DAFWA eConnected Project Decision Tools Update – August 2016

The target paddock with moisture probe (yet to be installed) and weather station was sown on 18th May to Mace wheat at 60kg/ha with 40kg DAP and 40L of Flexi N. It has since had 40L of Flexi N applied (18th June).

The decision making tools currently under investigation in the project include:

- Yield Prophet
- Flower Power
- iPaddock Yield
- Productionwise Crop Tracker
- Broken Stick – Modified French and Shultz by Yvette Oliver
- Rainfall & Rainfall to Date
- Soil Water App
- N Broadacre
- NUlogic – Nitrogen model
- Spectur camera

Soil test data

Depth (cm)	pH Ca Cl2	Colwell P	PBI	Colwell K	Nitrate	Ammonium	Exchangeable Sodium %
0-10	5.8	30	15	136	7	1	1.1
10-20	5.5	38	18	135	3	1	4.7
20-30	6.1	30	19	154	1	1	15.7
30-50	7.0	32	28	257	1	0	29.6
50-70	8.0	5	39	435	1	0	34.7
70-100	7.8	2	40	448	2	1	37.0
		Total N available to 1m:			**19**	**kg/ha**	
		Total N available to 30cm:			**14**	**kg/ha**	

pH- is good and high at depth
P levels are good in the topsoil and also very high in subsurface layers to 50cm
N – 14kg N was available to 30cm at soil sampling. The site was sampled 4th of April so 25mm of April rain will have mineralised some extra N prior to seeding. Top soil organic Carbon is only 0.48% so the addition may be small.
Exchangeable sodium percentage is high at depth. Kim and Jason's experience is that there is a layer that holds water up at depth. This sodic subsoil would drain only slowly.

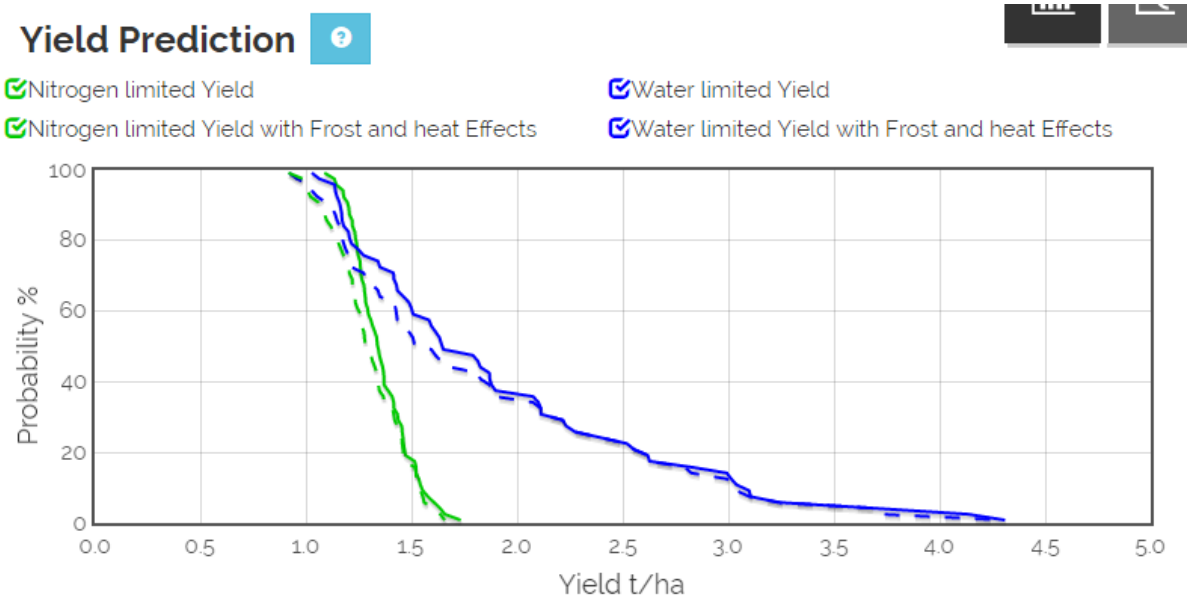
On Farm N response trial

Rates applied as 40kg DAP plus 0, 40, or 70L (max for orifice plate used) of Flexi N at seeding. Every treatment was topped up with 40L Flexi N (17N) on 18th June. High treatment was topped up with an additional 40L Flexi N on 8th July.

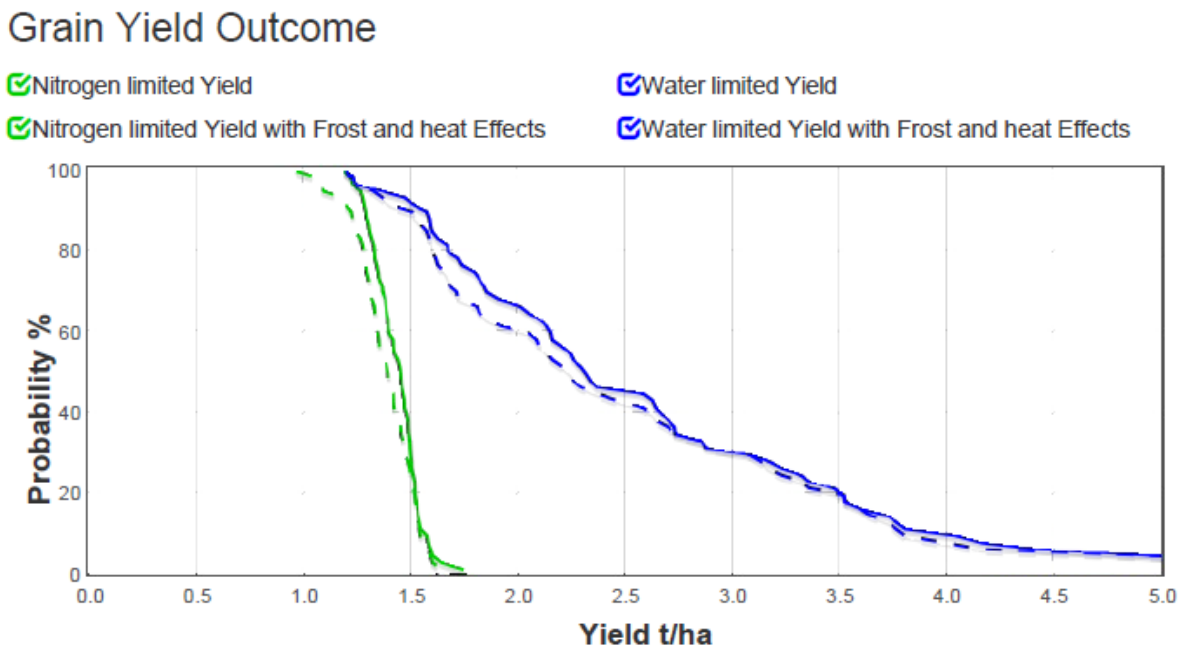
Trial Treatment	Seeding 18th May	18th June	8th July	Total N
Compound N + 40L UAN post	7	17	-	24
Low N	24	17	-	41
Medium N	36.5	17	-	53.5
High N	36.5	17	17	70.5

Yield Prophet login Username: yfig Password: yfig
The yield forecast for Battens paddock is below. Yield potential with 41kg/ha of N is about 1.4 t/ha at 50% probability for the 17th of August– the same as it was at the end of July, however the nitrogen non-limiting yield has declined from approx. 2.3t/ha to 1.7t/ha over that period. This is expected as early Yield prophet yield potentials are often very high. The nitrogen response trial in this paddock will confirm if more N was beneficial.

