



LandWISE  
INCORPORATED

# Future Proofing Farming

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PRECISION PRINCIPLES  
IN VEGETABLE SYSTEMS

DAN BLOOMER

# Precision Principles

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**R**IGHT

Thing

Amount

Place

Time

# Things make it hard

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“Vegetables” are very minor crops so don’t get tech investment

There are dozens of different crops with different signatures and needs

The things growers manage are already complex, don’t want more

Some crops are very rapid, not much time to measure and manage

3/2019

But  
Same Recipe

Image © 2021 Planet.com

Google Earth



# Tech Opportunities for Precision

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Guidance – do things in the right place

Rate control – use the right amount

Sensors – get timely information

Data processing – do the right thing

# Current Adoption of Precision Tools

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FIELD ROBOTS

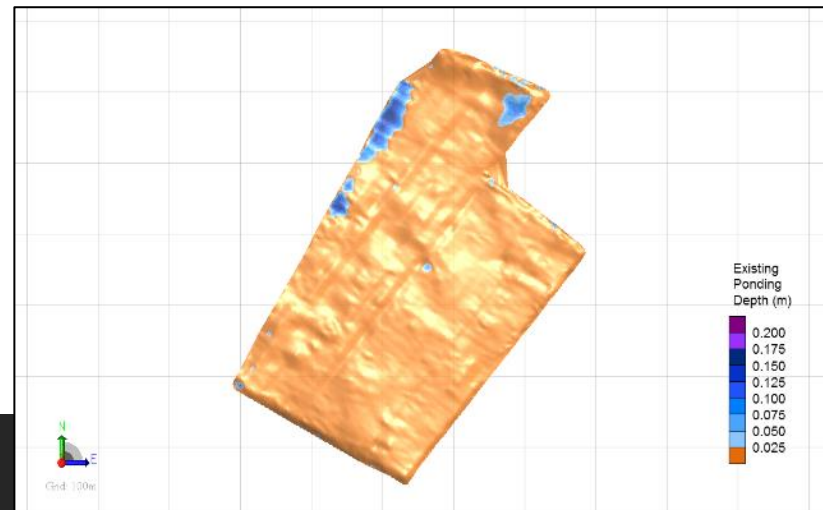
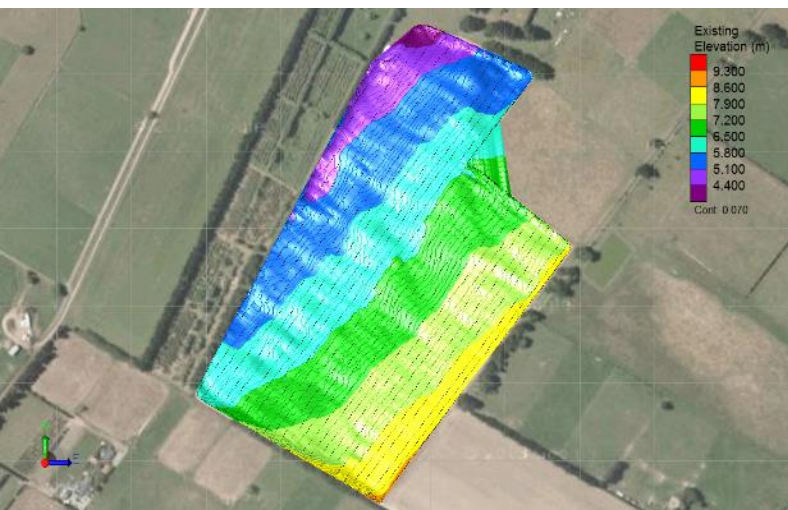
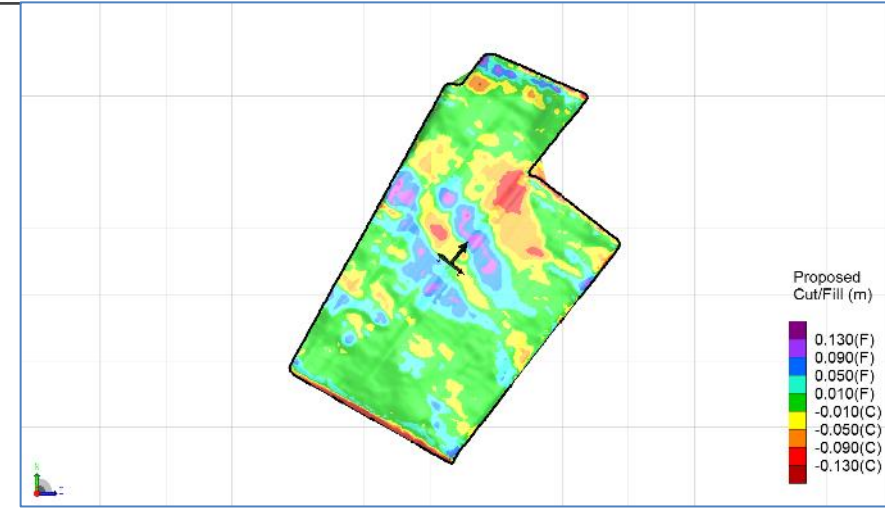
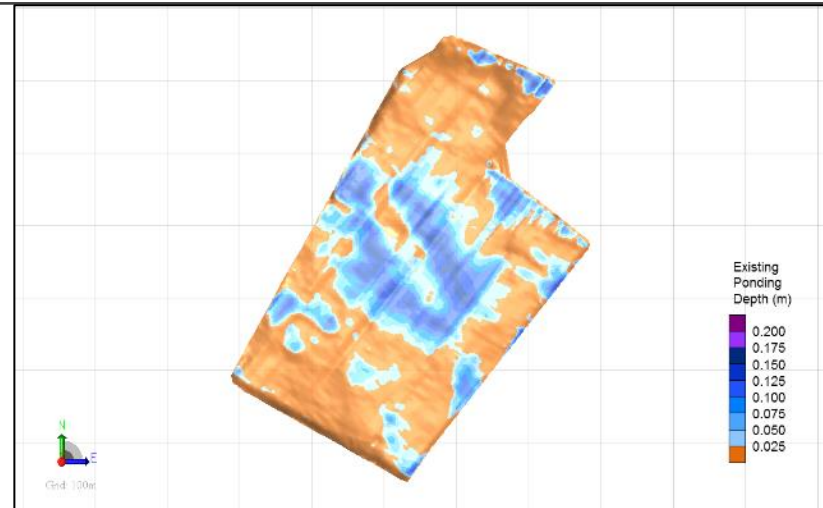
## Video | First AgXeed robot tractor delivered in the Netherlands

