

BEFORE THE ENVIRONMENT COURT

ENV-2010-WLG-000148

UNDER the Resource Management Act 1991

IN THE MATTER of an appeal under Clause 14 of the First Schedule to the Act

BETWEEN **FEDERATED FARMERS OF NEW ZEALAND**

APPELLANT

AND **MANAWATU-WANGANUI REGIONAL COUNCIL**

RESPONDENT

EVIDENCE OF HEW JOHN TREVOR DALRYMPLE

Federated Farmers of New Zealand
159 Khyber Pass
Private Bag 92-066
AUCKLAND 1142
Phone (09) 379-0057
Fax: (09) 379-0782
Contact Person: Richard Gardner

Introduction

1. My name is Hew John Trevor Dalrymple. I hold a Diploma of Agriculture from Lincoln University (1982).
2. I am a farmer and a shareholder of the Waitatapia station which comprises 3 separate blocks. Cropping is carried out on a total of 700 ha, forestry comprises approximately 400 ha, pasture contributes a further 1330 ha with the remaining 57 ha made up of lakes, restored wetlands and tracks. The farm has been in the family for 5 generations with each generation making contributions to our on-going success as a farming business. Our farm was awarded the supreme winners of the Ballance Farm Environment Awards in 2007.
3. I am also the current vice-chairman of the Federated Farmers of New Zealand Grain and Seed Industry Group, a board member of Landwise, which is a research and development company focused on arable and commercial vegetable production, the chairman of the Bulls community committee, a trustee of the Westhoe Farm Training Trust, a board member of the Royal Ohakea Visitors Centre Trust, a member of the Arable Industries Marketing Initiative (AIMI), and a member of Foundation for Arable Research (FAR). I am an invited guest lecturer to Massey University Environmental Studies students, in conjunction with Marco Amarti, who is now based in Sydney. We also routinely host both national and international visitors to our farm in conjunction with Massey University in order to showcase current best management practices for farming.
4. I believe the breadth of my involvement with research organisations and the wider community gives me the perspective to usefully describe for the Court what is possible and appropriate for the farm that my family has run over the last 100 years.

Scope of Evidence

5. In this evidence I describe from my own experience the potential for productively on what may be deemed fragile soils of the sand country. Because of the nature of these light sandy soils effective management

strategies which preserve the integrity of these soils is vital to the on-going success of our farming business.

Waitatapia Station's Farming Business

6. We have operated minimum tillage and direct drilling techniques for many years, we routinely use Global Positioning Systems / Real Time Kinematics (GPS/RTK) to manage fertiliser applications, spray applications, root zone water monitoring and management, comprehensive drainage management and targeted nutrient applications for maximum crop utilisation. We have also carried out extensive planting and stabilisation of dunes.
7. We have undertaken irrigation development in conjunction with Landcare Research and Dr Carolyn Hedley, who is based in Palmerston North, investigating water management in irrigated sand country, the management of water table heights and Variable Rate Irrigation, which have all contributed to our ability to get just what the crop needs, where it needs it, and at the appropriate time throughout the growing season. Overcoming limitations and working with the farm's natural advantages is the key to sustainable farming into the future.
8. I believe that using Land Use Capability (LUC) classes is a flawed mechanism for determining cumulative nitrogen leaching maximums. This is based on the ratings that are given to the sand country that I farm and given the performance that these sandy soils can achieve with good management and modern farming systems.
9. Evidence that we have from our farming practices shows that our sand country soils perform at least as well as, and in some instances better than, the Ohakea silt soils which are determined to be LUC class III according to a Landcare Research Contract Report: LC0910/050 commissioned by Horizons Regional Council and dated December 2009.
10. In May 2011 Landvision Ltd carried out a soils and LUC survey on one of our farm blocks. The determination of soil classes on this farm block as outlined in this report show a mix of soil classes with the highest LUC of III and the lowest LUC of VIII.

