parts and very light soil. The irrigator doesn't give enough water to the lighter parts of the paddock so the crop is uneven. We took these pictures in the better parts of the paddock. The estimated yield was 12 tons/ha however the crop has lasted considerably further than budgeted which is quite normal when people try to estimate yield on crops when our products are used. The drymatter percentage of the crops is usually 3-4% better than traditional crops where higher volumes of fertiliser and Urea are used to boost growth. For example, in 2018 Canterbury feed assessments measured K. Pierce's Kale at 22.5 tons DM/ha and 18.8% DM compared to the next best crops of 18 tons and 14% DM.

Method : At 1pm we spent 30 minutes timing how long the urination events of the cows were in the paddock. Most were 6-8 seconds with the odd one being 10-12 seconds or 5 seconds. The heifers were driven into the yards at around 2pm. Again we timed how long the urination events were in the yards when the heifers were clearly under stress. There was no difference between the yards and the paddock. Flow rates were not noticeably different either. The heifers were driven up the race in groups of about 15. In this situation they nearly all pee. We had watchers looking for the start of a pee. Due to the noise of the pee hitting the concrete we were able to start counting when the pee started and when it finished. They were consistent with paddock timings. During the urination event we collected a volume while continuing to count and then extrapolated to get the overall volume based on that. It was working out pretty close to 100 ml of pee per second which was in keeping with other collections we had made at other farms. I think our method will be 80% correct for the volume. We had John's daughter, Richard Jamieson and myself on pee collection. John Tanner, his farm manager and a stock agent were also present. Samples were taken from the cows we could get samples from with some degree of accuracy and confidence in the correct volume. We didn't stimulate the cows, so we could check the urine volumes against the paddock volumes. We tested the ground area : 1, 2, 3L of urine dropping from cow vulva height on both dry and semi-moist soil and onto grass.

		adjusted for time of day	g/L	gm/load	area	gmN/m2	
cow	pee volume	volume	concentration	total N/pee	covered m2		kgN/ha
1	0.7	0.84	0.53	0.45	0.25	1.79	18
2	1	1.20	0.6	0.72	0.25	2.89	29
3	1	1.20	0.4	0.48	0.25	1.93	19
4	0.7	0.84	0.32	0.27	0.25	1.08	11
5	1	1.20	0.6	0.72	0.25	2.89	29
6	1.5	1.81	1.09	1.97	0.25	7.88	79
		1.18	0.59	0.77	0.25	3.08	30.76

Leaching calculations : Urine makes up the main portion of leaching under traditional Winter feeding blocks. The urine portion is calculated by number of cows peeing 12 pees/day covering 1 m2 / 4 pees for 40 days. We assume 33% of the N is leached. So for 1 pee/cow :

* 155 cows × 0.25 m2 = 38.7 m2 / herd pee total 38.72 m
* 38.72 m2 × (3.08 gmN/m2 × 33%) = 39.33 gmN/155 cow pees
* 12 pees/day × 39.33 gmN = 472 gmN/day
* 40 days × 472 gmN = 18.8 kgN total over 10 ha
* 1.88 kg/ha

Mcdonald Agrifert sales rep R Jamieson supplied the 2017 samples. The Urea pdk had 70 kg of N over Spring and Magnify 25 kgN. The Magnify paddock was growing around 10 kgDM/day, more than equivalent paddocks with more nitrogen. We did the urine study the following Spring.

Ravensdown did the 2022 tests and commented that John was the only person who had significant amounts of clover in the district. John's comment was he had clover everywhere. So even with good amounts of clover in the sample, the nitrogen percentage is still below 3.5%, not 4.5% as might be expected. 60 kg of N had been applied up to December.

Sprosen *et al* 1997 found nitrate leaching was similar in N_2-fixing grass/clover pasture and N-fertilised grass-only pasture at similar N inputs (dietary N inputs).

The following assumptions have been made based on the findings of Ravera and her honours research paper done at Lincoln University :

* 12 urinations per day on kale.
* The cows pee only 83% of their average volume between 1pm and 4pm which is when we collected the samples. That's the adjusted volume figure in the table.
* 33% of Urine N is leached.

The Hills tests for nitrogen concentrations in urine is attached. These show the importance of having chow that is sweet and can be eaten happily to the ground. Almost all the N is going into the dung and the muscle. Brilliant - and what I thought might be happening.

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Biohelp NZ Limited	**Lab No:**	2018663	SPv1
Contact:	S Hobson	**Date Received:**	20-Jul-2018	
	C/- Biohelp NZ Limited	**Date Reported:**	25-Jul-2018	
	80 Bridge Road	**Quote No:**		
	RD 5, Fernside	**Order No:**		
	Rangiora 7475	**Client Reference:**		
		Submitted By:	S Hobson	

Sample Type: Biological Specimens (liquid)

	Sample Name:	Cow 1 [2015137.1] 12-Jul-2018	Cow 2 [2015137.2] 12-Jul-2018	Cow 3 [2015137.3] 12-Jul-2018	Cow 4 [2015137.4] 12-Jul-2018	Cow 5 [2015137.5] 12-Jul-2018
	Lab Number:	2018663.1	2018663.2	2018663.3	2018663.4	2018663.5
Total Nitrogen	g/100g as rcvd	0.053	0.060	0.040	0.032	0.060

	Sample Name:	Cow 6 [2015137.6] 12-Jul-2018				
	Lab Number:	2018663.6				
Total Nitrogen	g/100g as rcvd	0.109	-	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Biological Specimens (liquid)

Test	Method Description	Default Detection Limit	Sample No
Total Nitrogen	Dumas combustion. AOAC 992.15, 19th edition.	0.002 g/100g as rcvd	1-6

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Malar Sritharan BSc
Laboratory Technician - Food and Bioanalytical

End of Section

Full Data on Independent Studies

North Canterbury East Coast Hill Country Project (1)
Dr John Field-Dodgson's full summary and data
which were only summarised on page 20

Property : 'Spye', Omihi

Sites :
1 'Upper' 300m asl approx.
2 'Lower' 80m asl approx.