The first robot tractor developed in the Netherlands by manufacturer AgXeed was recently delivered to P. van Osch Groenteproducties. The vegetable grower wants to use the AgXeed robot tractor for intensive operations such as disc harrowing, deep cultivation and tilling at low speed.

Source: Future Farming



# Precision levelling



# VR Nutrient application

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But scale?

Stop throwing fert in the wheel tracks



# Direct Placement

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# Section control, nozzle control

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Wageningen researchers are developing a spot sprayer to combat, for example, volunteer potatoes in onions and beets. This in collaboration with a Robotti 150D field robot. Tests show that the spraying system needs to be even more robust.

Source: Future Farming



# Resson



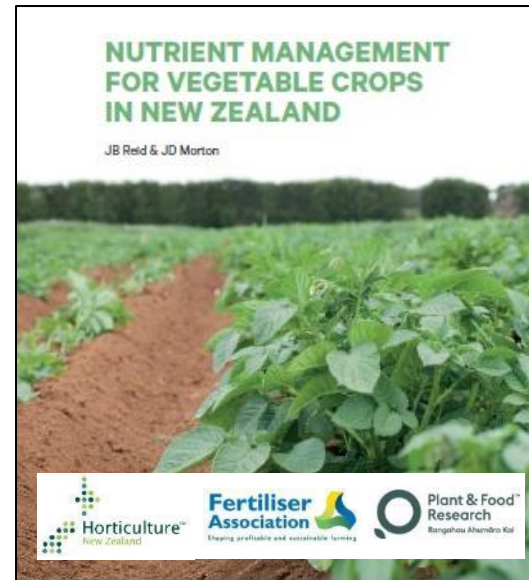
Precise  
Prescription



How much Nitrogen is in the soil already?  
 How much additional fertiliser can we justify?

