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Craige Mackenzie

Arable & Dairy Farmer

- New Zealand -

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Farming Businesses

Greenvale Pastures Ltd

- 200 ha intensive cropping

Three Springs Dairies Ltd

- 330 ha high output dairying

Agri Optics New Zealand Ltd

- Precision Agriculture company

The Smart-N
Fertiliser Application System

Mackenzie Research Group Ltd

- Farming technology

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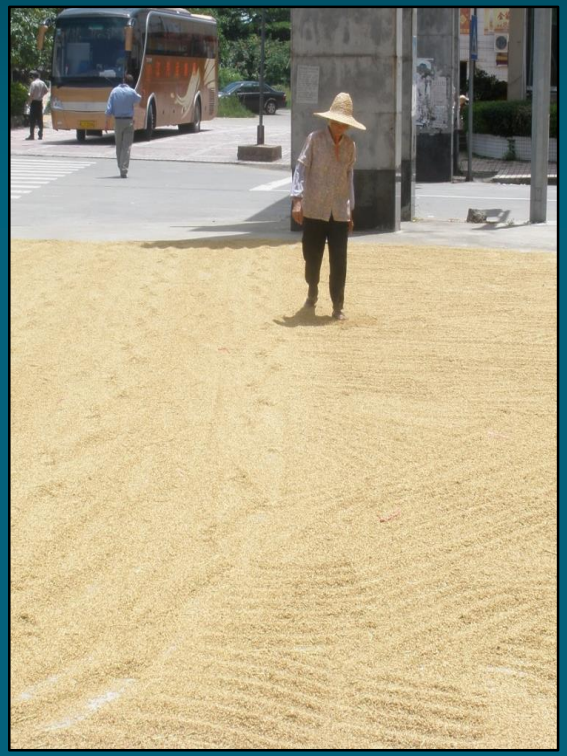
NEW ZEALAND NUFFIELD FARMING SCHOLARSHIP TRUST

Nuffield Scholarship

"Understanding our Carbon Footprint in Farming Systems"



- Grain Drying - China

- 80-a-side parallel shed - USA

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Global Farmer Roundtable

World Food Prize – Des Moines, Iowa

Precision Agriculture

from Innovation to Field in Water Efficiency

-

the Sustainable Use of Irrigation Water.

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The best way to predict the future is to create it

Abraham Lincoln

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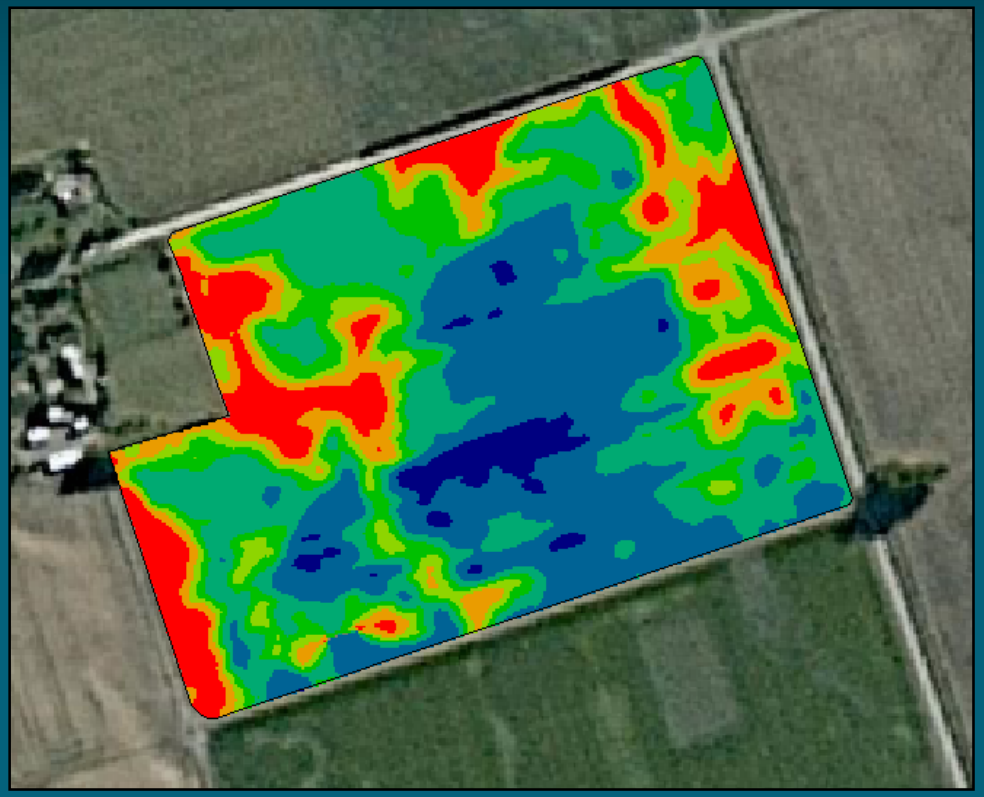
Profit Mapping