17th August Graph

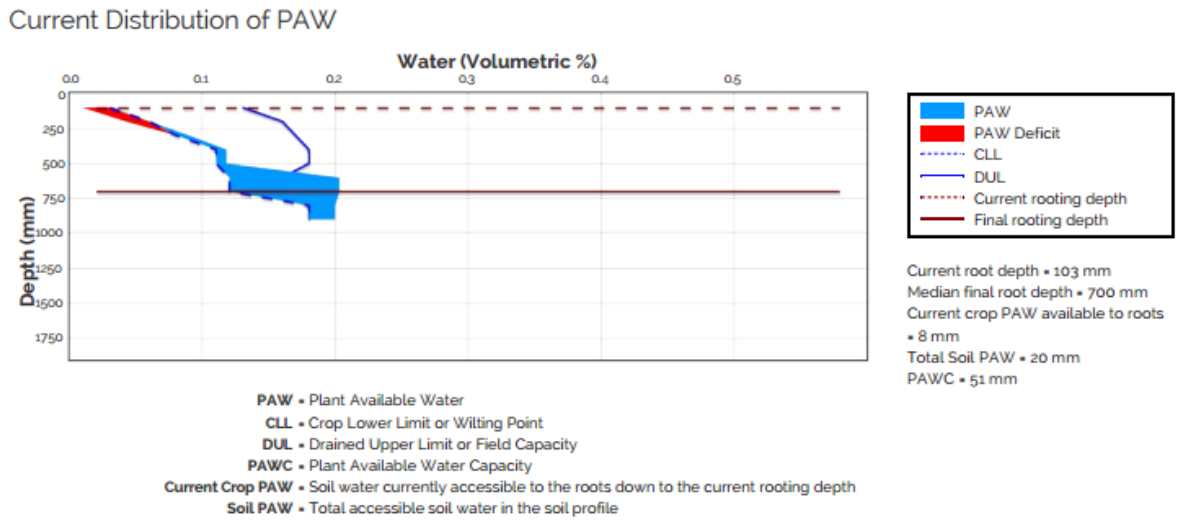


27th June Graph

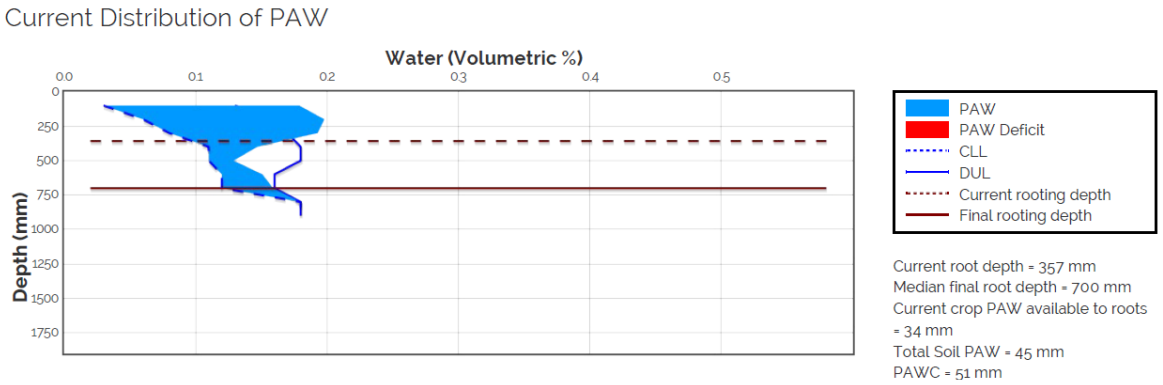


Yield Prophet also models soil water dynamics. Good winter rainfall is modelled to have recharged the entire profile by the end of July. However this has declined due to limited August rainfall and a large crop canopy.

Mid May graph

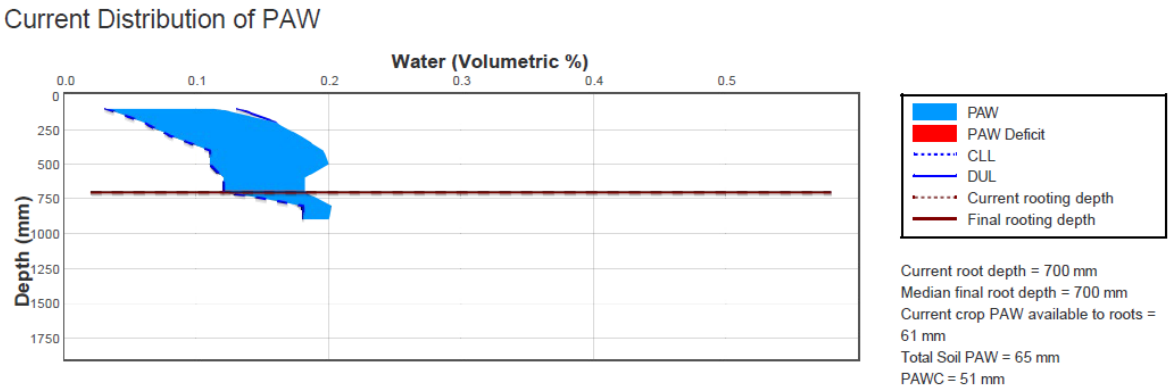


Mid June graph



Current root depth = 357 mm
Median final root depth = 700 mm
Current crop PAW available to roots = 34 mm
Total Soil PAW = 45 mm
PAWC = 51 mm