Treatments :
Biohelp : 2 litre/ha Microlife + 2 litre/ha Terrazone
'Control' : nil application

Application dates :
1 Autumn 2014 (20.3.14)
2 Late Spring 2014 (23.10.14)
3 Autumn 2015 (8.4.15)
4 Spring 2016 (7.11.15)

Results:

Site	Date	Treatments	DM (kg/ha)	DM Diff. (kg/ha)	Brix	Soil Temp	Soil Moisture
Upper	12.12.14	Biohelp	1,856	+ 242 (+ 15%)			
		Control	1,614				
	8.1.15	Biohelp	2,153	+ 386 (+ 22%)		17.9	0/10
		Control	1,767			18.5	1/10
	20.6.15		no data				
	23.10.15		no data				
	7.11.16	Biohelp	3750	+ 115 (+ 3%)			
		Control	3650				
	21.12.16	Biohelp	1244	+ 362 (+ 41%)			2/10
		Control	882				2/10
	3.5.17		no data				

Note : 20.6.15 No data collected. Larger caged areas required to give more realistic results.

Site	Date	Treatments	DM (kg/ha)	DM Diff. (kg/ha)	Brix	Soil Temp	Soil Moisture
Lower	12.12.14	Biohelp	2,063	+ 446 (+ 28%)			
		Control	1,617				
	8.1.15	Biohelp	2,430	+ 681 (+ 39%)	5.0	22.4	0/10
		Control	1,749		5.5	22.7	2/10
	20.6.15	Biohelp	1,215	+ 259 (+ 27%)	6.5	5.8	
		Control	956		6.0	6.0	
	23.10.15	Biohelp	2,289	+ 296 (+ 15%)			
		Control	1,993				
	7.11.16	Biohelp	3,453	+ 246 (+ 8%)			
		Control	3,207				
	21.12.16	Biohelp	1,585	+ 194 (+ 14%)			3/10
		Control	1,391				3/10
	3.5.17	Biohelp	3,896	+ 165 (+ 4%)			
		Control	3,731				
	17.11.17	Biohelp	3,324	+ 978 (+ 42%)			
		Control	2,346				

Notes :

8.1.15 Difference in DM production between Biohelp and control largely due to clover growth. No applications in Spring 2015 or Autumn 2016 because of drought.

7.11.16 'Residual' growth measured prior to spraying – 1233 kg/ha in both Biohelp and control areas. Data obtained 21.12.16 give actual DM production from 7.11.16.

21.12.16 More w/clover flowers noted in treated area than control.

17.11.17 Follows excellent Spring rains in October. First 'plot' out of sorts – sward composition probably reason for lower production compared with third 'plot', which looked tremendous.

North Canterbury East Coast Hill Country Project (2)

Property : Cheviot

Site : 'Top' paddock (320 m approx asl)

Treatments : Biohelp : Microlife @ 2 litre/ha + Terrazone @ 2 litre/ha
'Control' : no application

Application Dates :

1 Autumn 2014 (20.3.14)
2 Late Spring 2014 (23.10.14)
3 Autumn 2015 (8.4.15)
4 Spring 2016 (7.11.16)

Date	Treatments	DM (kg/ha)	DM Diff (kg/ha)	Brix	Soil Temp	Soil Moisture
12.12.14	Biohelp	2,561	+ 583 (+ 29%)			
	Control	1,978				
8.1.15	Biohelp	no data			23.3	0.50/10
	Control				24.0	0.25/10
23.10.15	Biohelp	2,260	+ 821 (+ 57%)			
	Control	1,439				
21.12.16	Biohelp	1,895	+ 469 (+ 33%)			2/10
	Control	1,426				2/10
3.5.17	Biohelp	4,211	+ 484 (+ 13%)			
	Control	3,727				

Notes :

8.1.15 No readings taken. Growth negligible. Very dry.

7.11.16 No readings taken. Cages down.

BIOHELP TRIAL REPORT

NORTHERN SOUTHLAND SEMI ARID SOILS

Biohelp rebranded to Magnify

OBSERVATIONS BY STAN WINTER

In September 2016 Five sites were selected for trials and treatments applied by Scott.

I requested to not be advised as to the materials applied to ensure unbiased observation.

The Five Sites were as follows:

1/ Bullmore. Lamb raising dry land farm set stocked.

2/ Currie. Dry land Sheep farm as a fenced mowing trial.

3/ Day. Irrigated silage paddock.

4/ Wilkins. Irrigated Dairy Farm.

5/ Bowmar. Chemical Free Beef rearing farm using TECHNO system. Dryland.

No Urea application was agreed by all participating farmers.

Executive Summary.

From establishment to March 2017 all sites responded Positively to the Biohelp applications.

All showed a diminishing return in the last half of the first 5 months.

Yield increases over farmer practice controls have ranged from 6% to 24%

Table 1. Summary of results.

Site	Kg DM/ha Cover at Grazing	% Increase over control
1	650	6 – 8
2	1000	20 – 24
3	2200	8 – 12
4	2400	18 – 22
5	3200	13 – 17

Site 1 has been abandoned due to farmer requirements.