Need Suitable Tools

Soil Analysis Results					
Sample Name: Broccoli Plot					
Lab Number: 2103873.1					
Sample Type: SOIL Broccoli (S173)					
Analysis	Level	Optimum	Below	Optimum	Above
pH	pH Units	6.4	6.0 - 7.2		
Resin P	mg/kg	169	70 - 150		
Olsen Phosphorus	mg/L	69	35 - 75		
Anion Storage Capacity*	%	15			
Potassium	MAF units	25	9 - 19		
Calcium	MAF units	13	7 - 14		
Magnesium	MAF units	37	21 - 63		
Sodium	MAF units	3	0 - 24		
Sulphate Sulphur	mg/kg	5	20 - 50		
Extractable Organic Sulphur*	mg/kg	2	12 - 20		
Boron	mg/kg	1.0	1.0 - 2.0		
TBK	me/100g	11.0	0.8 - 1.2		
Potentially Available Nitrogen (15cm Depth)*	kg/ha	96	100 - 150		
Anaerobically Mineralisable N*	µg/g	73			
Total Nitrogen*	%	0.33	0.30 - 0.60		
Soil Sample Depth*	mm	0.150			
Base Saturation % me/100g	K 7.5 Ca 63 Mg 9.8 Na 0.4				
Additional Properties	K 1.41 Ca 11.9 Mg 1.85 Na 0.07				
	Cation Exchange Capacity (me/100g)	19			
	Total Base Saturation (%)	81			
	Volume Weight (g/mL)	0.98			
Soil Type*	Sedimentary				



### The Nitrate Quick Test Mass Balance Tool

<b>Crop</b>		<b>Soil Nitrogen</b>	
System	Mixed cropping/arable	<b>Nitrate Quick Test</b>	
Crop	Sweetcorn	Sampling Date	14/11/2020
Planting date	4/10/2020	0-30 cm	30-60 cm
Target yield (t DW/ha)	20	60-90 cm	60
Harvested component (t FW/ha at 7.32)		Sampling depth start (cm)	0 30 60
Estimated seasonal N uptake (kg/ha)	282	Sampling depth end (cm)	30 60 90
<b>Seasonal N Balance</b> (kg N/ha)		Soil texture	Silt loam Silty clay Sa
Soil N supply	212	Soil moisture	Moist Moist M
Remaining crop N requirement	231	Quick test nitrate (mg/L)	35 35 10
<b>Net</b>	<b>-19 (deficit)</b>	Quick test nitrate-N (mg/kg)	26 22 5
<b>Next sampling date (SD)</b>		Mineral N supply (kg/ha)	81 82 22
Next SD	23/02/2020	<b>AAN Test</b>	
Crop N Requirement until next SD (-68)		Test value (kg/ha)	50
<b>Net (kg/ha)</b>	<b>280</b>	Remaining DIN supply (kg/ha)	27 0 0

Estimated whole crop N uptake

Estimated soil mineral N supply (from nitrate)

Info Sources

- Soil Tests
- Nutrient Management for Vegetable Crops in NZ
- FAR Nitrate Mass Balance Calculator

# Nutrient Budgets – Fertiliser Plans

**Step 1 - Paddock Info**

**Admin**  
 Grower/Agronomist Name: **Luke P**  
 Trading Name: **LandWISE**

**Paddock**  
 Paddock Name: **Microfarm**  
 Area (ha): **2.6**

**Crop**  
 Sweetcorn  
 Planted: **21 / 12 / 20** → Planned Harvest: / /

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**Step 2 - Fertiliser Plan**