Its hard to be Green when you're in the Red

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Water and its Use in Agriculture

- Globally, water quality is deteriorating
- 1 in 6 people are water stressed (UN) , not having direct access to drinking water
- Estimated that Agriculture uses 70% world's fresh water
- Irrigation has always been vital to crop and food production
- Irrigated farm land uses 2% of the world's rainfall
- Only 17% of crop land is irrigated but it produces 40% of the worlds food.
- Colorado study showed 89% of farmers used history or the look of the crop for irrigation scheduling
- WUE : Rice consumes 39% of the worlds irrigation water
  - In India its 3500 l/kg, in China hybrids use 1750 l/kg
- GM might reduce water use by 30-40%

Water allocation, use and quality all need to be addressed

Things we need to know about Irrigation

- Our farm soil types and WHC
- Incorporate rainfall into our irrigation schedules
- The $ return for every mm applied
- The cost per mm applied under various systems
- The water use efficiency of different crops
- About instantaneous water application and its effects
- Infiltration rates of our soils.

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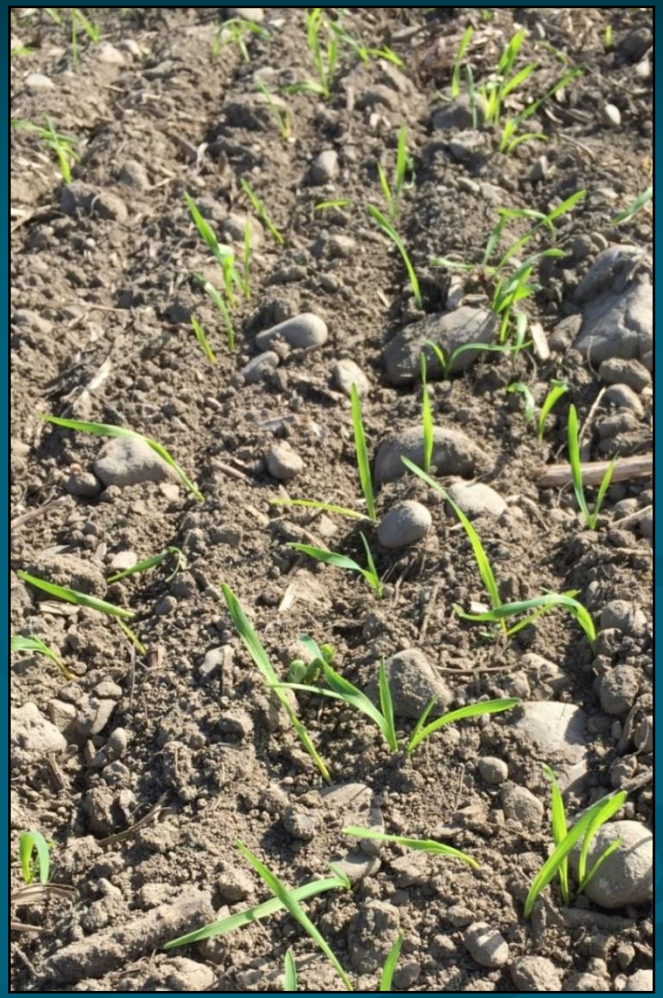
From the Ground Up

Farming starts with the soil

- Know your soil type
- Know your water-holding capacity (whc)
- Know your soil's potential
- Understand your farm's variability