Due to very cold conditions in winter and widespread drought since late September 2017 through to the present time no additional data has been collected from Curries site 2. It has also had some spray drift from cycle trail maintenance.

Site 3 Irrigated Silage continues but has had Potash Sulphur Super applied prior to direct drilling in late March. 2017

Site 4 Irrigated Dairy is abandoned as dairy shed effluent is now applied to the site.

Site 5 Beef Unit continues.

I can say with some certainty that the Biohelp treatments were effective at increasing yield and palatability for at least the first 3 months but this effect is now much less apparent 12 months on within the uncertainty factor of +/- 5% of yield as a precision of estimate for the measuring methods used.

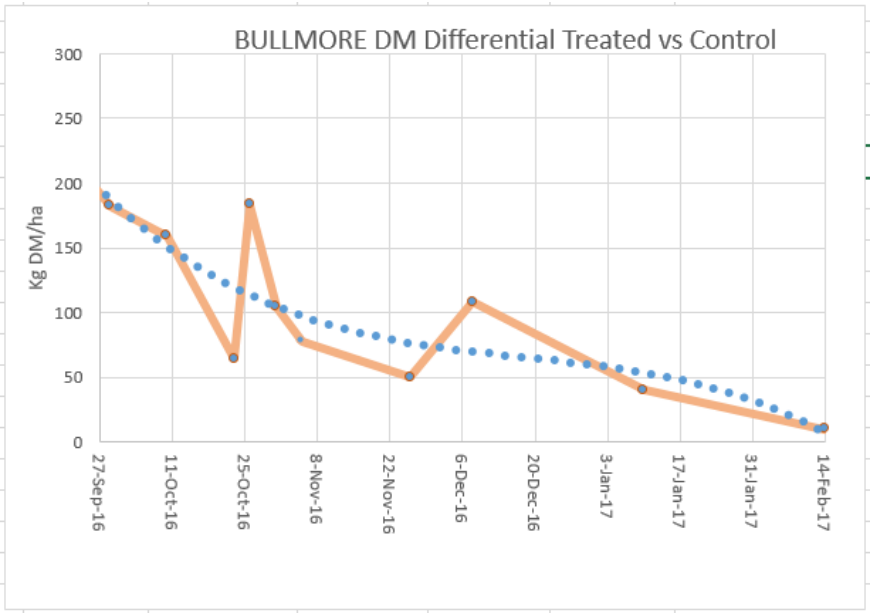
Biohelp can replace urea. By increasing yield, lowering feed protein and reducing nitrate from urine patches it is beneficial to the environment.

Stock initially graze the treated areas first before moving out to the rest of the site.

A full report will be made after April 2018 which will evaluate if any long term responses are measurable during months 6 - 20 after a single application.

PERFORMANCE DATA SUMMARIES

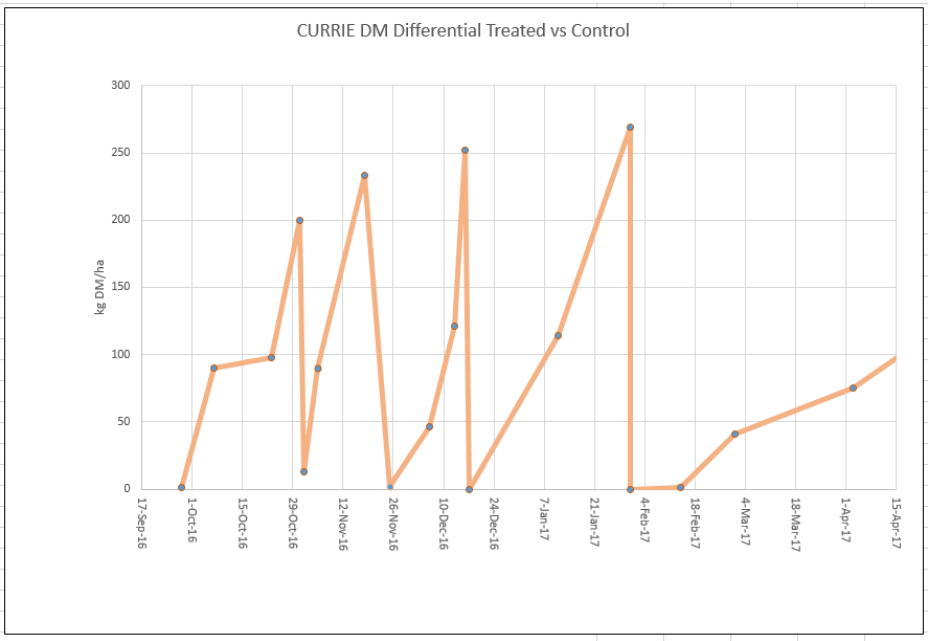
Fig 1



Average standing dry matter was in the order of 650 kg/ha. An increase over control of 6 – 8%.
Grazing:- Ewes with lambs at foot for periods of 1 week on 1 week off.

Trial stopped due to paddock use requirements. Soil Moisture and temps good throughout the reported trial period.
Effectiveness of around 18 weeks on this only example of a Gleyed Soil. Promising start implies follow up applications are required along with some aeration work on the farmers part as this site has very high penetrometer readings.
Organic matter is around 8%.

Fig 2



Average yield for this location was around 1000 kg DM/ha for the treatment which was an improvement over control of 20 -24%

A good result initially but the Nitrogen was rapidly consumed on this dry reserve which due to its roadside location gets little stock grazing or lime and fertilizer input.

These peak yields result after mowing. The site was fenced from stock during this period.

This is significant increase in production.