**Expected Yield**  
 16.0 t/ha

**Soil N**  
 80.0 kg N/ha

**Depth (cm)**  
 [ ]

**N Quick Test**  
 Lab Test Available N Min-N

**Nitrogen Recommended**  
 100.0 kg N/ha

**Fertiliser Planned**

Base Fert	0%	%N	×	kg/ha	=	0.0 kg N/ha
Starter Fert	Cropzeal 16N	15%	%N	×	300 kg/ha	= 45.0 kg N/ha
Sidedress 1	Sustain	46%	%N	×	200 kg/ha	= 92.0 kg N/ha
Sidedress 2		0%	%N	×	kg/ha	= 0.0 kg N/ha
Sidedress 3		0%	%N	×	kg/ha	= 0.0 kg N/ha

**Planned Fertiliser Nitrogen**  
 = 137.0 kg N/ha

**Previous Crop Residue Supply**  
 0.0 kg N/ha

**Planned Nitrogen Balance**  
 100.0 kg N/ha (Recommended) + 0.0 kg N/ha (Residue) - 137.0 kg N/ha (Planned) = **37.0 kg N/ha**

Positive = N Surplus  
 Negative = N Deficit

**Step 1 - Paddock Info**

**Admin**  
 Grower/Agronomist Name: **Luke P**  
 Trading Name: **LandWISE**

**Paddock**  
 Paddock Name: **Microfarm**  
 Area (ha): **2.6ha**

**Crop**  
 Sweetcorn  
 Planted: **21 / 12 / 20** → Planned Harvest: / /

Soil Type: **Sedimentary**

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**Step 2 - Fertiliser Plan**

**Expected Yield**  
 16 t/ha

**Olsen P**  
 35 mg/L

**Depth (cm)**  
 [ ]

**Phosphorus Recommended**  
 0 kg P/ha

**Fertiliser Applied**

Base Fert		MP/100	×	kg/ha	=	kg P/ha
Starter Fert	Cropzeal 16N	8.4	MP/100	×	300 kg/ha	= 25 kg P/ha
Sidedress 1	Sustain	0	MP/100	×	200 kg/ha	= kg P/ha
Sidedress 2			MP/100	×	kg/ha	= kg P/ha
Sidedress 3			MP/100	×	kg/ha	= kg P/ha

**P Surplus/Deficit**  
 25 kg P/ha (Applied) - 0 kg P/ha (Recommended) = **25 kg P/ha**

**Crop Removal**  
 Expected Yield: 16 t/ha × P in Yield: 0.58 kg P/t = 9 kg P/ha  
 9 kg P/ha × 100 = **278 %**

If Available Soil P is above optimum, use only a fraction (less than 100%) of your crop's P removal or maintenance rate to 'mine' soil P

If Available Soil P is below optimum, apply more P in Fertiliser than your crop's P removal (more than 100%) to raise soil P levels through "capital application"