11. This report goes on to further elaborate on the impact that LUC may have on the cumulative N leaching losses permitted by Horizons and based upon the LUC classes of the soil. Based on the Table 13.2 cumulative N loss targets as outlined in the decisions version of the proposed One Plan (DV POP) the N leaching loss limit for my farm, based on the LUC mix, is averaged in this Landvision report at a value of 19 kg N ha yr. This N leaching loss value is very close to the cumulative N leaching loss limit for LUC class IV soils which is allocated a cumulative N leaching loss limit of 18 kg N ha yr in Table 13.2 (DV POP). When compared to the more generous allowance for cumulative N leaching loss for class III soils at 24kg N ha yr. The advantages of having an LUC of III compared to IV are clear if regulation is to be based on LUCs and the cumulative N loss limits assigned as determined under Table 13.2 of the DV POP.
12. In appendix 1 attached to this evidence the maize yield from a sand country block is presented. These data show that there is a large area shaded purple illustrating a yield average in these locations as above 19 t/grain/ha. These yield data correspond to the soil test results presented in appendix 2 (sample name No.1 pivot – good). This gives evidence to the average nature of base fertility in this area which in general is quite low. This area had no additional fertiliser over the rest of the paddock and the soil tests were carried out post harvest.
13. By comparison the average yield on a silt block (appendix 3) can be seen to be similar to that recorded on the sand country (appendix 1) however the proportion of the silt block which delivers the peak yield of above 19 t/grain/ha is generally less than that recorded for the sand block when you compare the level of purple shaded area between the yield maps.
14. This reduced peak yield has occurred despite the base nutrient level in these silt soils being considerably higher than those recorded for the sand country. Appendix 4 and 5 contain the soil test results for the silt. Two different data sets of soil test results are presented here. Appendix 4 for the 2009 season where the format is the same as that presented for the sand soils for 2011 (appendix 2) whereas the 2011 data for the silts (appendix 5) is presented along with other unrelated data from other farms (samples pine 1-5 are for

the silt soils corresponding to yields presented in appendix 3). Both sets of data have been presented in the interests of transparency for the reader.

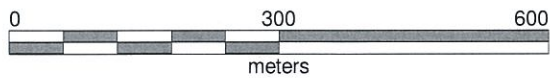
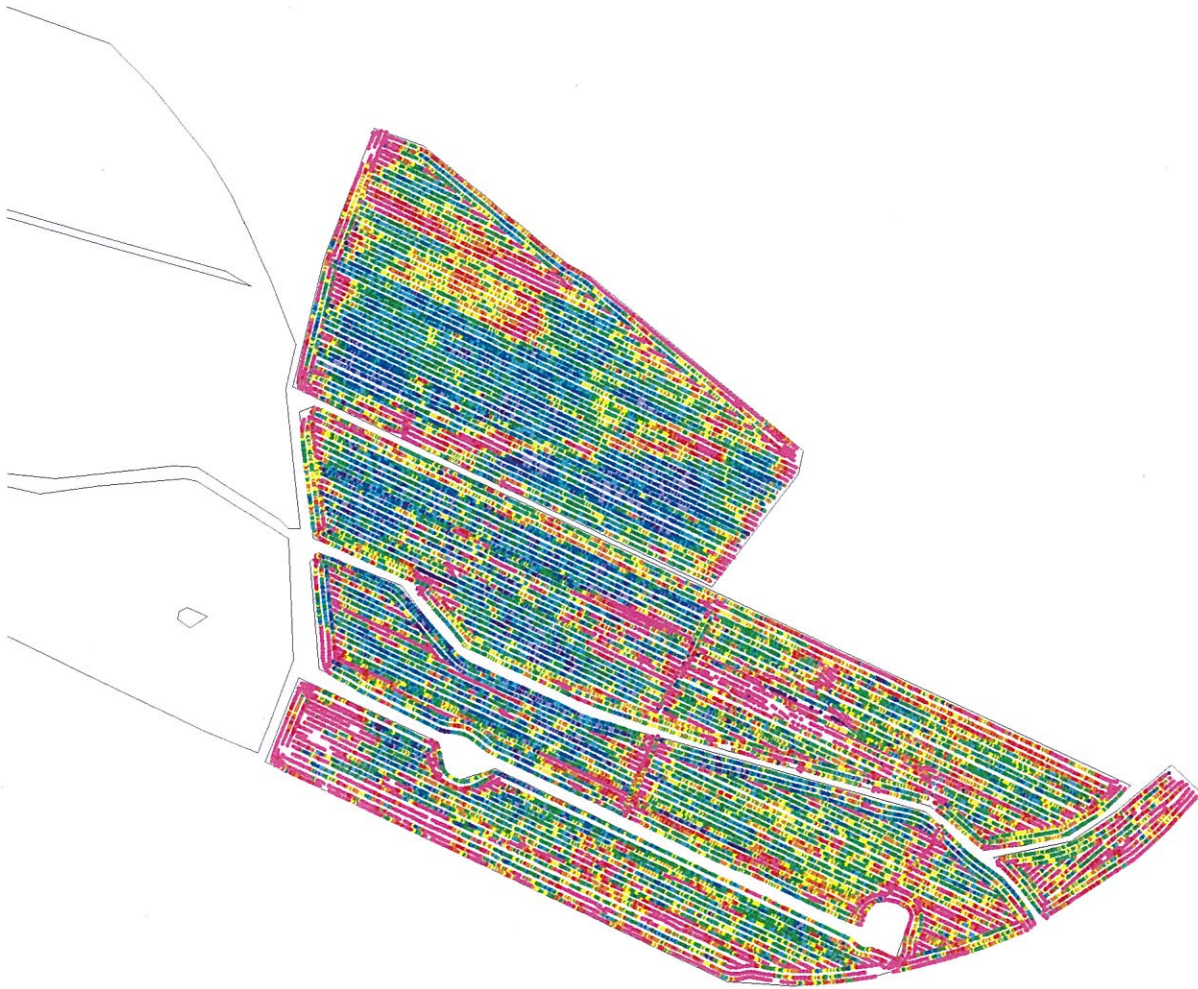
15. In the cases of both blocks, sand and silt, additional nutrient were applied to satisfy the plants needs and were applied at equivalent levels for both blocks. In 2011 this was based on 14t/ha of grain removed at harvest.
16. So despite the sand being classified as having a lower LUC class these data show that the sands have performed at least as well as and in some cases better than the silt soils which are evaluated as having a higher LUC class.
17. All soils are tested every year to maximise nutrient use efficiency. It is critical to the long term sustainability of our farming enterprise that soil nutrient status and the resulting plant performance is tightly controlled. Tightly controlled systems maximise the efficient use of the significant investments made in fertilisers.
18. These data illustrate the point I wish to make with my evidence, that is that sandy soils, if managed well, can out-perform other soils that are deemed more versatile due to their LUC class.