No further meaningful measurements have been possible due to winter and Drought. (See Met Data at the end of this document.) Growth is less than 1 Kg DM/ha/day

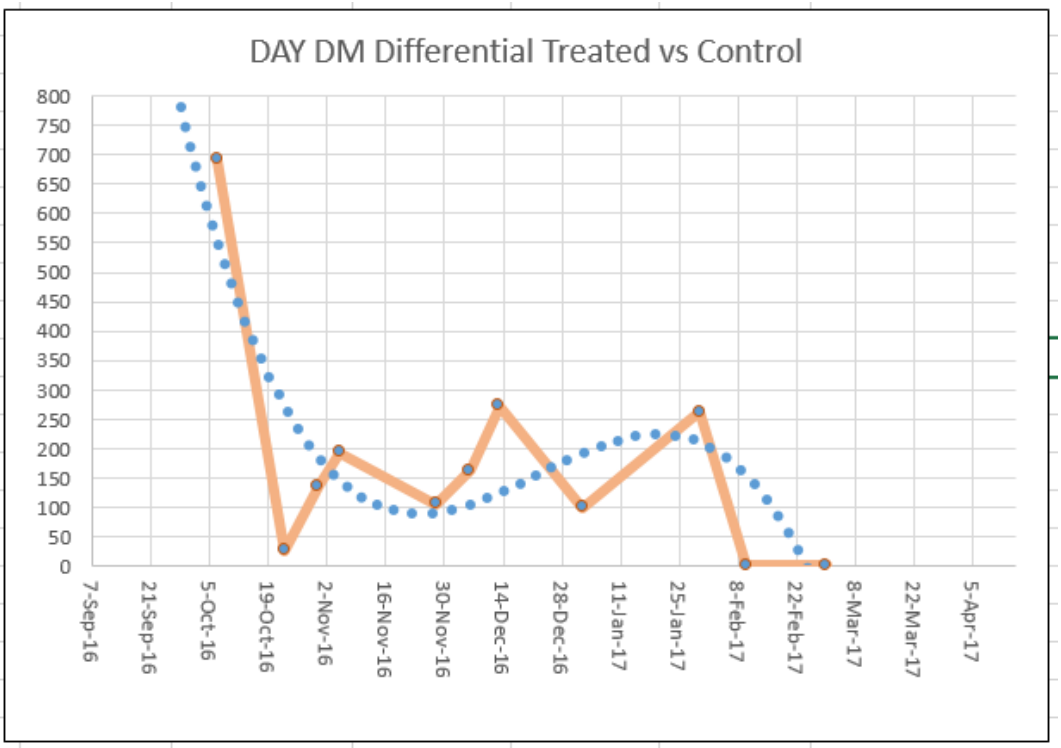
The Roadside control strip of 4 meters width has been affected by spray drift from weed control on the adjacent cycle trail.

The whole site has been in senescence since October 2017.

Soil moisture is still around 50%. Wilting point for this soil is 66%.

Soil Temperature at the end of January is averaging 22’C with a diurnal range of 19 – 25’C with a rate change of 0.5’c/hr. at 10cm depth. The shallow root zone will be much higher. This soil is common in Northern Southland.

Fig 3



Average yield for this location prior to harvest was around 2200 kg DM/ha for the treatment which was an improvement over control of 8 -12%

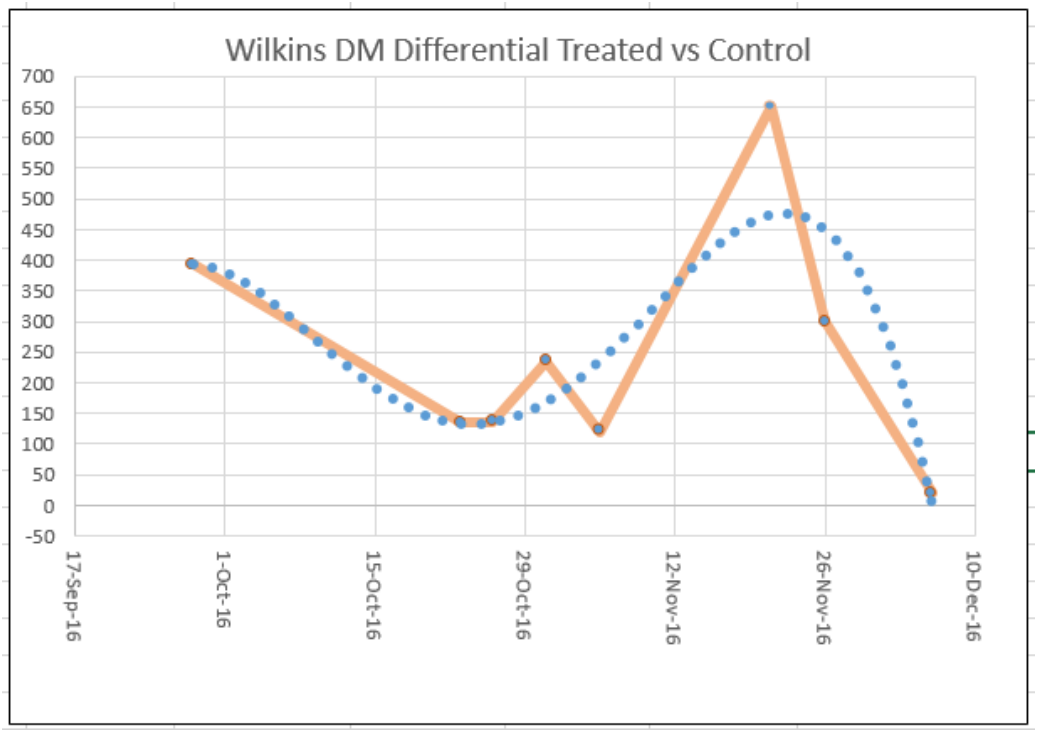
The farm practice is to apply basal fertilizer at the start of the season usually potash Sulphur super. Some urea is used on silage and crop but not on the trial site or 10 meters either side. The trial was applied after this basal application.