Precise  
Application

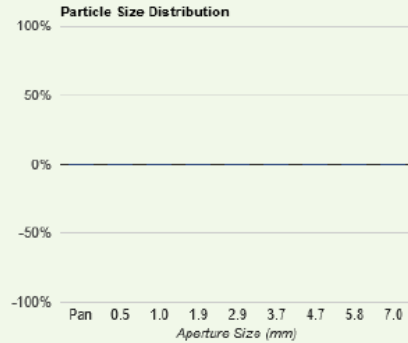




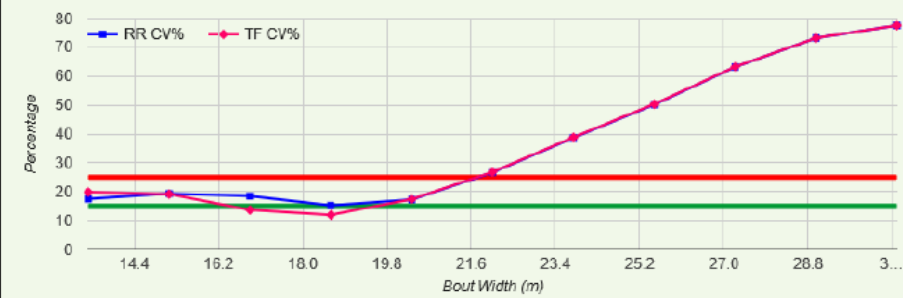
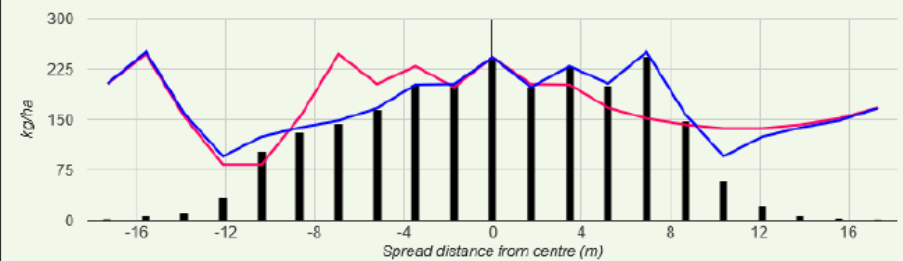


### Fertiliser Spread Analysis & Calibration Report

<b>Company Name:</b> Pescini Bros	<b>Product:</b> YaraMila Complex (from Ballance) 12.4-5.2-15.0-8.0
<b>Site Tested:</b> Pescini potatoes behind shed	<b>Nitrogen:</b> Y
<b>Test Date:</b> 2019-01-08	<b>Bulk Density:</b> 0.00 kg/L
<b>Tested By:</b> Chris	<b>Particle Size Distribution</b>
<b>Wind Speed:</b> 10.00 m/s	Pan: 0 %
<b>Wind Direction:</b> 200 deg	0.5 mm: 0 %
<b>Vehicle:</b> Case IH 5150	1.0 mm: 0 %
<b>Registration #:</b>	1.9 mm: 0 %
<b>Spreader Make:</b> Vicon	2.9 mm: 0 %
<b>Spreader Model:</b> Rota Flow - twin disc	3.7 mm: 0 %
<b>Spreader Age:</b> 0	4.7 mm: 0 %
<b>Spreader Condition:</b> Used	5.8 mm: 0 %
<b>Discharge Height:</b> 0	7.0 mm: 0 %
<b>Spinner Revs:</b> 0	<b>SGN:</b> 0
<b>Door:</b>	<b>UI:</b> 0
<b>Vane:</b>	



Set Bout: 22.49 m	Tray Size: 0.25 m <sup>2</sup>	CVs at Set Bout:	RR%: 26.6766	TF%: 26.8018
Set Rate: 200 kg/ha	Tray Spacing: 1.73 m	Measured Rate: 174 kg/ha	Left %: 47.37	Right %: 52.63



### Fertiliser Spread Analysis & Calibration Report

#### Fertiliser Equipment Application Testing

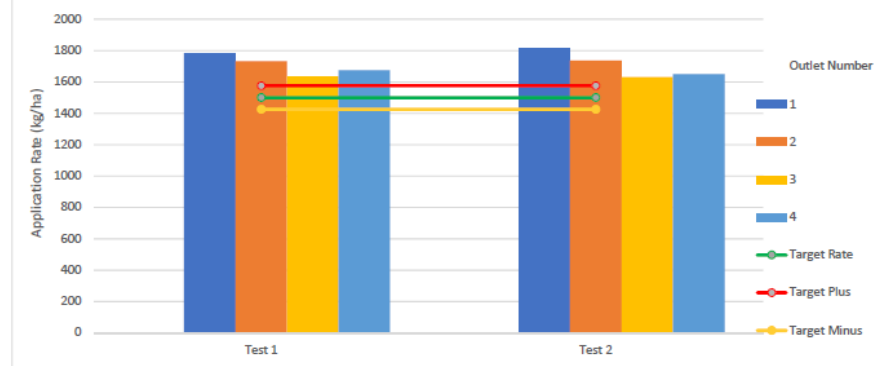
Client		Test Details	
Company Name	Pescini Bros	Test Name	Potato Planter
Contact Name	Chris Pescini	Test Date	8-Jan-19
Email Address	pescinibrositd@gmail.com	Test Site	55 Kimberley Rd Levin 5510
Phone Number	0274 302 602	No. of Repeats	2
Address	650 State Highway 57 Levin 5510	Vehicle/Tractor	
Tester Name	Pip, Dan and Georgia	Registration No	
Test Organisation	LandWISE	Applicator Make	Potato Planter
Email	pip.mcv@pagebloomer.co.nz	Applicator Model	
		Driving Speed	5.66 km/h