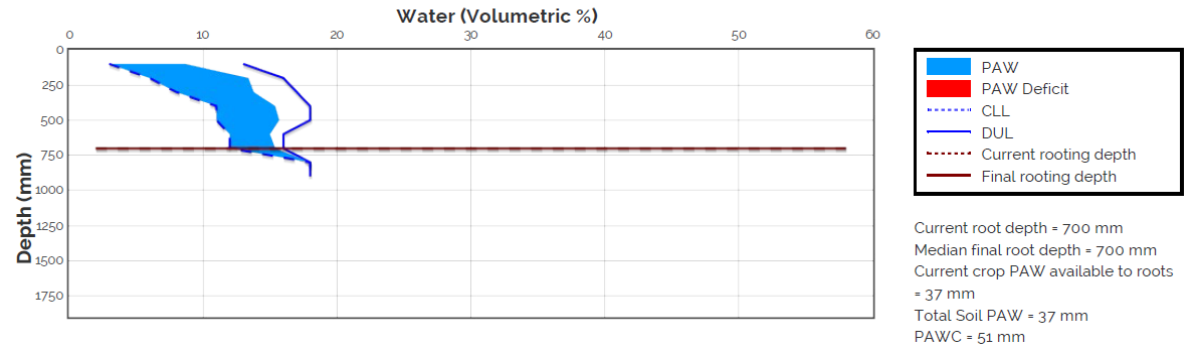
End July graph



Current root depth = 700 mm
Median final root depth = 700 mm
Current crop PAW available to roots = 61 mm
Total Soil PAW = 65 mm
PAWC = 51 mm

PAW = Plant Available Water
CLL = Crop Lower Limit or Wilting Point
DUL = Drained Upper Limit or Field Capacity
PAWC = Plant Available Water Capacity
Current Crop PAW = Soil water currently accessible to the roots down to the current rooting depth
Soil PAW = Total accessible soil water in the soil profile

Mid August graph (17th)



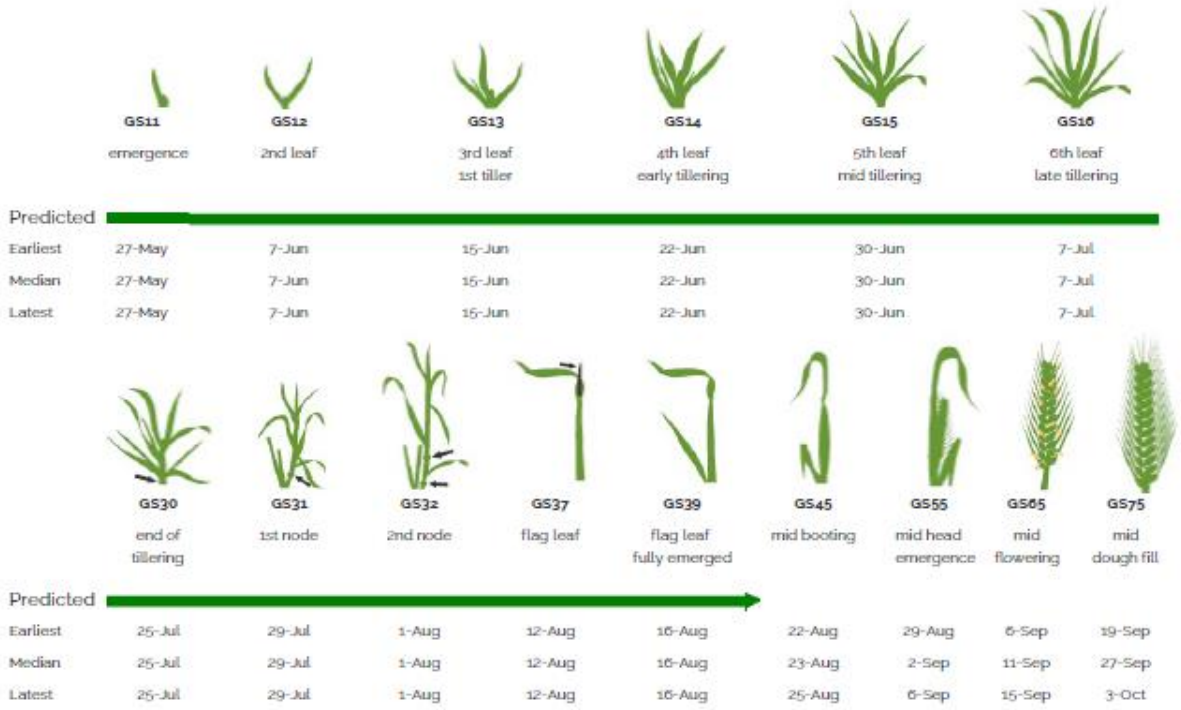
Current root depth = 700 mm
Median final root depth = 700 mm
Current crop PAW available to roots = 37 mm
Total Soil PAW = 37 mm
PAWC = 51 mm

PAW = Plant Available Water
CLL = Crop Lower Limit or Wilting Point
DUL = Drained Upper Limit or Field Capacity
PAWC = Plant Available Water Capacity
Current Crop PAW = Soil water currently accessible to the roots down to the current rooting depth
Soil PAW = Total accessible soil water in the soil profile

Yield Prophet Phenology

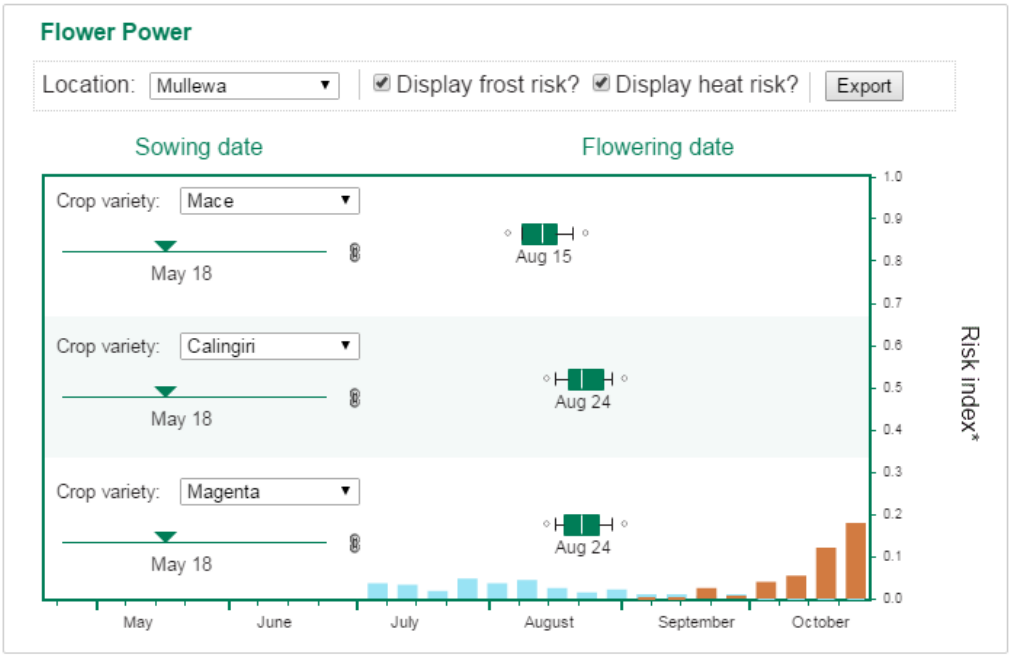
Yield Prophet models phenology to help predict yield and N requirements. We saw in the time of sowing trials last year that it is not very good at predicting development of early sown crops. This is a later sown crop, but Yield Prophet is suggesting the crop should be at full flag on the 16th of August however the Spectur Camera shows the crop is most likely at mid-head emergence on the 17th of August. That is not predicted until the 2nd of September.