Hew Dalrymple

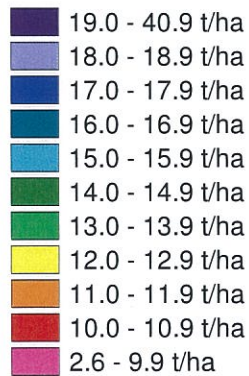
March 2012

Appendix 1

No.1 Maize 2011



Client : Hew Dalrymple
Farm : Waitatapia
Field : No. 1
Crop : Maize 2011
Area : 46 ha
Avg : 13.3 t/ha



Appendix 2



ANALYSIS REPORT Page 1 of 5

Client: Waitatapia Station	Lab No: 901824 shvpv1
Address: C/- H & R Dalrymple Dalrymple Road RD 1 BULLS 4894	Date Registered: 01-Jun-2011
Phone: 06 322 1018	Date Reported: 09-Jun-2011
	Quote No:
	Order No:
	Client Reference:
	Submitted By: K Cooney

Sample Name: No1 Pivot Good **Lab Number:** 901824.1
Sample Type: SOIL Maize (150mm) (S6)

Analysis	Level Found	Medium Range	Low	Medium	High	
pH	pH Units	7.0	5.6 - 6.2			
Olsen Phosphorus	mg/L	10	15 - 30			
Potassium	me/100g	0.09	0.40 - 0.60			
Calcium	me/100g	11.4	5.0 - 12.0			
Magnesium	me/100g	0.84	0.60 - 1.20			
Sodium	me/100g	0.10	0.00 - 0.50			
CEC	me/100g	12	12 - 25			
Total Base Saturation	%	100	50 - 85			
Volume Weight	g/mL	1.05	0.60 - 1.00			
Sulphate Sulphur	mg/kg	2	10 - 15			
Available Nitrogen (15cm Depth)*	kg/ha	85	100 - 150			
Anaerobically Mineralisable N*	µg/g	54				
Organic Matter*	%	5.8	7.0 - 17.0			
Total Carbon*	%	3.4				
Total Nitrogen*	%	0.35	0.30 - 0.60			
C/N Ratio*		9.8				
Anaerobically Mineralisable N/Total N Ratio*	%	1.6				
Soil Sample Depth*	mm	0-150				
Base Saturation %		K 0.7 Ca 92 Mg 6.8 Na 0.8				
MAF Units		K < 2 Ca 15 Mg 20 Na 5				

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.