The season reported was all irrigated and taken for silage. Residual is around 450kg/ha after baling.

Again, this improved yield is approaching that of the urea treated areas of this paddock.

The effect is similar for a measurement taken late January 2018. I.e. around 200kg over control of 1800kg.

Fig 4



Average yield for this location was around 2400 kg DM/ha for the treatment which was an improvement over control of 18 -22% reflecting the past inputs of urea and some effluent at seasons end.

For the dairy farmer on 30 day rotations and for this 3 months there is a potential for a total additional DM of at least 1000kg from a base of 800kg post grazing. At $0.2 /kg this is an extra $200 worth of a lower Protein pasture more beneficial to milk production and the environment.

This site is abandoned due to a K Line placed through the site for effluent application.

Fig 5 A

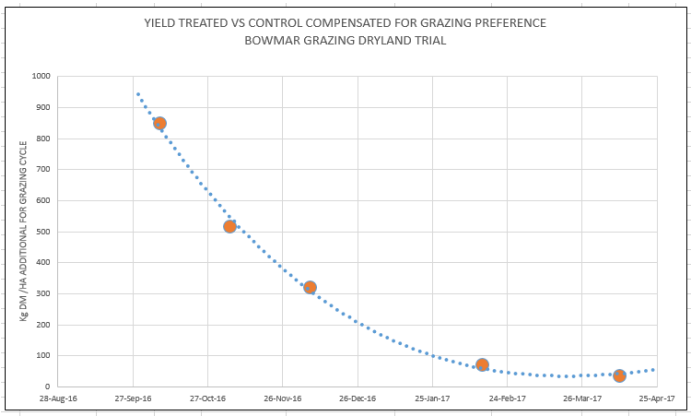
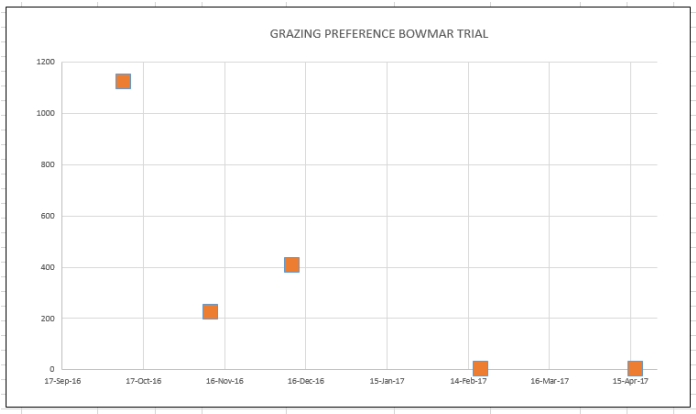
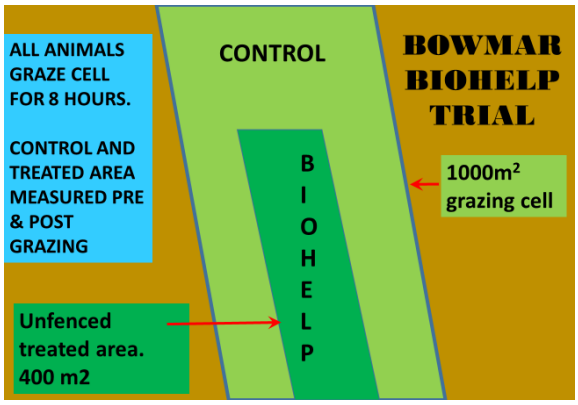


Fig 5B Additional dry matter consumed in treated area vs Control



Average yield for this location was around 3200 kg DM/ha for the treatment which was an improvement over control of 14 -17%. No NPK fertilizer has been applied to this site for 15 years. Small applications of lime flour and trace elements have been applied by air in the recent past.

Grazing is intense for around 6-8 hours on a 40 to 60-day rotation. Yield is measured 1 day prior to grazing and 2 days post grazing inn both areas of the cell.



All animals are introduced to the 1000 M2 cell and have the option to graze the entire area.

Once the animals have started ruminating they will be left for 4 hours and then moved to the next cell.

Grazing preference is the difference between Biohelp consumption and control consumption.

For this site the effect has reduced after each grazing and is not measurable after 4 months from application. The initial 3 months response was very good.

This Beef Rearing site has very high penetrometer readings up to 500 psi. Less than 200 is ideal.

Table 2. EFFECT OF TREATMENT ON SOIL TEMPERATURE.

conrol soil temp					biohelp soil temp		
depth		C’			depth		C’
0-2.5cm		25.2			0-2.5cm		25.3
2.5-5.0cm		21.8			2.5-5.0cm		24.7
5-7.5cm		20.4			5-7.5cm		23.5
7.5-10cm		18.6			7.5-10cm		21.4

A first attempt has been made to investigate soil temperature profiles.

On a first look it would seem that Biohelp has allowed for a temperature increase.

To confirm this a series of investigations is needed.

a/ At least 4 replicates using thermocouples compensated for ambient air temperature.

b/ All measurements to be made simultaneously as soils can change up to 2 degrees / hour depending on depth.

c/ Soil moisture at measurement depth to account for evaporative cooling. More water will provide more cooling.

d/ Canopy height, composition and density. Bare dirt 60’C. Adjacent 15cm cover 18’C.

e/ Grass grub/Worm density.

f/ Soil compaction status.

g/ Organic matter and turf matting differences.

h/ Soil to stone ratio with depth and location.