Simulated and Predicted Crop Growth Stage



Flower Power

DAFWAs Flower Power Tool can also be used to predict flowering dates – though it does not provide information on any other growth stages. It is suggesting that Battens paddock (Mace sown 18th May) will be mid-flowering on the 15th August with a low risk of frost and heat stress. It seems that the crop is not at mid-flowering on the 15th of August as Flower Power expected. This may be due to a colder than average winter slowing crop development.



iPaddock Yield

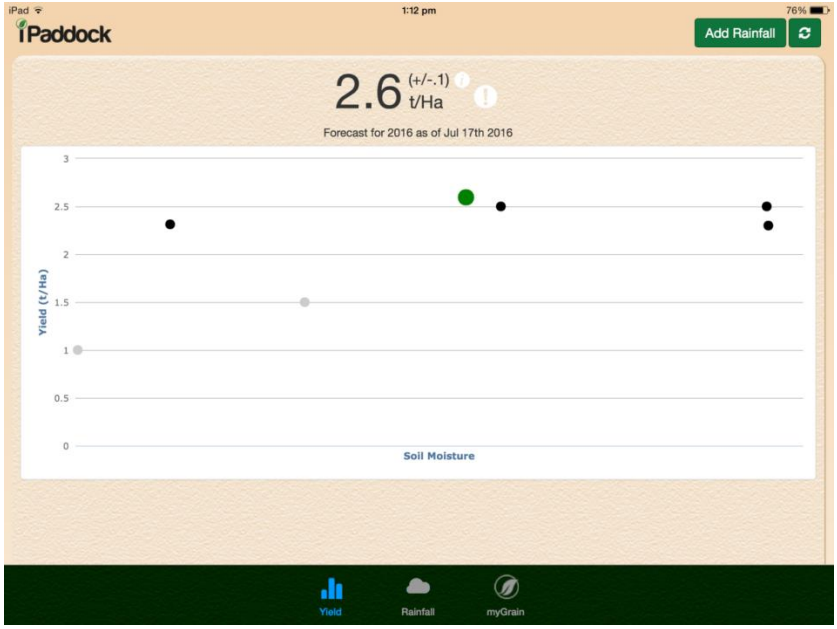
iPaddock Yield was developed by Esperance grower Mic Fels to provide an easy to use yield prediction tool based on historical rainfall and how well your farming system/soil has converted that to yield. You need to enter your yield and rainfall data. Kim has removed some of the lower yielding years from the May to June graphs below which has 'improved' the predictive ability. The scatter of data in the mid May graph suggests that iPaddock yield may not be the best tool to predict yield in this environment. In less variable yield environments ie. Where historical data forms a more linear relationship iPaddock yield is likely to work better.

iPaddock yield has not been updated since late July.