Analyst's Comments

The Available Nitrogen (kg/ha) test above assumes the sample is taken to a 15 cm depth. If the depth is 7.5 cm, then the level above should be divided by two.



This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised. The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.



ANALYSIS REPORT Page 2 of 5

Client: Waitatapia Station	Lab No: 901824 shvpv1
Address: C/- H & R Dalrymple Dalrymple Road RD 1 BULLS 4894	Date Registered: 01-Jun-2011
Phone: 06 322 1018	Date Reported: 09-Jun-2011
	Quote No:
	Order No:
	Client Reference:
	Submitted By: K Cooney

Sample Name: No1 Pivot Poor **Lab Number:** 901824.2
Sample Type: SOIL Maize (150mm) (S6)

Analysis	Level Found	Medium Range	Low	Medium	High	
pH	pH Units	6.1	5.6 - 6.2			
Olsen Phosphorus	mg/L	28	15 - 30			
Potassium	me/100g	0.14	0.40 - 0.60			
Calcium	me/100g	3.8	5.0 - 12.0			
Magnesium	me/100g	0.36	0.60 - 1.20			
Sodium	me/100g	0.06	0.00 - 0.50			
CEC	me/100g	7	12 - 25			
Total Base Saturation	%	60	50 - 85			
Volume Weight	g/mL	1.20	0.60 - 1.00			
Sulphate Sulphur	mg/kg	< 1	10 - 15			
Available Nitrogen (15cm Depth)*	kg/ha	117	100 - 150			
Anaerobically Mineralisable N*	µg/g	65				
Organic Matter*	%	3.8	7.0 - 17.0			
Total Carbon*	%	2.2				
Total Nitrogen*	%	0.23	0.30 - 0.60			
C/N Ratio*		9.5				
Anaerobically Mineralisable N/Total N Ratio*	%	2.8				
Soil Sample Depth*	mm	0-150				
Base Saturation %		K 1.9 Ca 52 Mg 4.9 Na 0.8				
MAF Units		K 3 Ca 6 Mg 10 Na 3				

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.

Analyst's Comments

The low CEC level found in this soil indicates that it can only retain cation nutrients (potassium, calcium, magnesium and sodium) at low levels. The normal ranges and the derived histograms are based on a typical soil with a CEC level between 12 and 25 me/100g. The % base saturation data for each element provides an alternative presentation that may be more appropriate for soils with atypical CEC values. Normal %BS levels, as a general guide, are: K 2%-5%, Ca 50%-75%, Mg 5%-15%, Na 1%-2%.

The Available Nitrogen (kg/ha) test above assumes the sample is taken to a 15 cm depth. If the depth is 7.5 cm, then the level above should be divided by two.



ANALYSIS REPORT

Client:	Waitatapia Station	Lab No:	901824	shvpv1
Address:	C/- H & R Dalrymple Dalrymple Road RD 1 BULLS 4894	Date Registered:	01-Jun-2011	
Phone:	06 322 1018	Date Reported:	09-Jun-2011	
		Quote No:		
		Order No:		
		Client Reference:		
		Submitted By:	K Cooney	