Sustainability needs to be built in – not bolted on

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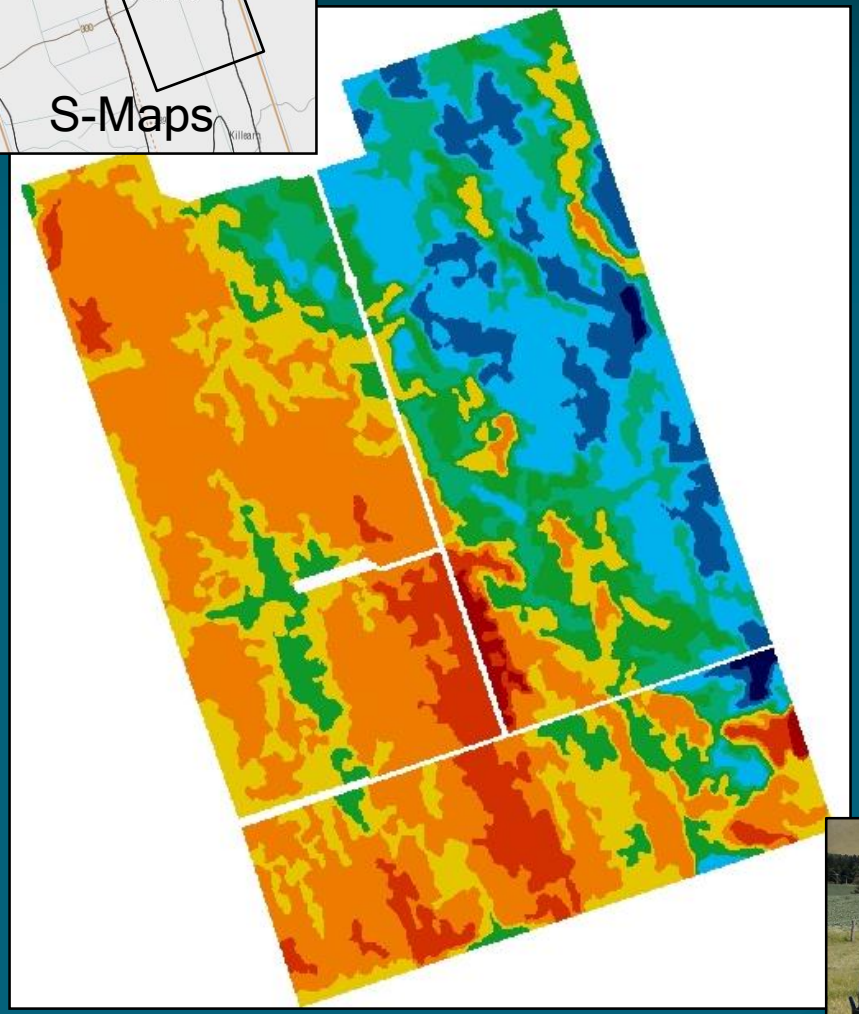
Electromagnetic (EM) Mapping



- Different pattern to S-Map
- GIS site specific detail
- Accurate to individual farm
- Makes targeted management easier
- Useful going forward for informing Overseer inputs

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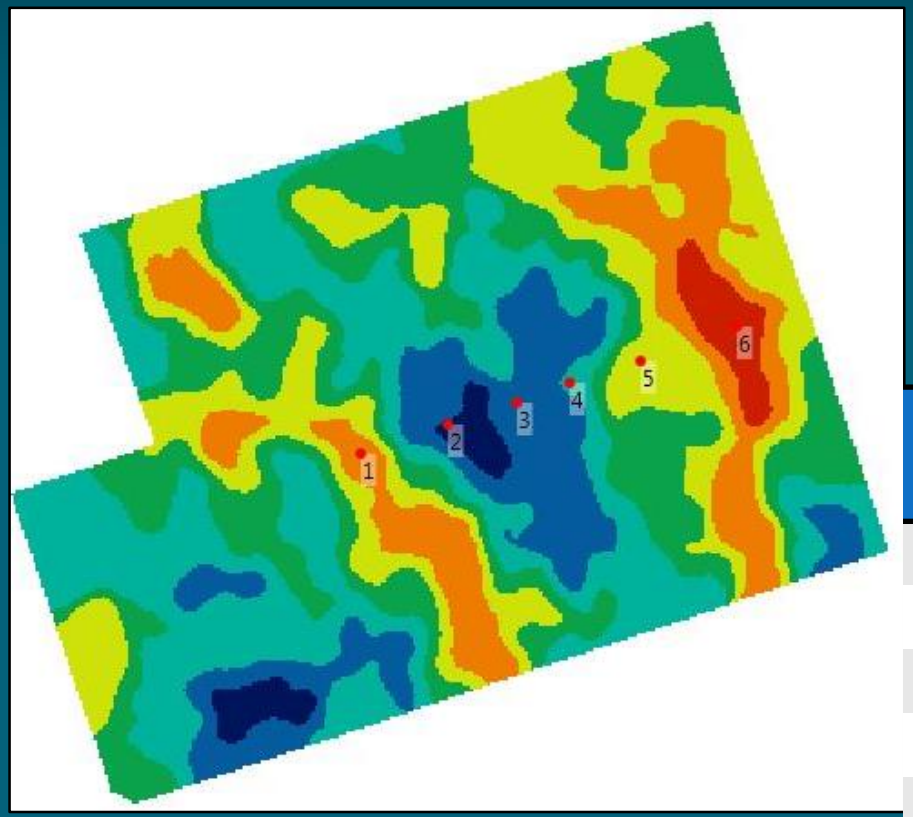
EM Surveying for Irrigation Management