Mid May

Mid June

End July

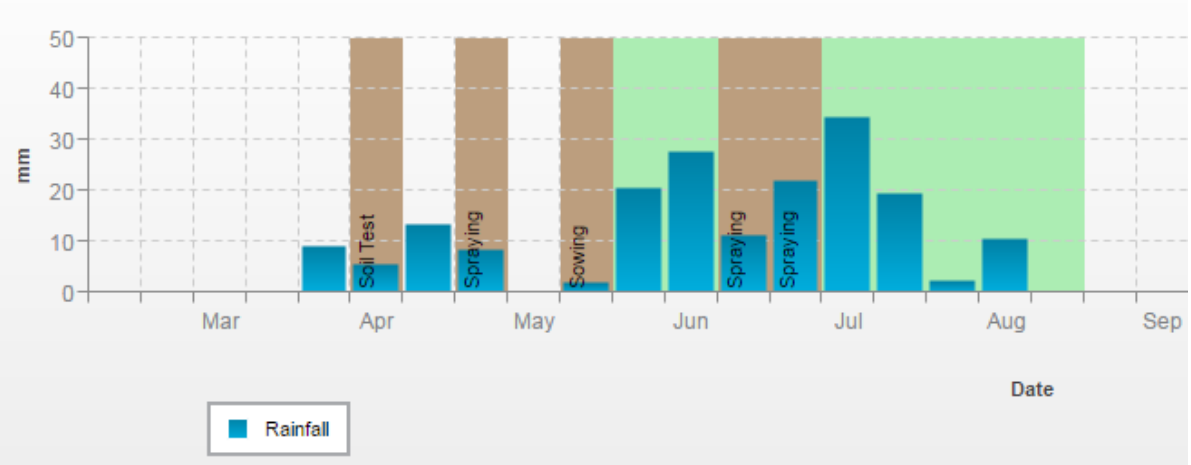


Productionwise

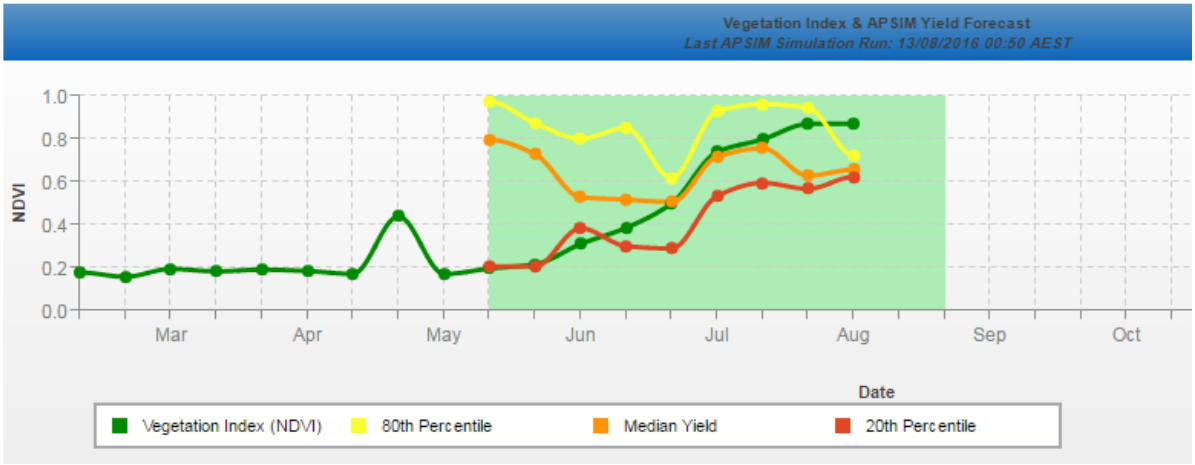
Productionwise is a paddock management software much like Agworld or Back Paddock. It is both a web platform and an App and growers and agronomists can plan, recommend, and record paddock activities. The basic functionality of the platform is free. In addition to the basic functions are some more involved tools – of interest here is the Crop Tracker. Paddock inputs are used as the inputs to APSIM (the model behind Yield Prophet) to generate paddock by paddock yield predictions. In addition frequent large pixel biomass imagery is averaged over the paddock and displayed over time. Crop Tracker is a paid annual subscription that Grain Growers have kindly waived for this project.

You can logon via the web or download and login to the iPad App (Crop Tracker doesn't seem to be available on the App). You can even create a new farm and enter data for a paddock or two of your own to see how it might work for your business. Username: Batten_Farms Password: yfigyfig

Below is rainfall and paddock operations for Farrell's Mailbox Paddock this year. (Rainfall from Yuna)



NDVI in early July was 0.74, and it has continued steady. APSIM based yield predictions are 1.3t/ha in the best 20% of years, 1.18t/ha in 50% of years and 1.12t/ha in the bottom 20% of years. The relatively narrow range of predictions suggests APSIM thinks yield is no likely to be altered much by any likely rainfall scenarios from now on.



Broken Stick

The Broken Stick model has been created as an excel model by several people based on the work of Yvette Oliver to modify the French and Shultz equation to better predict yield, especially when infrequent large rainfall events saturate the profile and water is lost below the crops rooting depth. It requires you to estimate a bucket size based on soil type and rooting depth, and enter your summer and winter rain so far as well as an expectation of rainfall for the rest of the growing season. An advantage of this method is like iPaddock Yield it works off your farms rainfall, not the nearest weather station with historical data, and unlike most other models you can enter your expected rainfall or different rainfall scenarios.

The output below utilises rainfall to date for Batten's paddock combined with average rainfall for the last 16 years as the expected rainfall for the rest of the season. In this rainfall scenario altering the bucket size has no influence on yield as the profile is never predicted to reach its Plant Available Water Capacity (Full Bucket). This model is predicting a yield of 1.92t/ha at this point in time. This is a significant increase on earlier modelling (1.4t/ha) due to rainfall in June & July being well above the last 16 years average rainfall for these months that was used as expected rainfall. These values are displayed in the next section.

1. Bucket Size? mm/m

Enter appropriate value in the gray box

Soil Type	60
Sand	40
Sandy Loam	60
Duplex	80
Clay	100
	m
Rooting Depth (m)	0.8
Bucket Size (mm)	48

2. Stored Summer Moisture

Enter values for rainfall events greater than 15mm only

Months	Rainfall > 15mm	Stored (mm)
Nov/Dec	0	0
Jan/Feb	0	0
Mar/Apr	0	0
SUM	0	0

3. Rainfall to date (mm)

May	20.8
June	56
July	47
August	26
September	20
SUM	169.8

RF actual Actual rainfall, and expected future rainfall. Same values as entered in 3.

RF max Maximum rainfall that can be held in the 'bucket', plant root zone (ie. without leaching below) in that month

RF used Amount of rain from that month that has been added to the 'bucket'

PAW end Plant available water at the end of the month. mm in the 'bucket'

	RF actual	RF max	RF used	PAW end
May	21	77	21	-8
June	56	95	56	9
July	47	82	47	13
August	26	84	26	-10
September	20	94	20	-26
SUM	169.8		169.8	
	Total Plant Available Rainfall		80	
	Yield (t/ha)	**Wheat**	**1.92**	

Rainfall

Not a model, but what has been used for years to predict crop yield – and it's changing. The data presented below is rainfall for Wandana (Batten homestead). The full data set averages are from 1960 to present. Only years since 2000 are displayed in the screen shot below. There has been a clear decline in average rainfall mainly in May, June, and July, and a moderate increase in March. April to August rainfall has declined by a massive 68mm or 32% to an average of only 142mm over the last 16 years. Using the original French and Shultz equation 142 mm growing season rainfall, minus 110mm of evaporation, times 20 kg/mm equates to a wheat yield of a little over 600kg. Luckily this relationship does not hold true in low rainfall and no till farming.