Soil Analysis Results

Sample Name:		No1 Pivot Good	No1 Pivot Poor			
Lab Number:		901824.1	901824.2			
Sample Type:		SOIL Maize (150mm)	SOIL Maize (150mm)			
Sample Type Code:		S6	S6			
pH	pH Units	7.0	6.1	-	-	-
Olsen Phosphorus	mg/L	10	28	-	-	-
Potassium	me/100g	0.09	0.14	-	-	-
Potassium	%BS	0.7	1.9	-	-	-
Potassium	MAF units	< 2	3	-	-	-
Calcium	me/100g	11.4	3.8	-	-	-
Calcium	%BS	92	52	-	-	-
Calcium	MAF units	15	6	-	-	-
Magnesium	me/100g	0.84	0.36	-	-	-
Magnesium	%BS	6.8	4.9	-	-	-
Magnesium	MAF units	20	10	-	-	-
Sodium	me/100g	0.10	0.06	-	-	-
Sodium	%BS	0.8	0.8	-	-	-
Sodium	MAF units	5	3	-	-	-
CEC	me/100g	12	7	-	-	-
Total Base Saturation	%	100	60	-	-	-
Volume Weight	g/mL	1.05	1.20	-	-	-
Sulphate Sulphur	mg/kg	2	< 1	-	-	-
Available Nitrogen (15cm Depth)*	kg/ha	85	117	-	-	-
Anaerobically Mineralisable N*	µg/g	54	65	-	-	-
Organic Matter*	%	5.8	3.8	-	-	-
Total Carbon*	%	3.4	2.2	-	-	-
Total Nitrogen*	%	0.35	0.23	-	-	-
C/N Ratio*		9.8	9.5	-	-	-
Anaerobically Mineralisable N/Total% N Ratio*		1.6	2.8	-	-	-
Soil Sample Depth*	mm	0-150	0-150	-	-	-

ANALYSIS REPORT

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Client: Waitatapia Station	Lab No: 901824	shvpv1
Address: C/- H & R Dalrymple Dalrymple Road RD 1 BULLS 4894	Date Registered: 01-Jun-2011	
	Date Reported: 09-Jun-2011	
	Quote No:	
	Order No:	
Phone: 06 322 1018	Client Reference:	
	Submitted By: K Cooney	

Analyst's Comments

The Available Nitrogen (kg/ha) test above assumes the sample is taken to a 15 cm depth. If the depth is 7.5 cm, then the level above should be divided by two.

The low CEC level found in this soil indicates that it can only retain cation nutrients (potassium, calcium, magnesium and sodium) at low levels. The normal ranges and the derived histograms are based on a typical soil with a CEC level between 12 and 25 me/100g. The % base saturation data for each element provides an alternative presentation that may be more appropriate for soils with atypical CEC values. Normal %BS levels, as a general guide, are: K 2%-5%, Ca 50%-75%, Mg 5%-15%, Na 1%-2%.

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: Soil			
Test	Method Description	Default Detection Limit	Samples
Sample Registration*	Samples were registered according to instructions received.	-	1-2
Soil Prep (Dry & Grind)*	Air dried at 35 - 40°C overnight (residual moisture typically 4%) and crushed to pass through a 2mm screen.	-	1-2
pH	1:2 (v/v) soil:water slurry followed by potentiometric determination of pH.	0.1 pH Units	1-2
Olsen Phosphorus	Olsen extraction followed by Molybdenum Blue colorimetry.	1 mg/L	1-2
Sulphate Sulphur	0.02M Potassium phosphate extraction followed by Ion Chromatography.	1 mg/kg	1-2
Potassium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	2 MAF units	1-2
Calcium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	2 MAF units	1-2
Magnesium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	2 MAF units	1-2
Sodium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	2 MAF units	1-2
Available Nitrogen*	Determined by NIR, calibration based on Available N by Anaerobic incubation followed by extraction using 2M KCl followed by Berthelot colorimetry. (Calculation based on 15cm depth sample).	1 mg/L	2
Available Nitrogen	Anaerobic incubation followed by extraction using 2M KCl followed by Berthelot colorimetry. (Calculation based on 15cm depth sample).	1 mg/L	1
Anaerobically Mineralisable N*	As for Available Nitrogen but reported as µg/g.	5 µg/g	1-2
Organic Matter*	Organic Matter is 1.72 x Total Carbon.	0.2 %	1-2
Total Carbon*	Determined by NIR, calibration based on Total Carbon by Dumas combustion.	0.1 %	1-2
Total Nitrogen*	Determined by NIR, calibration based on Total N by Dumas combustion.	0.04 %	1-2
Potassium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.01 me/100g	1-2
Calcium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.5 me/100g	1-2
Magnesium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.04 me/100g	1-2
Sodium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.05 me/100g	1-2
Potassium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.1 %BS	1-2
Calcium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	1 %BS	1-2



ANALYSIS REPORT

Client: Waitatapia Station	Lab No: 901824	shvpv1
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	Date Reported: 09-Jun-2011	
	Quote No:	
	Order No:	
Phone: 06 322 1018	Client Reference:	
	Submitted By: K Cooney	

