GRDC Irrigation Project on Agronomy and Soil Amelioration -

Summer Field Walk

Maize Agronomy in Focus

Wednesday 29 January 2020
9.30am - 11.30am

170 Teagues Road, Peechelba East, VIC

Development and validation of soil amelioration and agronomic practices to realise the genetic potential of grain crops grown under a high yield potential, irrigated environment in the northern and southern regions.

Background objectives

This GRDC investment starting in spring 2019 will develop and evaluate the effectiveness of novel soil management technologies and crop specific agronomic management practices on system profitability. Crop specific agronomic practices will focus on maximising system profitability through:

1. optimising the return on nitrogen through improved use efficiency
2. improving the understanding of N-form, timing and rate in the context of irrigation timing and inter-related agronomic decisions
3. understanding how to consistently optimise yield (in the context of water price, input costs and commodity price) for the crops where gaps are most apparent:

Soil management technologies will focus on improving soil structure, infiltration and moisture retention on (i) shallow and poorly structured red duplex soils ii) sodic grey clays prone to dispersion and waterlogging.

Which Crops?

The crops to be researched as part of the project are:

i) Faba bean (the pulse crop seen with the most potential for irrigated systems), ii) chickpea (an emerging high value pulse, important in crop sequences to provide a cereal disease break), iii) durum (the major option to increase the profitability of the cereal phase under irrigation), iv) canola (higher yields provide scope for significant increase in profitability and potential break effect) and v) maize (the summer crop with the greatest scope to improve returns under a double cropping system).

In tendering for the project, the project team added a sixth crop which is barley. This will be based on spring sown barley in Tasmania and winter barley where appropriate on the mainland.

How will the project objectives be achieved?

The objectives of the project will be underpinned by 66 field trials conducted annually at five Irrigated Research Centres (IRCs). The principal Research Centres at Kerang and Finley will cover all four autumn sown crops (faba beans, chickpeas, durum, and canola) with the addition of maize sown in the spring. Satellite centres will be established in Frances, Griffiths and Tasmania with a smaller number of trials per annum. Each year six trials will be reserved for other regions (e.g. Yarrawonga, Coleambally, Corop) that have smaller acreages of irrigated broad acre will be serviced by individual trials covering different crop and agronomic issues. The soil amelioration research to be conducted in collaboration with NSW DPI is based on two large block research trials at Kerang (Grey Clay under flood irrigation) and Finley (Red Duplex under overhead irrigation). It is planned to carry out amelioration this February.

Maize Protocols and treatment lists:

The following treatments lists and assessment protocols evaluate nitrogen use efficiency in irrigated grain maize under different rates and timings of applied N fertiliser.

The individual objectives are as follows:

- Evaluating nitrogen use efficiency under different N rates and timings in grain maize (0 – 500kg N/ha total N).
- Influence of different rates of urea N fertiliser (46%N) applied pre-drill
- Influence of N rate and N timing on harvest index (HI) in grain maize
- Influence of plant population on nitrogen use efficiency and harvest index.

All plots will be assessed for final harvest dry matter, grain yield and final nitrogen content in the maize stover (stalks, leaves, husks, and cobs) and maize grain so that nitrogen offtake can be calculated and harvest index can be calculated.

Paddock Details:

Sowing Date: 13 November 2019
Hybrid: Pioneer Hybrid 1756
Emergence Date: 21 November 2019
Starting soil N (8 November – taken before N application): **0-30cm** =17.8 kg/ha, **30-60cm** = 15.0 kg/ha.
First Water: 15 November 2019
Water Applied: 7mm per day through a pivot, except for a 5 day period in mid-late December where 14 mm was applied per day due to high temperatures.

Crop Management Details:

Crop Nutrition

No.	Date	Product	Rate/ha	Placement	Note
1	11/11/19	Urea	400 kg/ha	Spread	
		Gypsum	2.2 t/ha	Spread	
		Potash	300 kg/ha	Spread	
2	13/11/19	1% Zinc	250 kg/ha	With Seed	
		Cotton Starter	30 L/ha	With Seed	
3	10/12/19	Urea	100 kg/ha	Fertigation	
4	26/12/19	Urea	130 kg/ha	Fertigation	
		Molybdenum Mix	250 ml/ha	Fertigation	
5	11/1/20	SL Tec TE8	4 L/ha	Sprayed	
6	14/1/20	Urea	110 kg/ha	Fertigation	
7	15/1/20	Urea	110 kg/ha	Fertigation	