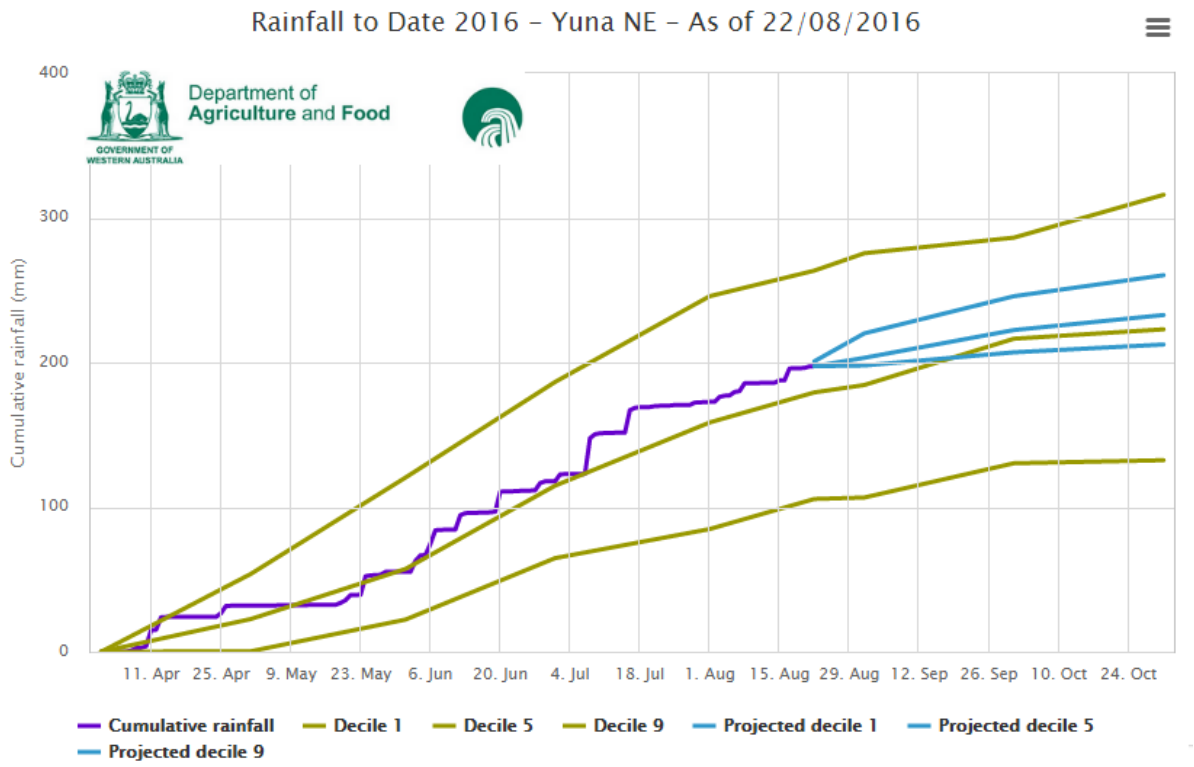
Rainfall figures for 2016 so far are included in the below screen shot.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual		Oct-March	Apr-Aug
2000	18	3	188	11	5	19	39	29	9	14	0	3	**337**		275	**102**
2001	16	29	0	8	30	20	46	19	30	79	17	0	**293**		62	**122**
2002	41	3	0	12	31	28	28	22	15	8	2	0	**190**		139	**122**
2003	1	3	3	11	41	null	32	57	37	4	48	0	**238**		17	**142**
2004	0	9	null	47	41	30	41	20	41	3	1	6	**239**		61	**179**
2005	0	12	11	25	69	69	12	32	24	9	2	0	**264**		33	**207**
2006	39	54	3	38	19	19	13	17	26	0	0	22	**250**		106	**107**
2007	14	5	0	0	6	28	38	7	9	2	1	34	**143**		41	**79**
2008	0	127	47	23	9	39	65	12	18	7	2	9	**357**		210	**147**
2009	0	7	0	0	22	64	72	19	19	4	null	6	**213**		25	**177**
2010	0	0	9	6	25	39	39	69	8	1	0	79	**275**		18	**178**
2011	45	107	0	1	53	56	62	38	8	33	1	null	**406**		233	**211**
2012	21	41	0	13	9	69	8	20	21	0	7	5	**213**		96	**119**
2013	13	19	28	5	30	3	15	20	18	12	0	0	**162**		72	**73**
2014	0	0	0	66	48	13	12	10	41	18	0	0	**208**		12	**150**
2015	10	27	196	37	7	28	56	26	0	0	13	0	**400**		251	**154**
2016	14	0	8	25	20.8	56	48.3								35	**150**
Average	**17**	**22**	**21**	**26**	**45**	**56**	**52**	**31**	**20**	**12**	**8**	**9**	**325**			**210**
16 year Avg	**14**	**28**	**32**	**19**	**28**	**35**	**36**	**26**	**20**	**12**	**6**	**11**	**258**			**142**
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**				

17 mm has fallen for August as at the 22nd.

Rainfall to Date

DAFWA's rainfall to date tool visually displays rainfall received against historical rainfall deciles, and the influence of different decile rainfall from today's date to the end of the season. It shows how different 2016 has been to the previous 3 years with relatively frequent rainfall events maintaining rainfall at or above decile 5 since the end of May.