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Samples
Magnesium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.2 %BS	1-2
Sodium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.1 %BS	1-2
CEC	Summation of extractable cations (K, Ca, Mg, Na) and extractable acidity.	2 me/100g	1-2
Total Base Saturation	Calculated from Extractable Cations and Cation Exchange Capacity.	5 %	1-2
Volume Weight	The weight/volume ratio of dried, ground soil.	0.01 g/mL	1-2

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

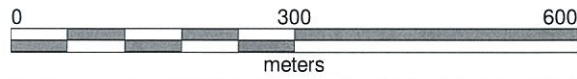
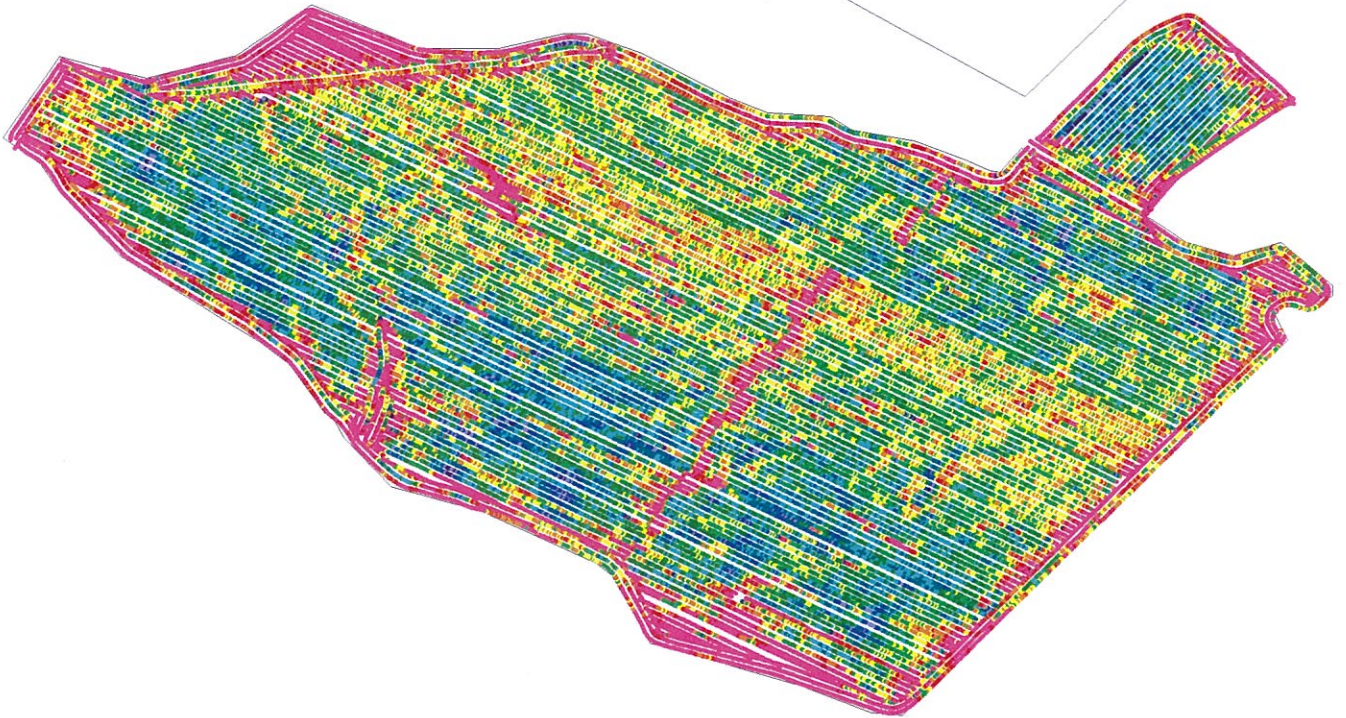
Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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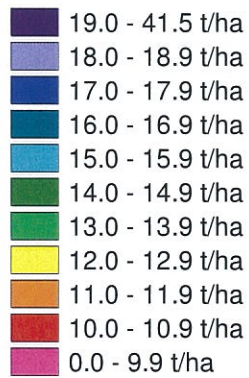
Gordon Rajendram PhD
Senior Technologist - Agriculture Division