- Neutron probes placed in different soil zones to enable fine tuning of management
- 127mm of AWC variation so need differential management

	Full Point (mm)	Stress Point (mm)	Zone Area
Site 1	187	139.5	0.6
Site 2	233	178	3.0
Site 3	228	178	5.4
Site 4	232	178	7.2
Site 5	181	134	3.6
Site 6	106	70	0.6

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EM Surveying for Irrigation Management

	Full Point (mm)	Stress Point (mm)	2011/12 Wheat Yield (t/ha)
Site 1	187	139.5	17.56
Site 2	233	178	12.31
Site 3	288	178	13.26
Site 4	232	178	15.58
Site 5	181	134	16.48
Site 6	106	70	10.00

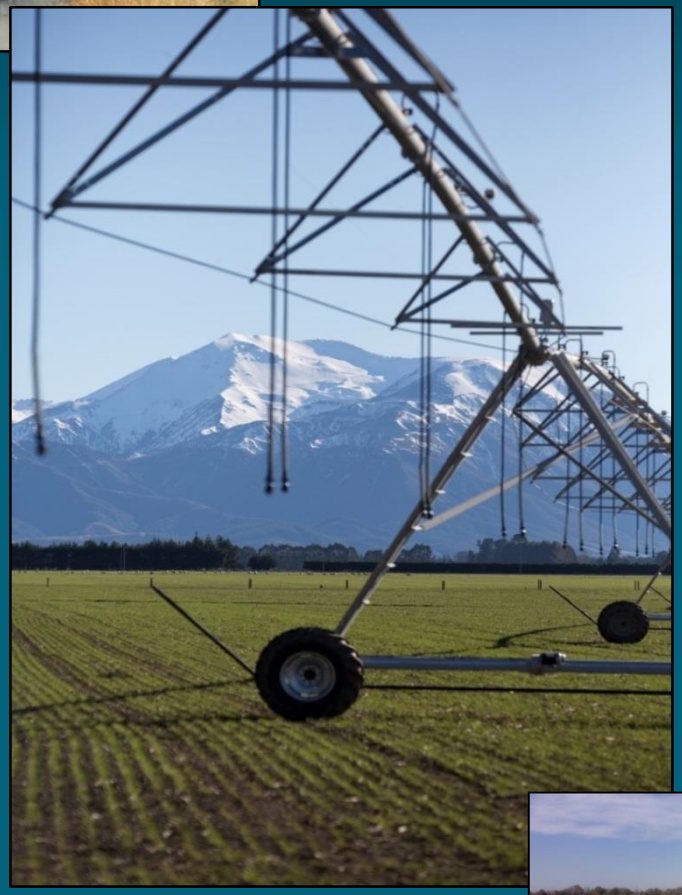
- Sites 1, 4 and 5 had highest yields in 2012
- Anticipated that sites 2 and 3 would have highest yield due to heaviest soils
- Over-watering occurred causing a yield penalty

Average loss of yield from Zones 2 and 3 = 3.79t/ha

or $1064/ha when compared to Zone 4

VARIABLE RATE IRRIGATION WAS INSTALLED IN 2012 TO ELIMINATE THIS PROBLEM!!

Irrigation Management



- We've come a long way with technology, hardware and science
  We use variable rate irrigation (VRI)
- Get an accurate understanding of the spatial variability of soils.
  We use data from EM Survey
- Understand the water holding capacity of each soil type to be irrigated
- Situate soil moisture probes by zone and water holding capacity