Crop Protection

No.	Date	Product	Rate/ha	Placement	Note
1	14/11/19	Dual Gold	2 L/ha	Post sow-Pre Emerg	
		Atrazine	2.5 L/ha	Post sow-Pre Emerg	
		Lorsban		Post sow-Pre Emerg	Check rate
		Glyphosate	2 L/ha	Post sow-Pre Emerg	
2	11/1/20	Abamectin		Foliar Spray	Check rate
		Trojan		Foliar Spray	Check rate
3	13/1/19	Gemstar	500 ml/ha	Foliar Spray	

Meteorological data:

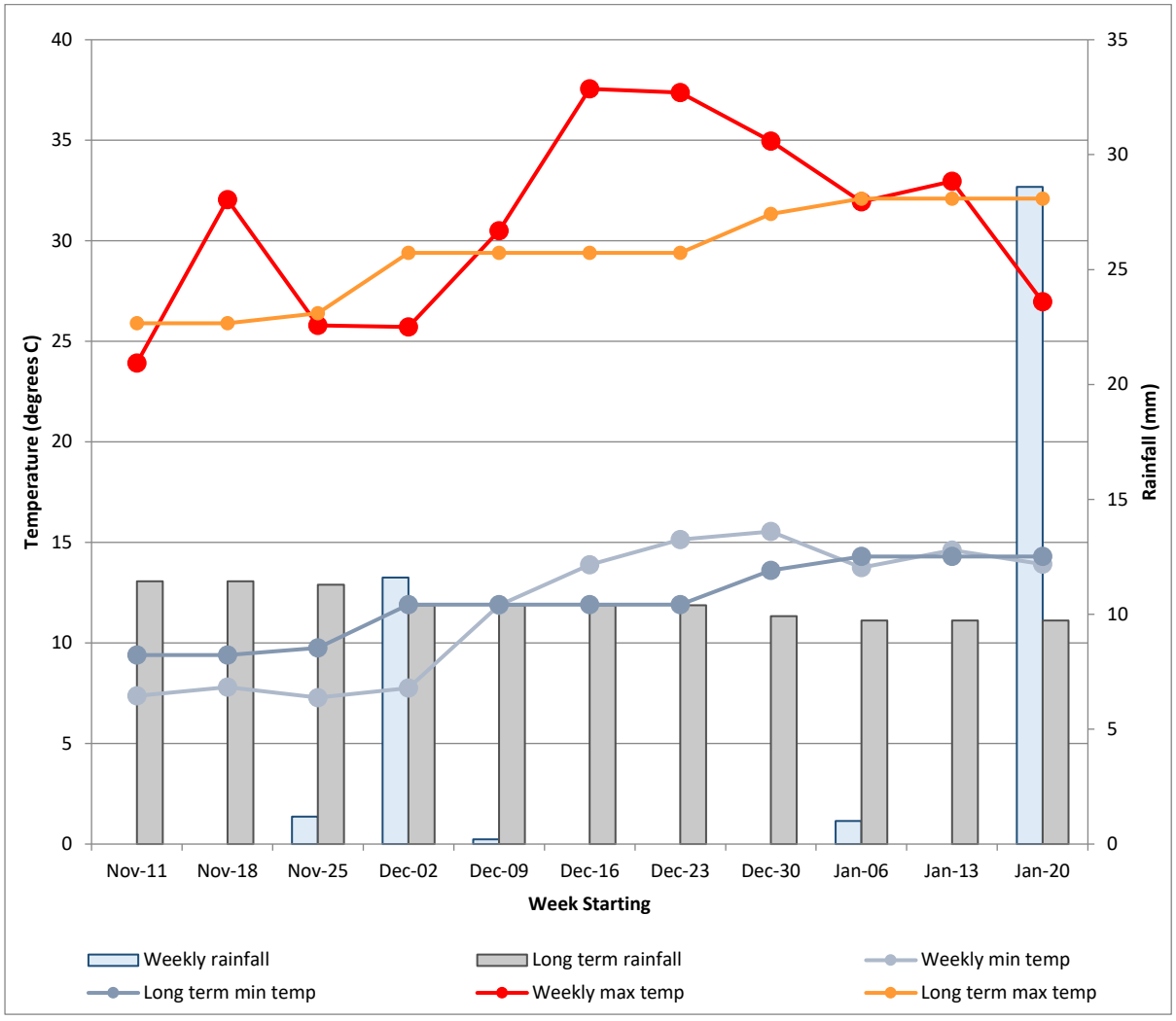

Figure 1. Meteorological data and irrigation applied, Wangaratta BOM station, Nov 2019 – January 2020.