Appendix 3

Russells - Pines Maize 2011



Client : Hew Dalrymple
Farm : Waitatapia
Field : Russells - Pines
Crop : Maize 2011
Area : 61 ha
Avg : 13.3 t/ha



Appendix 4



ANALYSIS REPORT Page 1 of 4

Client: Waitatapia Station	Lab No: 724604 shpv1
Address: C/- H & R Dalrymple RD 1 BULLS 4894	Date Registered: 09-Sep-2009
	Date Reported: 14-Sep-2009
	Quote No:
	Order No:
	Client Reference:
	Submitted By: Waitatapia Station

Sample Name: Russells/Pines **Lab Number:** 724604.1
Sample Type: SOIL Wheat (S154)

Analysis	Level Found	Medium Range	Low	Medium	High	
pH	pH Units	6.4	5.7 - 6.2			
Olsen Phosphorus	mg/L	37	20 - 30			
Potassium	me/100g	0.51	0.30 - 0.60			
Calcium	me/100g	8.2	5.0 - 12.0			
Magnesium	me/100g	0.84	0.60 - 1.20			
Sodium	me/100g	0.10	0.00 - 0.50			
CEC	me/100g	14	12 - 25			
Total Base Saturation	%	69	50 - 85			
Volume Weight	g/mL	0.93	0.60 - 1.00			
Sulphate Sulphur	mg/kg	3	10 - 15			
Base Saturation %		K 3.6 Ca 59 Mg 6.0 Na 0.7				
MAF Units		K 10 Ca 10 Mg 18 Na 4				

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.

Analyst's Comments
For high potential yield crops, desirable soil test levels for nutrients are towards the top of the medium or optimum range.





ANALYSIS REPORT Page 2 of 4

Client: Waitatapia Station	Lab No: 724604 shpr1
Address: C/- H & R Dalrymple RD 1 BULLS 4894	Date Registered: 09-Sep-2009
	Date Reported: 14-Sep-2009
	Quote No:
	Order No:
	Client Reference:
	Submitted By: Waitatapia Station

Sample Name: Russells/Pines (0-45cm) **Lab Number:** 724604.2
Sample Type: SOIL Wheat (S154)

Analysis	Level Found	Medium Range	Low	Medium	High
Ammonium-N* mg/kg	3				
Nitrate-N* mg/kg	5				
Mineral N (sum)* mg/kg	8				
Dry Matter* %	79.0				
Sample Temperature on Arrival* °C	2.6				
Soil Sample Depth*	0-400 mm				

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.

Analyst's Comments
 For high potential yield crops, desirable soil test levels for nutrients are towards the top of the medium or optimum range.



ANALYSIS REPORT

Page 3 of 4

Client: Waitatapia Station	Lab No: 724604	shpv1
Address: C/- H & R Dalrymple RD 1 BULLS 4894	Date Registered: 09-Sep-2009	
	Date Reported: 14-Sep-2009	
	Quote No:	
	Order No:	
	Client Reference:	
	Submitted By: Waitatapia Station	

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: Soil			
Test	Method Description	Default Detection Limit	Samples
Sample Registration*	Samples were registered according to instructions received.	-	1-2
Soil Prep (Dry & Grind)*	Air dried at 35 - 40°C overnight (residual moisture typically 4%) and crushed to pass through a 2mm screen.	-	1
pH	1:2 (v/v) soil:water slurry followed by potentiometric determination of pH.	0.1 pH Units	1
Olsen Phosphorus	Olsen extraction followed by Molybdenum Blue colorimetry.	1 mg/L	1
Sulphate Sulphur	0.01M Calcium phosphate extraction followed by Ion Chromatography.	1 mg/kg	1
Potassium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	2 MAF units	1
Calcium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	2 MAF units	1
Magnesium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	2 MAF units	1
Sodium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	2 MAF units	1
Ammonium-N*	Analysed on an 'as received' fraction but reported on a dry weight basis. 2M KCl extraction followed by Berthelot colorimetry.	1 mg/kg	2
Nitrate-N*	Analysed on an 'as received' fraction but reported on a dry weight basis. 2M KCl extraction followed by Cd reduction and NED colorimetry.	1 mg/kg	2
Mineral N (sum)*	Sum of Nitrate-N and Ammonium-N, calculated on a dry weight basis.	2 mg/kg	2
Dry Matter*	Weight loss on drying at 105°C for 24 hours.	0.5 %	2
Sample Temperature on Arrival*	Temperature of soil on arrival.	-40.5 °C	2
Potassium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.01 me/100g	1
Calcium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.5 me/100g	1
Magnesium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.04 me/100g	1
Sodium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.05 me/100g	1
Potassium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.1 %BS	1
Calcium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	1 %BS	1
Magnesium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.2 %BS	1
Sodium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.1 %BS	1
CEC	Summation of extractable cations (K, Ca, Mg, Na) and extractable acidity.	2 me/100g	1
Total Base Saturation	Calculated from Extractable Cations and Cation Exchange Capacity.	5 %	1
Volume Weight	The weight/volume ratio of dried, ground soil.	0.01 g/mL	1