#### Summary

	Based on fertiliser product .....	YaraMila Complex (Bal)
Target Application Rate	1500 kg/ha => Fert required for block	960 kg
Measured Application Rate	1708 kg/ha => Fert required for block	1093 kg
Maximum Application Rate	1817 kg/ha	121 % of Target => Over-applying by 17%
Average Application Rate	1708 kg/ha	114 % of Target => Over-applying by 12%
Minimum Application Rate	1631 kg/ha	109 % of Target => Over-applying by 8%
Overall Variability SD	70.8 kg/ha	
Overall Variability CV	4.1 %	=> Variability within acceptable limits

The Coefficient of Variation should be <15% for nitrogen fertilisers and <25% for other fertilisers  
Variation greater than this is likely to reduce profits from agronomic crops.  
The Outlet Coefficient of Variation is 3.9% so the outlets are applying fertiliser evenly

Application Rate by Outlet and Test



This testing was carried out for LandWISE Incorporated under MPI SFF Project 405649 "Future Proofing Vegetable Production"

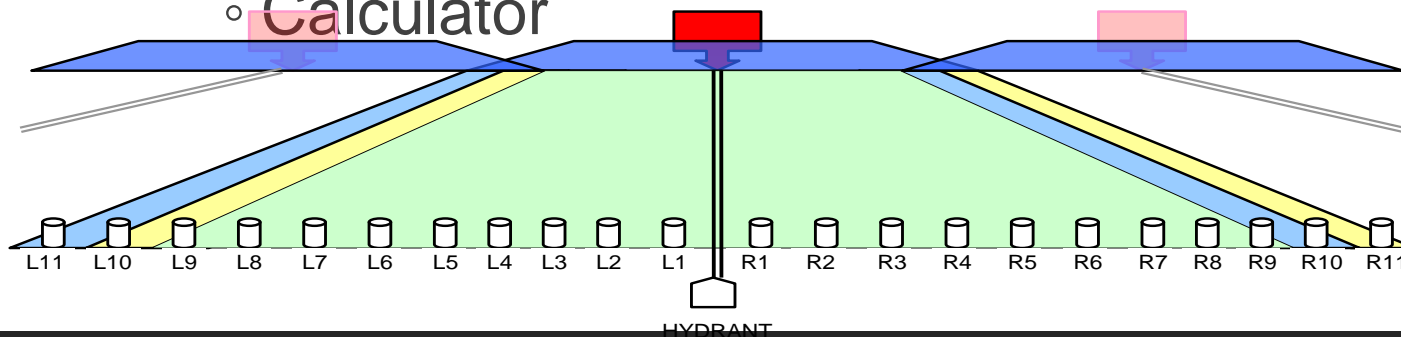


# IRRIG8 Quick and IRRIG8 Lite

## Quick assessment for farmers

- How to make measurements
- Where to make measurements
- How to calculate key values