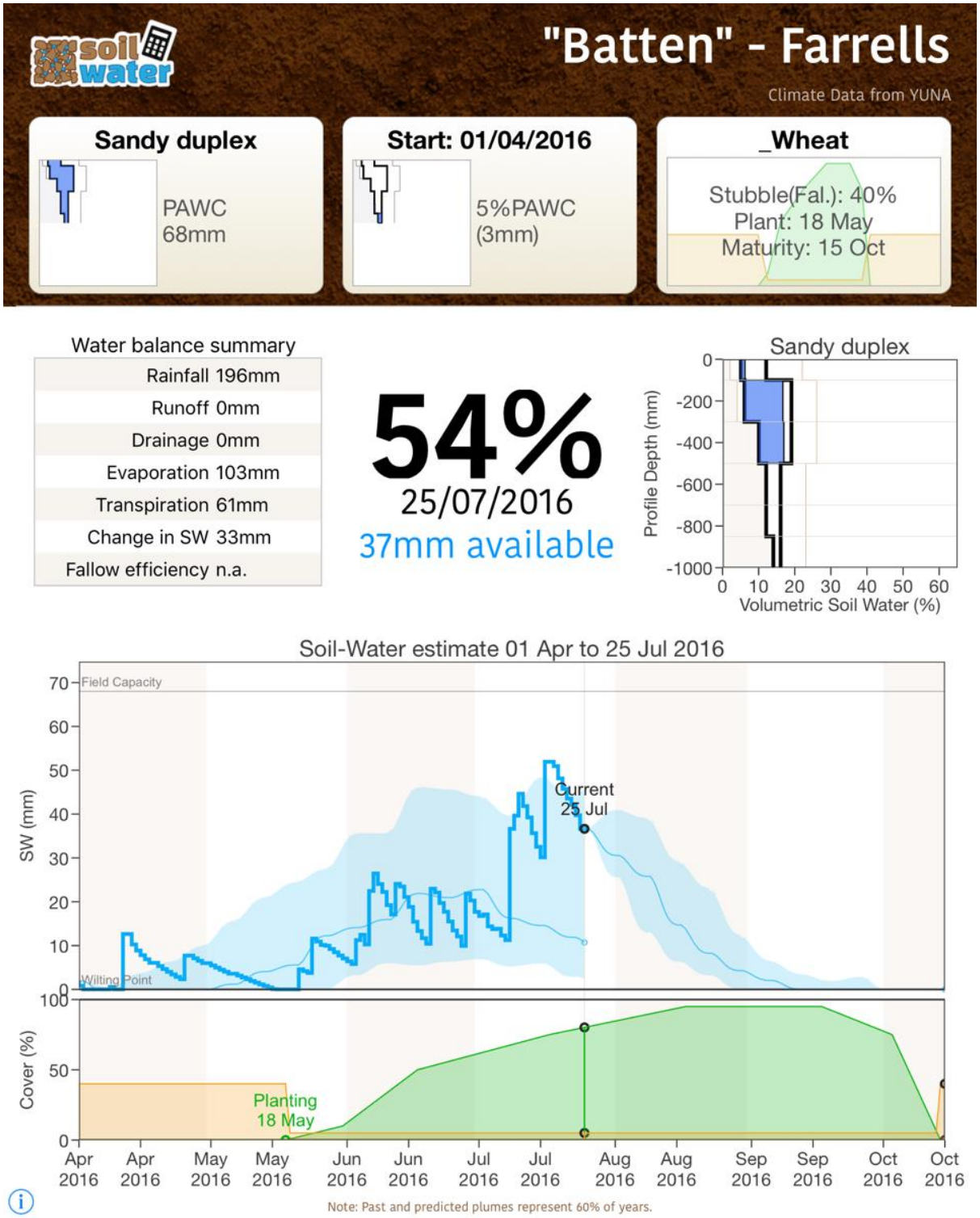
Soil Water App

This App was developed as a very simple to use way to model soil water. You select a soil type that suits your needs, then estimate how full the bucket was at a certain date – this can be when you have measured it, taken a soil core to have a look, or just a rough estimate. It also asks for the distribution of that starting moisture in the profile. You can chose from a range of crops (or fallow) and their growing season length. The app then takes rainfall and other weather information from your selected weather stations and models how much plant available water there was from the start of the year until today, and visually displays a range of possible scenarios for the future.

Below is a snapshot for the paddock at Batten's from the **27th July. The program is not currently allowing new updates.** On the 12th May there was 3mm of available water, so the bucket was only 4% full. Things have improved greatly since then with 24mm, or 36% on the 13th June, and now after good winter rainfall there is 37mm available and the bucket is expected to be 54% full. It is evident from the light blue 'plumes' which represent 60% of years that the soil moisture status is well above what was expected.

Yield Prophet is modelling 61mm of Plant Available Water, compared to 37mm for the soil water app. Yield Prophet is using rainfall data from the new Yuna NE DAFWA rainfall gauge, whilst Soil Water App can only access data from the Yuna weather station.

Snapshot from the 27th July. The program is not currently allowing new updates.



N Broadacre

N broadacre is an iPad app that helps make nitrogen requirement decisions with lots or only a little data available to you.

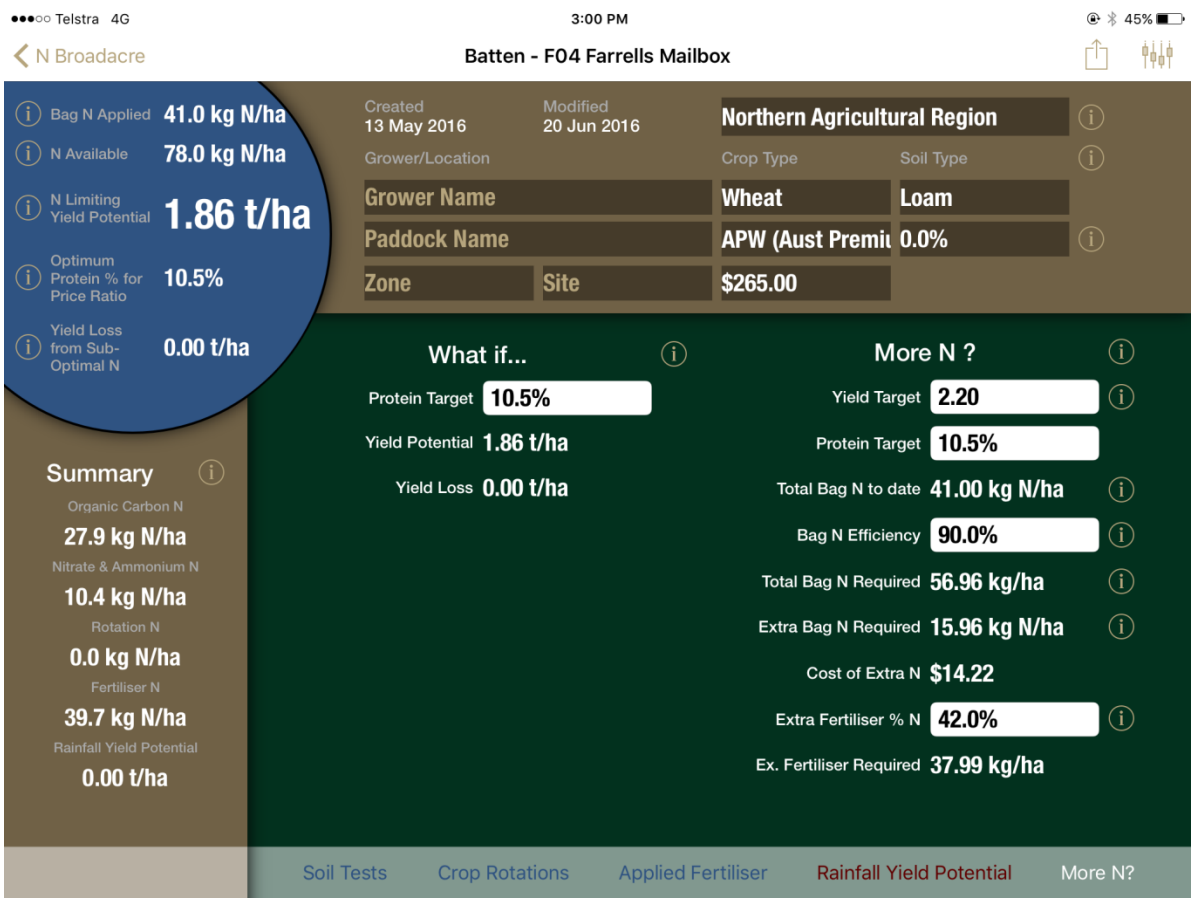
You can enter:

- nitrogen soil test results
- soil organic carbon
- previous rotations
- current fertiliser applications (or intended)
- yield and protein level you are targeting
- your rainfall – yield prediction tool
- Scope to customise the model by altering the efficiency of different soil N pools, and applied fertiliser, or you can keep it really simple.

Without the addition of any fertiliser the expected yield potential for Batten's paddock is 0.91t/ha. With the amount of N currently applied (41 N) N broadacre is suggesting a possible yield of 1.86t/ha. Below is a table of N recommendations for different yield targets from N broadacre.