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.

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Wendy Homewood
Quality Assurance Officer - Agriculture Division

Appendix 5



Laboratory Report

Client:

Ian Yule
Institute of Natural Resources
Massey University

FAR Project

Date: 26/08/11

Type of material: Soil

ANALYSES:

SAMPLE	pH	Olsen P µgP/g	SO ₄ µgS/g	K me/100g	Ca me/100g	Mg me/100g	Na me/100g	CEC me/100g	Soil volume g/ml
Dal Rd 1	6.2	56.3	6.5	1.15	12.6	1.00	0.13	19	1.04
Dal Rd 2	6.2	70.2	6.0	1.26	12.2	1.21	0.09	19	1.02
Dal Rd 3	6.5	53.0	12.5	1.56	13.4	1.29	0.09	20	1.03
Pines 1	6.1	45.1	3.0	0.79	9.4	1.09	0.09	15	1.09
Pines 2	6.2	40.9	2.0	1.11	10.4	1.31	0.15	17	1.05
Pines 3	6.1	44.0	3.0	0.99	11.5	1.39	0.11	18	1.02
Pines 4	6.4	33.0	1.0	0.68	7.6	0.70	0.07	19	1.20
Pines 5	6.2	36.3	8.0	0.82	13.3	1.18	0.11	19	1.06
Wilcox 1	6.5	12.6	39.0	0.44	20.4	1.17	0.09	26	0.81
Wilcox 2	6.1	17.2	47.0	0.37	11.2	0.40	0.09	27	0.81
Wilcox 3	6.4	12.6	50.5	0.70	14.3	0.44	0.05	27	0.79
Wilcox 4	6.5	15.3	27.0	0.44	20.2	1.28	0.07	32	0.81

Phosphate and sulphate values are expressed as µg/g (air-dry). Exchangeable cations and CEC values are expressed as me/100g (air-dry).

Soil volume is a measure of the weight of air-dry soil (g) per volume (ml) and can be used to convert results to a volume basis.

CONVERSION TO MAF 'QUICK TEST' VALUES:

SAMPLE	P µgP/ml	SO4 µgS/g	K	Ca	Mg
Dal Rd 1	58	7	19	15	24
Dal Rd 2	72	6	20	14	28
Dal Rd 3	54	13	25	16	30
Pines 1	49	3	14	12	27
Pines 2	43	2	18	13	32
Pines 3	45	3	16	13	33
Pines 4	40	1	13	11	19
Pines 5	38	8	14	16	29
Wicox 1	10	39	6	19	22
Wilcox 2	14	47	5	10	7
Wilcox 3	10	51	9	13	8
Wilcox 4	12	27	6	19	24

**ADDITIONAL
ANALYSES:**

P Ret %	Total C %	Total N %
18	3.0	0.29
22	3.3	0.34
16	3.0	0.29
22	2.8	0.26
21	2.9	0.26
25	3.2	0.28
17	2.3	0.19
21	2.9	0.27
98	11.1	0.76
98	11.4	0.76
98	10.5	0.65
98	11.4	0.74

'Quick Test' values are calculated using conversion factors reported in Fertiliser Recommendations for Pastures and Crops in New Zealand (1984) compiled by I S Cornforth and A G Sinclair.

Total Carbon and Total Nitrogen were determined by IR and TC detection following combustion in an resistance furnace (LECO).

SIGNED: _____



Mr Lance D Currie (Senior Technical Manager)