- Guidelines
- Worksheets
- Calculator



HYDRANT

### Measurement Procedure

#### What equipment will you need?

This guide and the worksheet

24 Collectors of the same diameter (at least 150 mm) – 9 Litre plastic buckets are good

1 Measuring cylinder (about 2 Litre)

1 5 m tape

2 Electric fence standards

1 Stop watch

1 Pen or pencil

#### Application test

1 Set your 24 buckets in a row across the direction of irrigator travel [T1 in Diagram 1]

2 Arrange two buckets at even spacing between the left hand edge of the lane (i.e. half way to the next hydrant 'a') and the extent of obvious wetting [see 'L12,11' in Diagram 2]

3 Mirror this inside the edge of the lane, with two buckets arranged at the same spacing from the edge of the lane [see 'L10,9' in Diagram 2]

4 Arrange eight more buckets at even spacing to cover the area back to the centre line (the hose or cable) [see 'L8-L1' in Diagram 2]. The spacing may be different to the first four buckets

5 Repeat 2, 3 & 4 on the right hand side

6 Start the irrigator away from (before any water can reach) the line of buckets

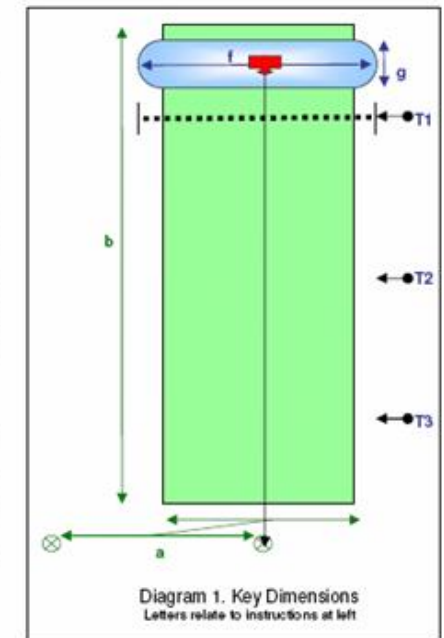
7 Run the irrigator keeping it going until it is well past wetting the buckets. Measure the irrigator speed as it passes over the test buckets

8 Measure the volume of water caught in each bucket and record on the Record Sheet

#### Speed test

- Set two markers (electric fence standards) 5.0m apart along the hose or cable
- The markers should be in line with the collectors
- Measure the time for the irrigator to travel between markers – they move when the carriage hits them

#### Field test layout



General Info

Pump Efficiency

Delivery Efficiency

Centre Pivot

Linear Move

**Travelling Irrigator**

Sprayline Irrigator

Drip Micro

Background Info

Test Details

Field Details

Collected Volumes

Results

**Distribution Graph**



Traveller fixed boom

### Irrigation Event - Applied Depth -mm-

Help

- Samples
- Samples Average
- Target



# Drivers of Adoption

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Compliance

Capability

Complexity

Connectedness

Confidence

Conscience

Capacity

Convenience

Champions

Cost

Compliance  
Conscience

Drivers of  
On-Farm  
Change

Champions - Compliance - Conscience - Convenience - Complexity - Cost - Capacity - Capability



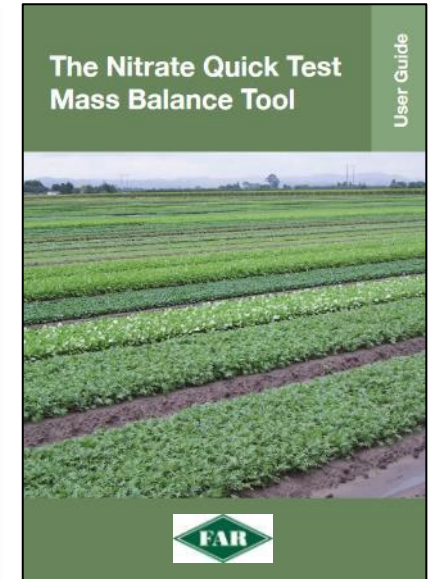
CGTrader



REDUCE  
Inconvenience  
Complexity  
Cost

Drivers of  
On-Farm  
Change

Convenience - Complexity - Cost - Capacity - Capability - Champions - Compliance - Conscience









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