Trial 1: **Nitrogen Use Efficiency Trial – N rates**

Location: Peechelba East, VIC 3678

Trial treatments: Eight rates of pre-drill N (46% N solid urea fertiliser) when N dose is standardly applied as fertigation.

Hybrid: Pioneer Hybrid 1756

Emergence: 93,500 plants/m^2

Treatment list:

Trt.	Pre-drill kg N/ha	Post – em (kg N/ha)	Total (kg N/ha)
1	0	207	207
2	45	207	252
3	90	207	297
4	135	207	342
5	180 (Farm standard)	207	387
6	225	207	432
7	270	207	477
8	315	207	522

Table 1. Dry matter (t/ha) on 17 December V6 stage and NDVI (0-1) at V4, V6 and V8 stage, Peecehlba East, VIC.

Trt.	Pre-drill (kg N/ha)	Dm (t/ha)	NDVI (V4 10-DEC)	NDVI (V6 17-DEC)	NDVI (V8 24-DEC)
1	**0**	1.01 a	0.234 a	0.558 a	0.757 a
2	**45**	1.16 a	0.275 a	0.579 a	0.758 a
3	**90**	1.05 a	0.260 a	0.557 a	0.729 a
4	**135**	1.23 a	0.257 a	0.579 a	0.775 a
5	**180**	1.00 a	0.253 a	0.577 a	0.775 a
6	**225**	1.18 a	0.250 a	0.555 a	0.734 a
7	**270**	1.11 a	0.251 a	0.549 a	0.722 a
8	**315**	1.10 a	0.271 a	0.607 a	0.818 a
Mean		1.10	0.260	0.571	0.757
LSD P=.05		0.25	0.059	0.071	0.108
P Value		0.53	0.677	0.790	0.732

Image 1. N Rate trial - 0 kg N/ha pre-sowing on 17/12/20 V6 Stage

Image 2. N Rate trial - 315 kg N/ha pre-sowing on 17/12/20 V6 Stage

Image 3. N Timing trial - 180 kg N/ha @ pre-sowing, on 17/12/20 V6 Stage

Image 4. N Timing trial - 180 kg N/ha @ V6, on 17/12/20 V6 Stage

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Trial 2. **Nitrogen Use Efficiency Trial – N Timing**
Location: Peechelba East, VIC 3678
Trial treatments: 3 N timings (pre-drill, 2weeks post sow, 4 weeks post sow) x 3 N rates x 4 replicates
Hybrid: Pioneer Hybrid 1756
Emergence: 93,500 plants/m^2

Treatment list:

Trt.	Timing (1st N dose)	N rate (1st N dose) (Kg N/ha)	Standard 2nd N dose (Kg N/ha)	Total (Kg N/ha)
1	Pre drill	0	207	207
2	Pre drill	90	207	297
3	Pre drill	180	207	387 (Farm standard)
4	3-4 leaf	0	207	207
5	3-4 leaf	90	207	297
6	3-4 leaf	180	207	387
7	6-8 leaf	0	207	207
8	6-8 leaf	90	207	297
9	6-8 leaf	180	207	387

Table 2. Dry matter (t/ha) on 17 December, V6 stage and NDVI (0-1) at V4 and V6 stage Peecehlba East, VIC.

Trt.	Timing	N rate (kg N/ha)	DM (t/ha)	NDVI (V4 10-DEC)	NDVI (V6 17-DEC)
1	Pre drill	0	0.89 a	0.262 b-e	0.562 c
2	Pre drill	90	1.03 a	0.258 b-e	0.583 bc
3	Pre drill	180	0.93 a	0.266 a-d	0.565 bc
4	3-4 leaf	0	0.95 a	0.252 cde	0.526 de
5	3-4 leaf	90	0.90 a	0.247 de	0.524 e
6	3-4 leaf	180	0.93 a	0.243 e	0.556 cde
7	6-8 leaf	0	0.91 a	0.272 abc	0.559 cd
8	6-8 leaf	90	0.99 a	0.278 ab	0.599 ab
9	6-8 leaf	180	0.89 a	0.286 a	0.623 a
Mean			0.94	0.263	0.566
LSD P=.05			0.18	0.022	0.035
P Value			0.53	0.609	0.081