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Variable Rate Irrigation

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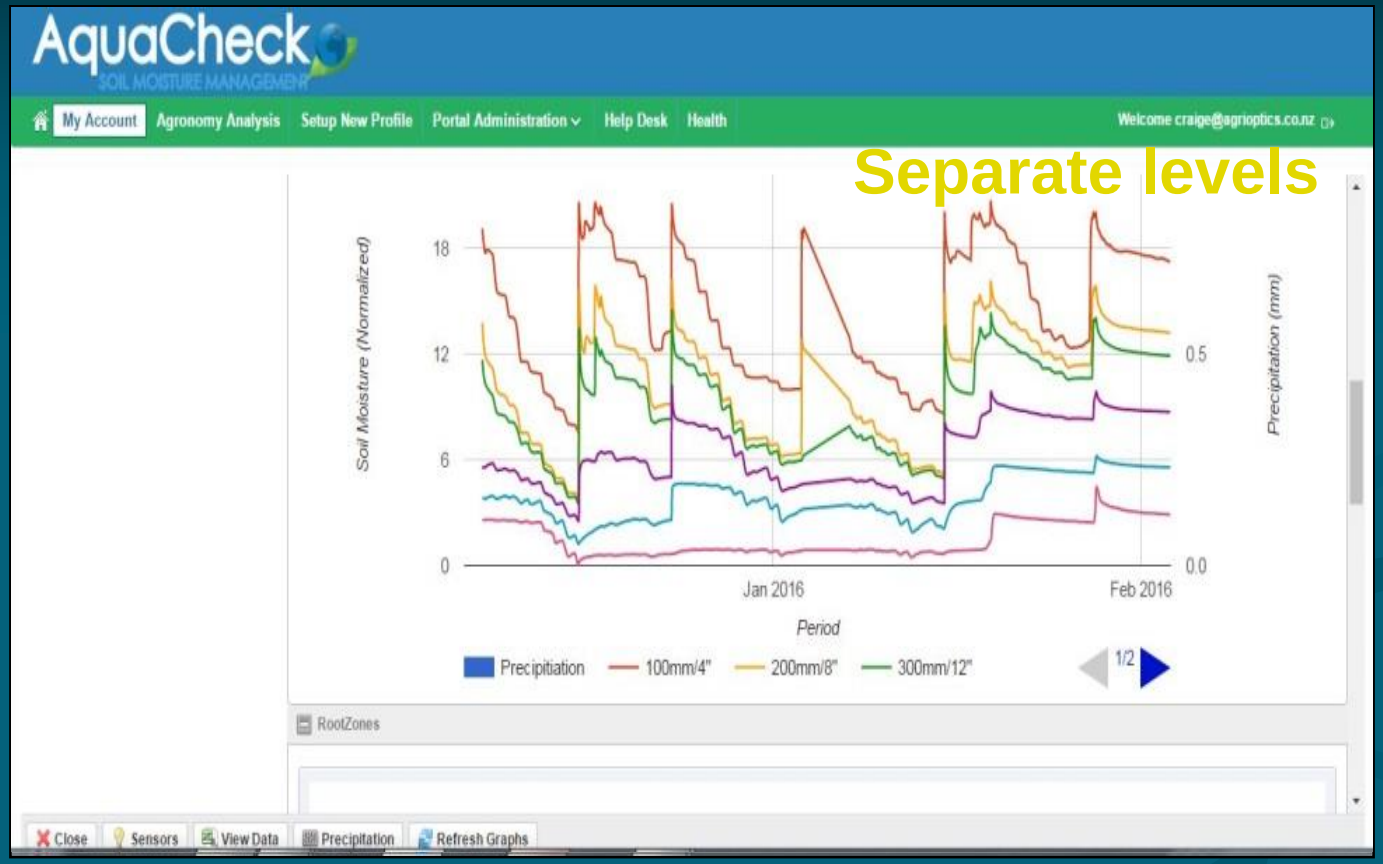
AquaCheck Soil Moisture probes



- Greenvale Pastures soil moisture status over several zones using VRI to control moisture level in each zone individually.
- Aiming for the flattest line possible
- On Greenvale 35 individually managed zones

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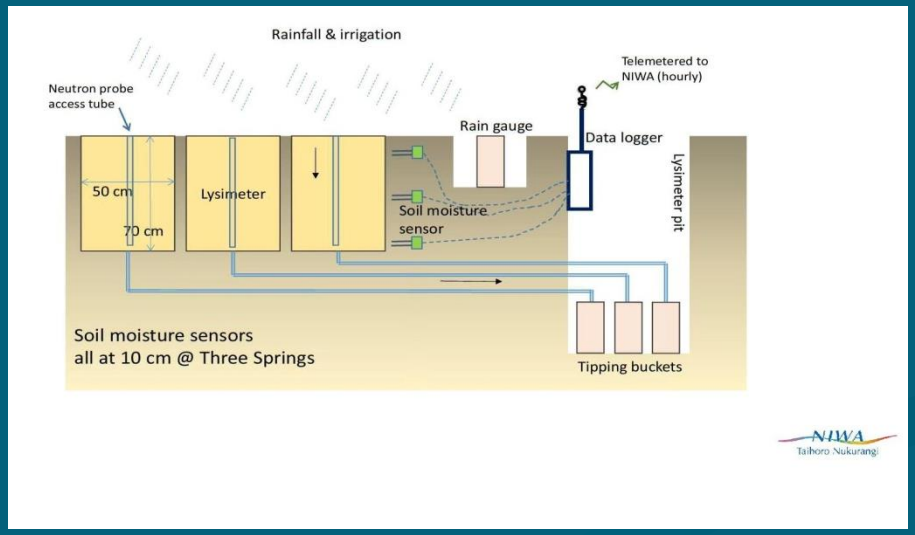
Science on the Farm

Lysimeter - ECan



Measure / Model /Manage

- Measuring leaching in a real situation
- Accurate figures needed for NZ regulatory schemes
- Need to show what we are doing to the wider public
- Urban - Rural Connection