Yield Target t/ha	N Broadacre recommendation (N kg/ha)
1	4
1.5	27
2	51
2.5	74

Telstra 4G
3:00 PM
45%
N Broadacre
Batten - F04 Farrells Mailbox
Bag N Applied 41.0 kg N/ha
N Available 78.0 kg N/ha
N Limiting Yield Potential 1.86 t/ha
Optimum Protein % for Price Ratio 10.5%
Yield Loss from Sub-Optimal N 0.00 t/ha
Created 13 May 2016
Modified 20 Jun 2016
Northern Agricultural Region
Grower/Location
Crop Type
Soil Type
Grower Name
Wheat
Loam
Paddock Name
APW (Aust Premiu
0.0%
Zone
Site
$265.00
Organic Carbon
Nitrate & Ammonium
0.48% % 17.7 kg N/ha
< 10 cm 8.00 ppm 7.2 kg N/ha
0.26% % 7.2 kg N/ha
10-20 cm 4.00 ppm 2.4 kg N/ha
0.12% % 3.1 kg N/ha
20-30 cm 2.00 ppm 0.6 kg N/ha
30-50 cm 1.00 ppm 0.2 kg N/ha
50-100 cm 0.00 ppm 0.0 kg N/ha
27.9 kg N/ha Total 16.00 ppm 10.4 kg N/ha
Summary
Organic Carbon N
27.9 kg N/ha
Nitrate & Ammonium N
10.4 kg N/ha
Rotation N
0.0 kg N/ha
Fertiliser N
39.7 kg N/ha
Rainfall Yield Potential
0.00 t/ha
Soil Tests
Crop Rotations
Applied Fertiliser
Rainfall Yield Potential
More N?


Telstra 4G
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Grower Name
Wheat
Loam
Paddock Name
APW (Aust Premiu
0.0%
Zone
Site
$265.00
What if...
Protein Target 10.5%
Yield Potential 1.86 t/ha
Yield Loss 0.00 t/ha
More N ?
Yield Target 2.20
Protein Target 10.5%
Total Bag N to date 41.00 kg N/ha
Bag N Efficiency 90.0%
Total Bag N Required 56.96 kg/ha
Extra Bag N Required 15.96 kg N/ha
Cost of Extra N $14.22
Extra Fertiliser % N 42.0%
Ex. Fertiliser Required 37.99 kg/ha
Summary
Organic Carbon N
27.9 kg N/ha
Nitrate & Ammonium N
10.4 kg N/ha
Rotation N
0.0 kg N/ha
Fertiliser N
39.7 kg N/ha
Rainfall Yield Potential
0.00 t/ha
Soil Tests
Crop Rotations
Applied Fertiliser
Rainfall Yield Potential
More N?

NUlogic

Nulogic is CSBPs soil and tissue test recommendation model. In this instance we are interested in the N recommendation part of the model. It uses nitrogen data from your soil test and recent crop rotations combined with a yield target and expected efficiency of N use to determine crop demand for N, soil supply of N, and the requirement for fertiliser N to supplement soil supply. In this instance given we are working on red loam and a low rainfall environment scenarios are presented for 60% and 70% efficiency of soil and fertiliser N conversion to the crop.

In the table below N Broadacre and Nulogic recommendations are presented. Below that are expected yields from Yield Prophet for three N scenarios.

Yield Target t/ha	N Broadacre recommendation (N kg/ha)	Nulogic - 60% efficiency (N kg/ha)	Nulogic - 70% efficiency (N kg/ha)
1	4	0	0
1.5	27	15	7
2	51	35	24
2.5	74	54	40

How much N?

Above are outputs from N broadacre and Nulogic. Below is the amount of N applied (or to be applied) in Battens trial, plus expected Yield Prophet expected yield from that N.

As you can see the amount of N recommended varies significantly between models. All these models should be viewed through the lens of your farm, soil, rainfall and typical N responses. N rich strips, or trials like this are a great way to calibrate how your farm sits in respect to decision making tools.

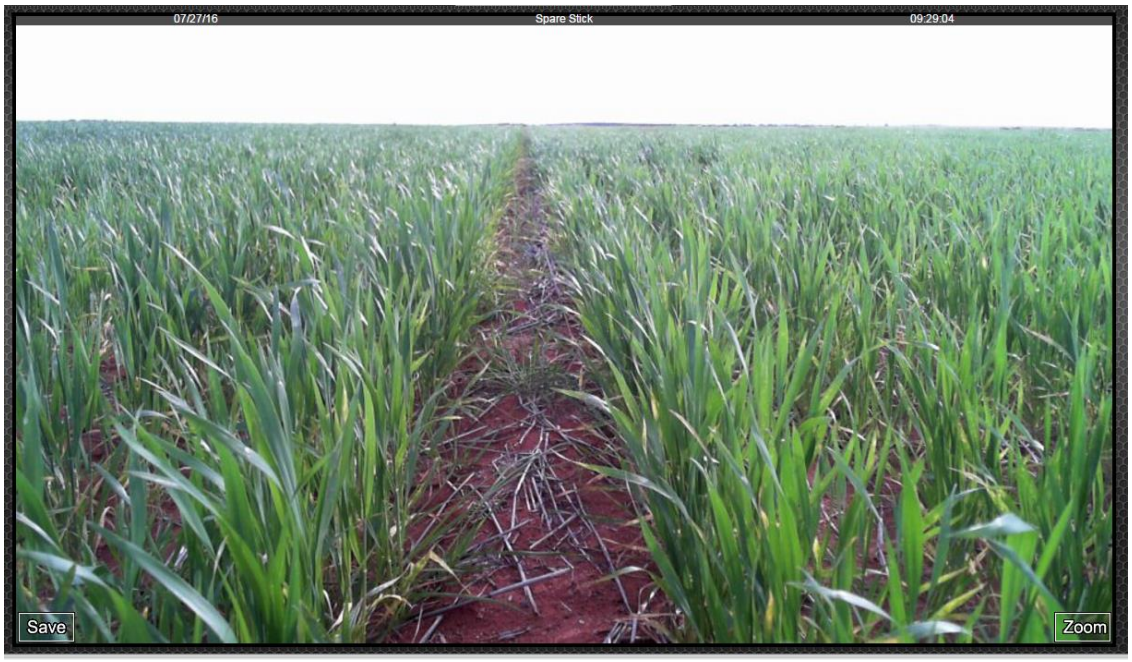
Trial Treatment	N applied in Battens Trial (kg/ha)	Yield Prophet Yield Expectation t/ha
Compound N + 40L UAN post	24	?
Low N	41	1.45
Medium N	53.5	1.75
High N (56.5)	70.5	2.1

Spectur Camera login: Batten password: batten123

As part of the project a camera has been installed in the paddock to take daily photos of the crop to allow remote monitoring of approximate crop growth stage and appearance and as a record for later reference. Something we wish was part of last season's Time of Sowing trial.

14th June

27th July



17th August