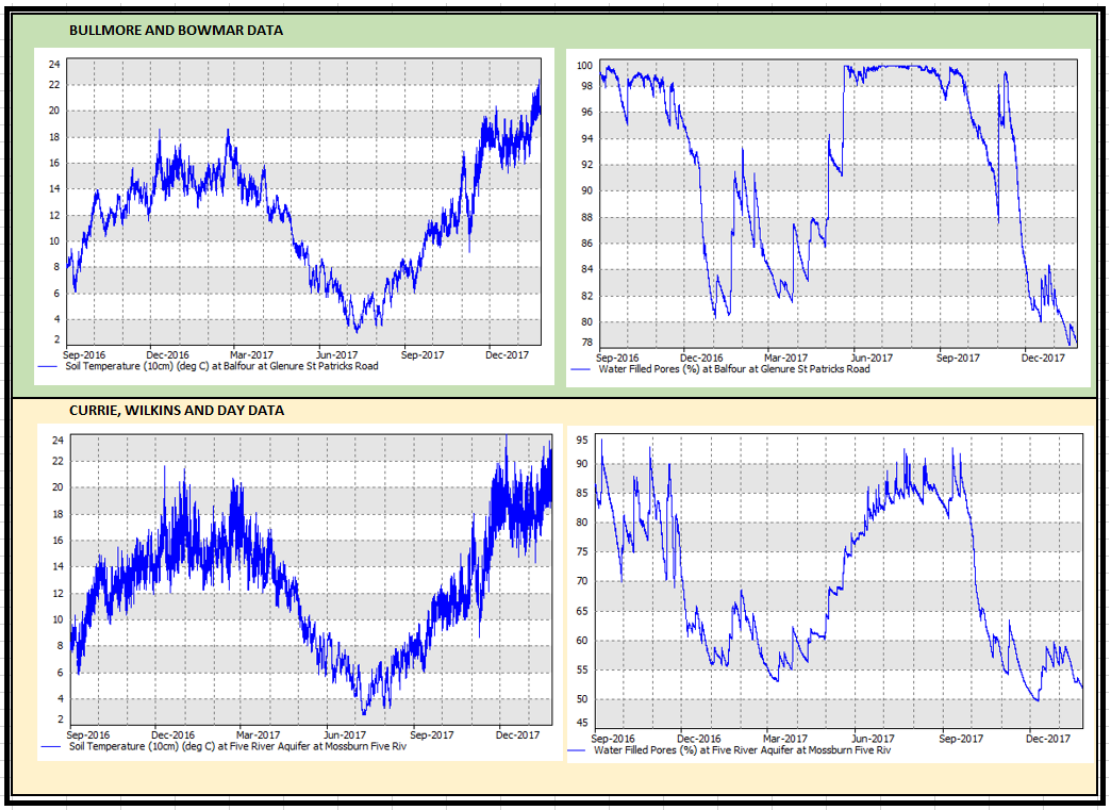
i/ Microbial activity via oxygen consumption measurement.

This will help eliminate obvious variables that confuse the interpretation.

Stan Winter

27 January 2018.

Fig 6 CLIMATE DATA FROM TRIAL COMMENCEMENT TO JANUARY 24th 2018



The two eastern sites have had normal weather with average temperature and soil moisture.

The three Western sites have been above average for soil temperature and 9 out of 17 months of extreme soil water deficit. This demonstrates the value of irrigation for those wishing to farm intensively on these semi-arid soils.