Its all about being engaged

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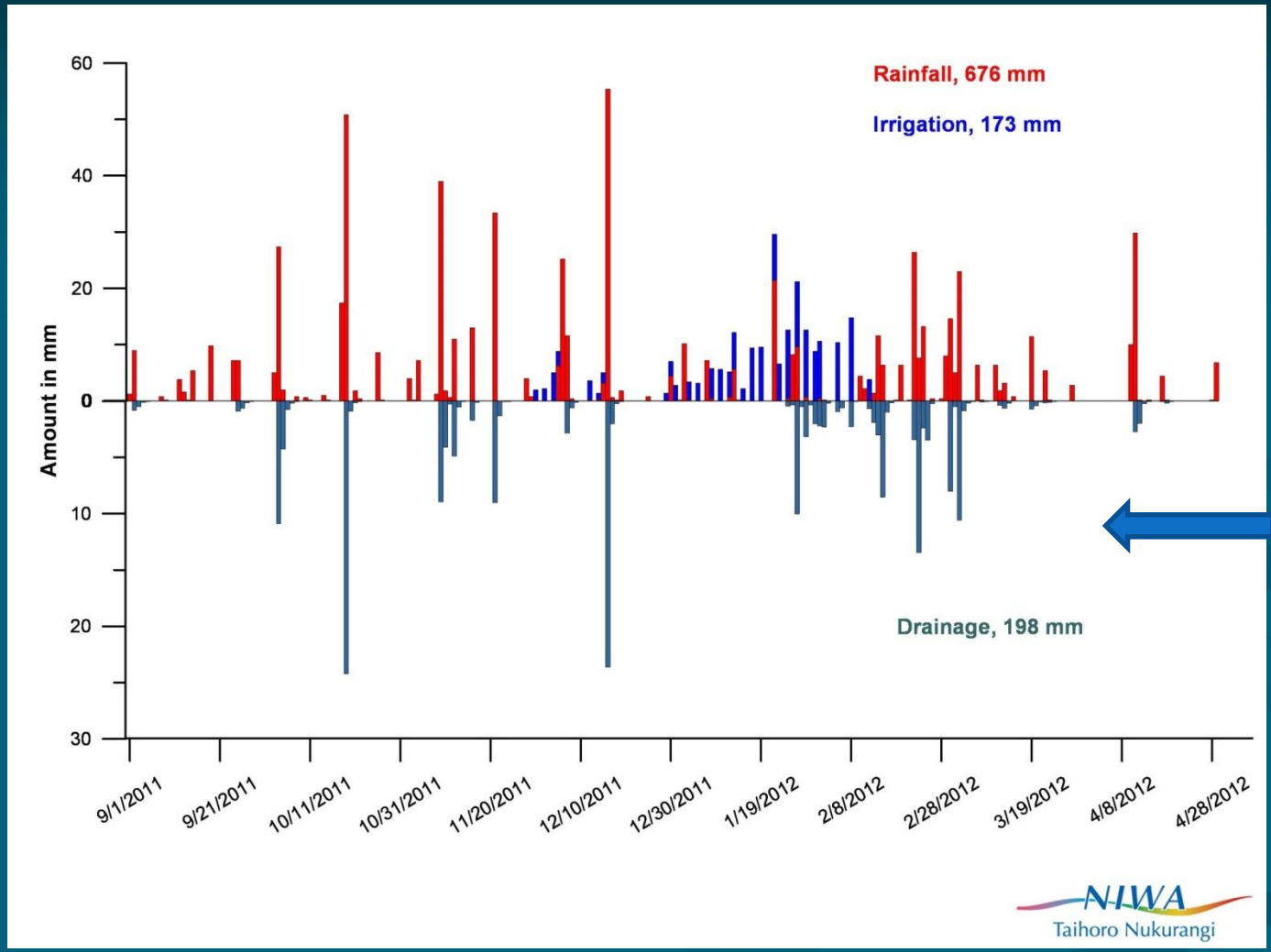
Science on the Farm



Lysimeter data
Weekly feed
by email

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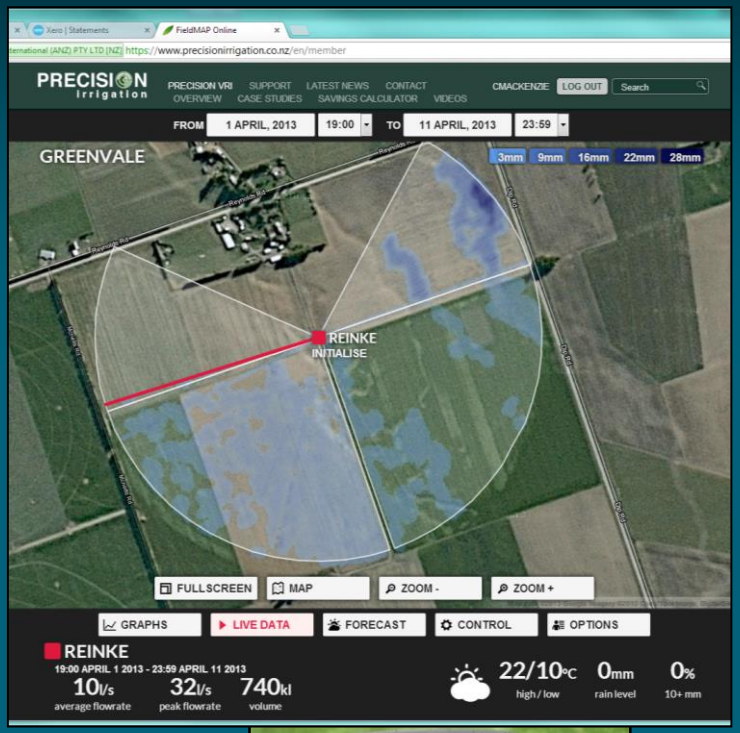
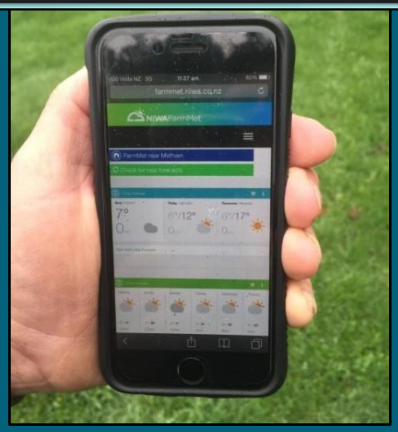
Irrigation Management





- Understand individual crops requirements
- Irrigate to appropriate levels to capture all rainfall events while avoiding drainage to eliminate any environmental impact.
- Incorporate accurate weather forecasting into irrigation scheduling. We use FarmMet
- Management available at your fingertips from anywhere in the world

Outstanding Farmers still need to be out standing in their fields

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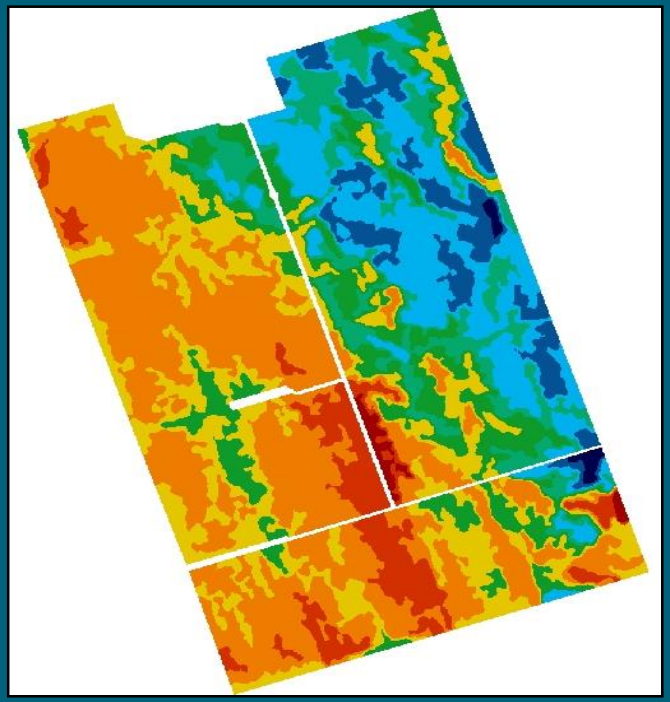
Variable Rate Effluent

EM Map



AquaCheck soil moisture Probes

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The Smart-N Fertiliser Application System

- Site-specific application of nitrogen
- Up to 30% reduction of applied nitrogen without production loss.
- Reduces N_2O & NO^3 emissions.