APPENDICES - SUPPORTING RESEARCH

Appendix 1

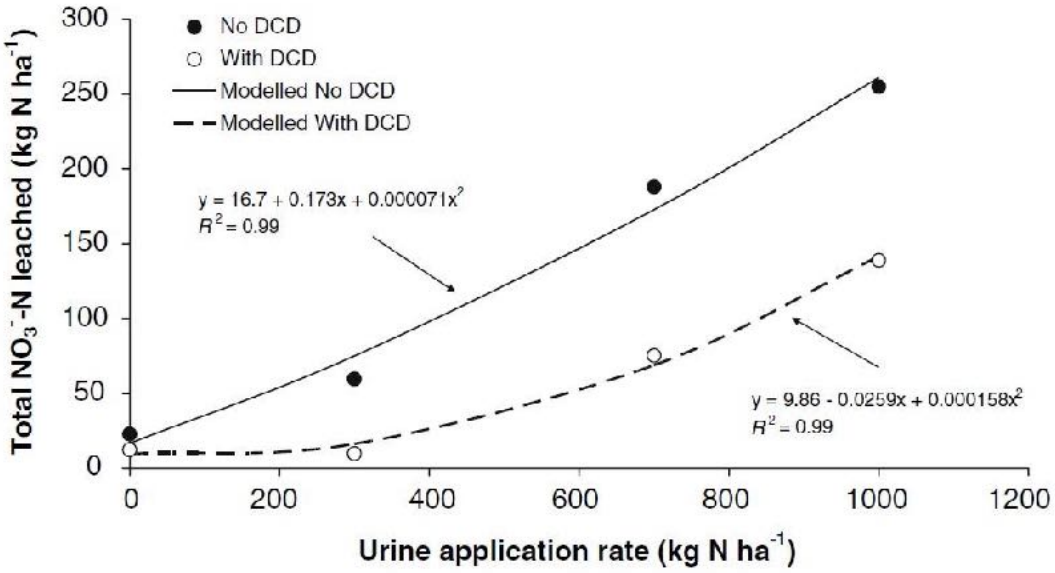
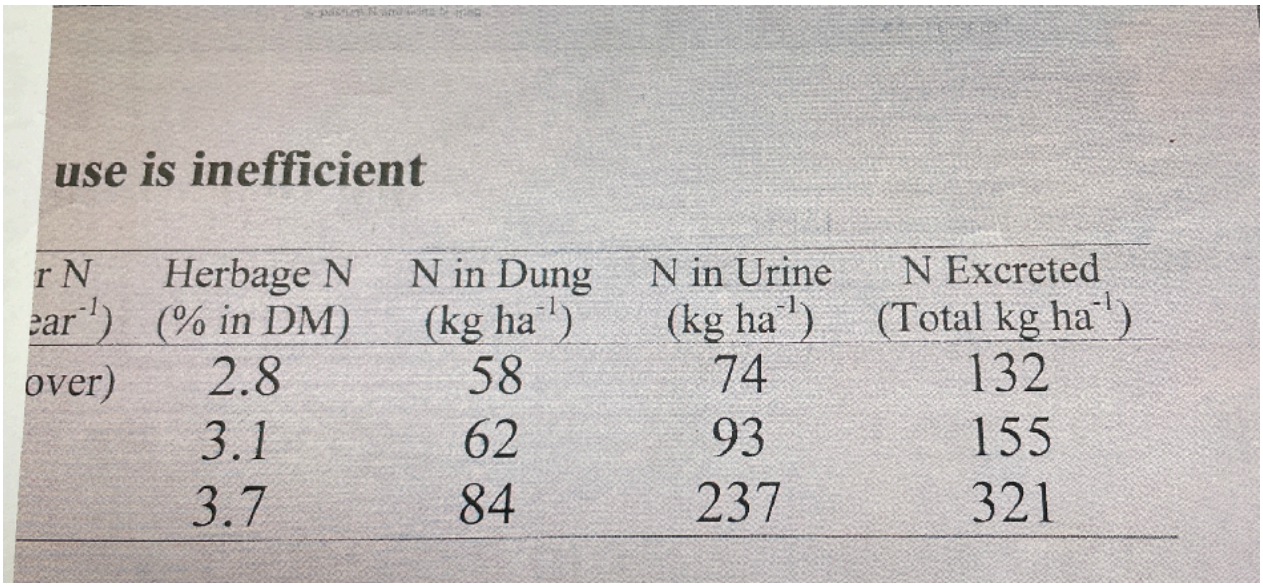


Figure 2.12: Relationships between urine application rate and total nitrate-N leaching loss with and without DCD nitrification inhibitor (Di and Cameron, 2007).

Appendix 2



use is inefficient

r N ear^{-1})	Herbage N (% in DM)	N in Dung (kg ha^{-1})	N in Urine (kg ha^{-1})	N Excreted (Total kg ha^{-1})
over)	2.8	58	74	132
	3.1	62	93	155
	3.7	84	237	321

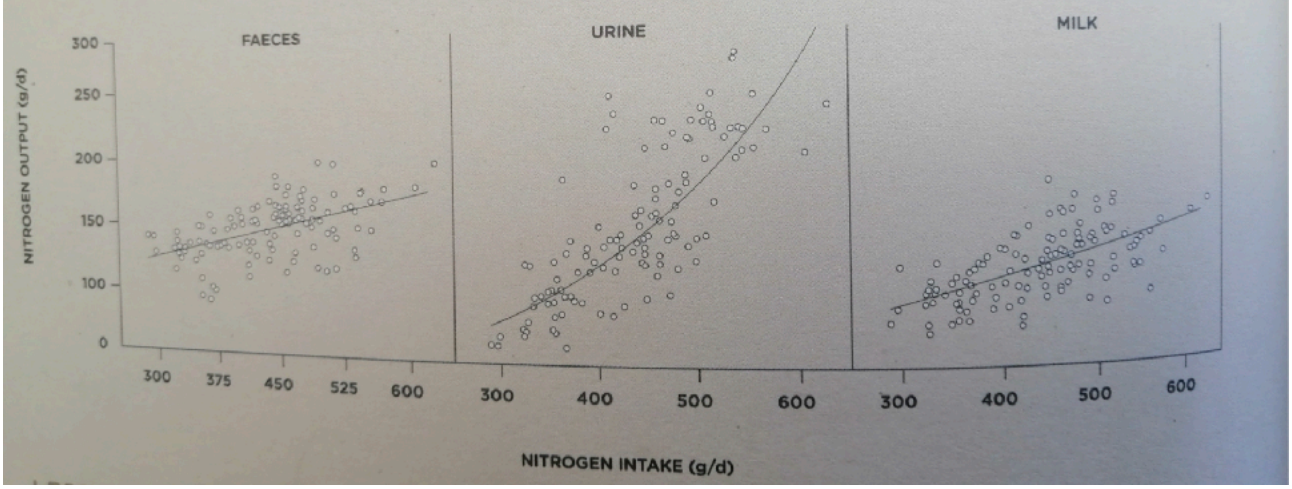
This was the first information I saw relating N in Urine to Herbage N. It was part of a talk by Dr T Jenkins. I'm pretty sure it came from research done in Australia but I haven't been able to find the paper. It was done on steers.

Appendix 3

conclusion is that N p

In normal circumstances the excretion of N in urine is related to N intake (Tas *et al.*, 2006) and is approximately linear. Greater N intake leads to a greater concentration in urine, and to a lesser extent milk and faeces (Figure 3, Kebreab *et al.*, 2001).

Figure 3: Excretion of nitrogen in urine, faeces and milk from dairy cows fed pasture varying in N content.



Appendix 4

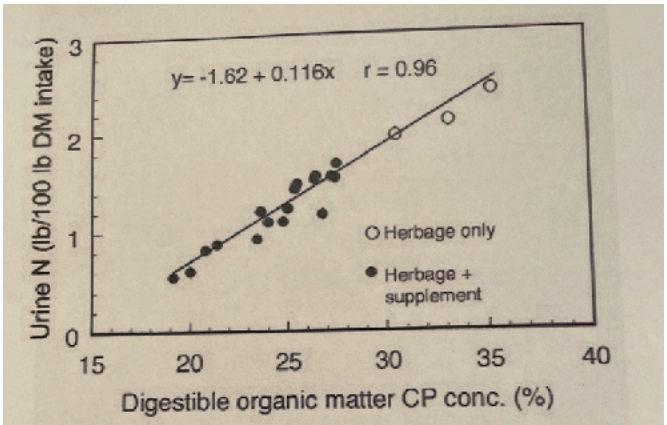


Figure 2. The relationship between N concentration in ingested feed (based on the digestible organic matter of the diet) and N excretion in urine of lactating dairy cows fed freshly cut, highly fertilized herbage or herbage plus different dietary supplements (redrawn from Valk and Hobbelink 1992). Ni-

Both of these graphs show that reducing dietary nitrogen from 4.5% down to 3.2% lowers urine nitrogen approximately 60-70%. The top graph needs to be extrapolated upwards as the dietary nitrogen input per day for a NZ cow consuming 16 kg Dry Matter per day at 4.5% N is 720 gm/day. We estimate the output would be approximately 500 gmN/day in urine. To convert from protein to nitrogen, divide the protein amount by 6.25.

Soil can buffer a certain volume of nitrogen. It's the excess at 500 gm above the buffering capacity which causes the leaching.

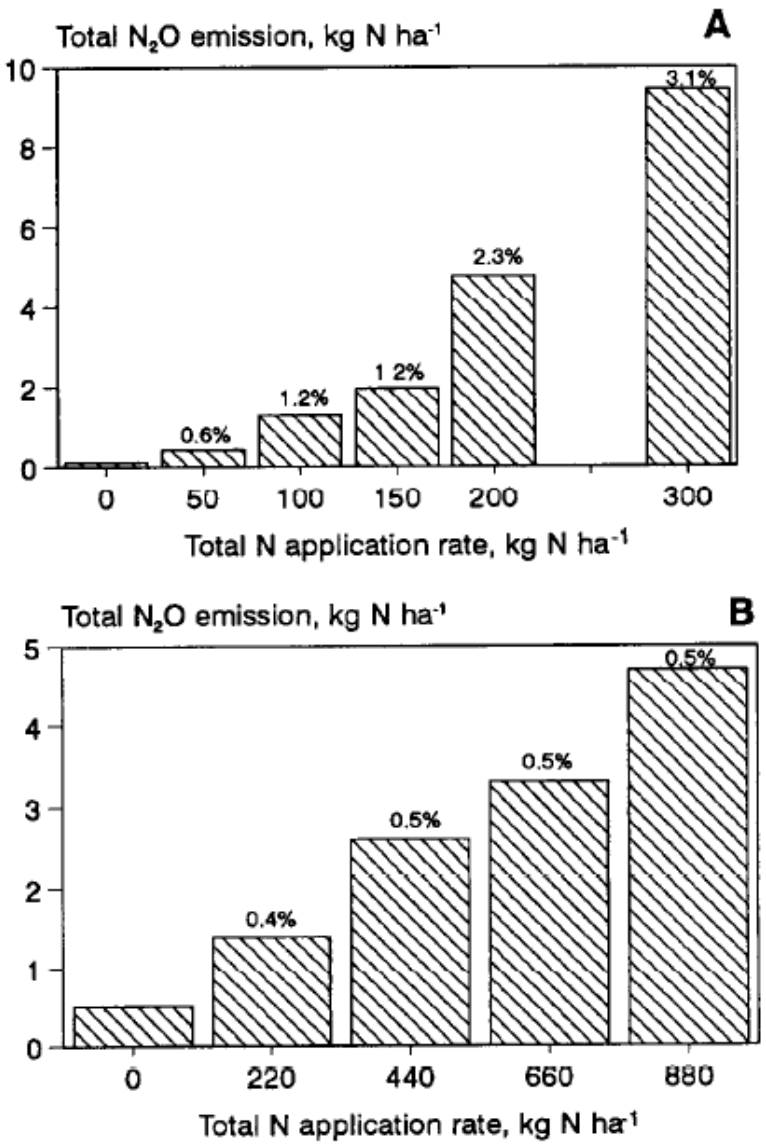


Figure 2.13 : The relationship between total N application rate and total N_2O emission from grassland, A = single Spring CAN application, B = split CAN application. Percentage of applied fertiliser N emitted as N_2O presented above bars (Velthof *et al*., 1997).

What this data indicates is that if you have a urine patch that has the equivalent of 300kg Nitrogen per hectare, ie a single application of N shown in graph 'A', then it will produce 8 times more nitrous oxide than a urine patch with 100 kgN/ha.

NZ cows have been assumed to all excrete urine at 500-1000 kgN/ha from a single application. Given graph A looks exponential in shape, there might be a 20 fold difference between 500 kg and 100 kgN/ha.

All NZ farms have been treated the same with respect to emissions from urine patches. Fonterra have a standard number supplied by MPI for 518 kgN_2O/cow/yr.