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Nutrient Budgets & Overseer®

Overseer Nutrient Budget

- Includes all nutrients
  e.g. fertiliser, effluent,
- Helps reduce fertiliser inputs
- Help access profitability
- Increased understanding of models for future use

•**Trimble Juno for GPS location**

OVERSEER®

http://www.overseer.org.nz

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The Value of EM Mapping in Overseer

	Estimated N Leached / Ha			
% OF AREA	EM, VV	EM, FV	EM, VF	EM, FF
9%	39	43	58	142
3%	24	24	26	67
7%	39	43	58	141
4%	23	22	24	65
15%	48	53	68	154
11%	32	31	33	76
11%	39	43	58	141
6%	24	24	26	67
33%	39	43	58	141
100%	39	42	54	127

	Estimated N Leached / Ha			
% OF AREA	VV	FV	VF	FF
12%	39	43	58	142
12%	39	43	58	141
26%	48	53	68	154
18%	39	43	58	141
33%	39	43	58	141
100%	42	47	62	146

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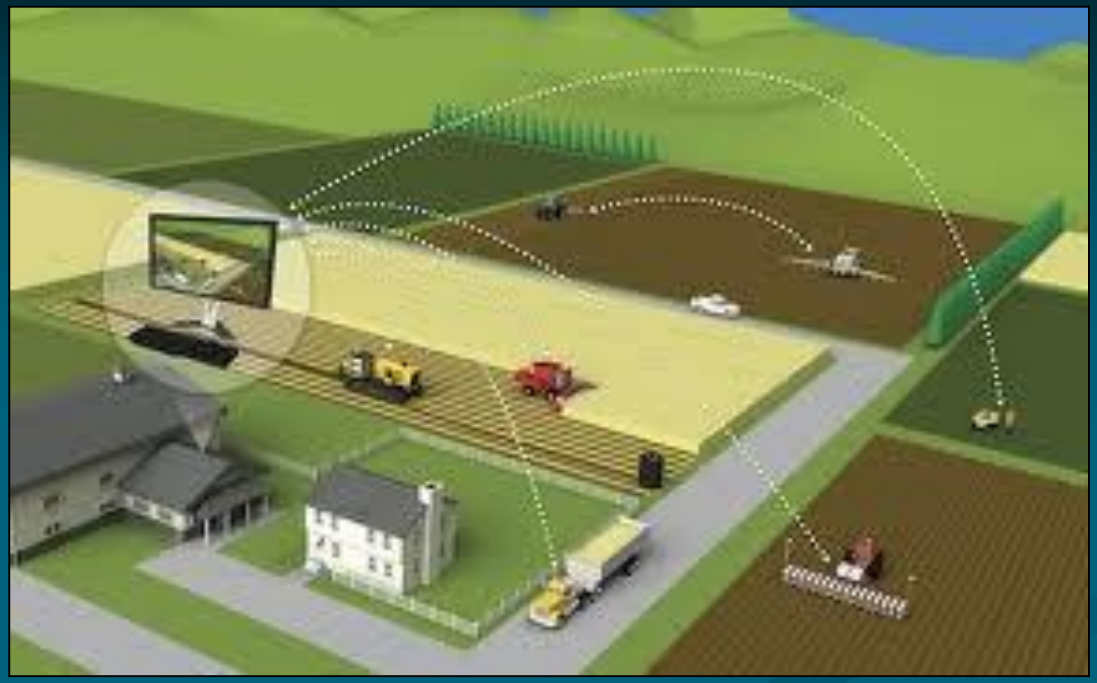
Big Data in the Cloud

Getting Connected



We're a Connected Farm

- 3G connection - farm office and machinery
- WiFi connection - farm office and irrigators, soil moisture probes
- 3G connection - Irrigators, software server and cellphones
- 3G connection - wells and irrigation auditor
- GPS on all irrigators, combine and tractors - all with autosteer

Rural Connectivity is a huge issue for NZ development

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Keeping Connected

Three Pillars of Sustainability:

- Farmers
- Industries
- Rural communities
- Urban communities
- Lobby groups
- Central & Local Government

Its all about working together

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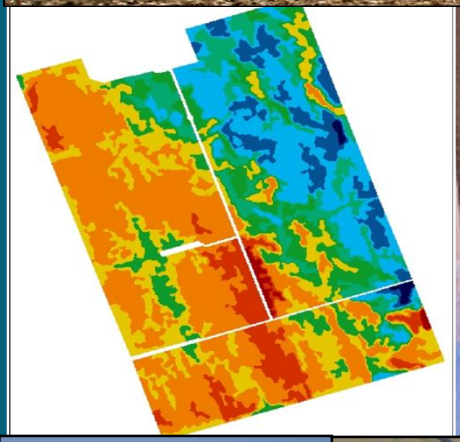
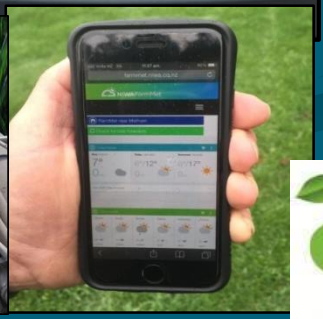
Exciting times for Agriculture - What tools to choose?





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Exciting times for Agriculture

Good sustainable farming practices
and
profitable farming practices go hand in hand

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