Trial 3. **Nitrogen Use Efficiency – Plant population trial x nitrogen interaction**
Location: Peechelba East, VIC 3678
Trial treatments: 3 plant populations x 3 N rates applied pre-drill x 4 replicates
Hybrid: Pioneer Hybrid 1756 sown at 3 populations

Treatment list:

Trt.	Plant pop (seeds sown/ha)	N rate 1st N dose (Kg N/ha)	Standard (2nd N dose) (Kg N/ha)	Total
1	83,000	0	207	207
2	83,000	90	207	297
3	83,000	180	207	387 (Farm standard)
4	93,000	0	207	207
5	93,000	90	207	297
6	93,000	180	207	387
7	103,000	0	207	207
8	103,000	90	207	297
9	103,000	180	207	387

Table 3. Emergence (plants/ha) on 10 December, V4 stage, Dry matter (t/ha) on 17 December, V6 stage and NDVI (0-1) at V6 stage Peecehlba East, VIC.

Trt.	Target Plant Population (plants/ha)	N rate (kg N/ha)	Emergence (plants/ha)	DM (t/ha)	NDVI (V6 17-DEC)
1	**83000**	**0**	81201 c	0.76 ab	0.511 ab
2	**83000**	**90**	77920 c	0.70 ab	0.498 b
3	**83000**	**180**	78740 c	0.68 ab	0.517 ab
4	**93000**	**0**	92684 b	0.88 a	0.579 a
5	**93000**	**90**	91864 b	0.85 ab	0.525 ab
6	**93000**	**180**	91043 b	0.91 a	0.559 ab
7	**103000**	**0**	103346 a	0.78 ab	0.547 ab
8	**103000**	**90**	104167 a	0.59 b	0.573 ab
9	**103000**	**180**	103346 a	0.80 ab	0.568 ab
Mean			91590	0.77	0.542
LSD P=.05			5596	0.27	0.079
P Value			<0.001	0.320	0.323

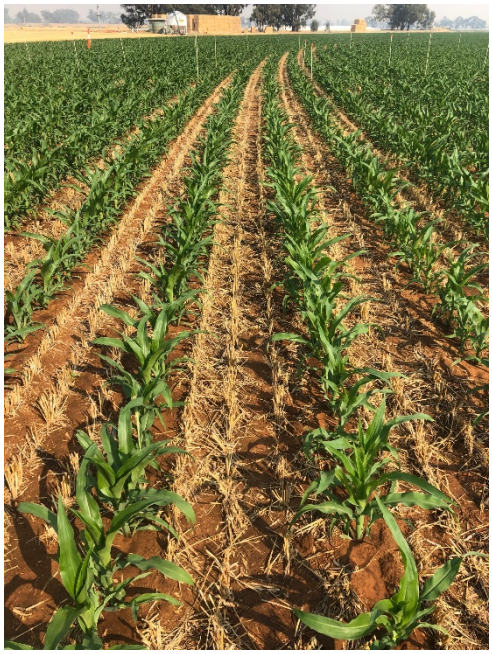	
Image 5. Plant Population Trial – 83,000 plants/ha, 0 kg N/ha at sowing, on the 17/12/19 (V6)	**Image 7. Plant Population Trial** – 93,000 plants/ha, 0 kg N/ha at sowing, on the 17/12/19 (V6)
	
Image 7. Plant Population Trial – 103,000 plants/ha, 0 kg N/ha at sowing, on the 17/12/19 (V6)	

Trial 4. Crop establishment – row spacing x plant population interaction
Location: Boort, VIC
Trial treatments: 3 plant populations x 2 row spacing (500mm & 750mm) x 4 replicates
Sowing Date: November 7th
Hybrid: Pioneer Hybrid 1756

Treatment List:

Trt.	Plant pop (seeds sown/ha)	Row spacing (mm)
1	90,000 (9 seeds/m^2)	500
2	90,000 (9 seeds/m^2)	750
3	105,000 (10.5/m^2)	500
4	105,000 (10.5/m^2)	750
5	120,000 (12/m^2)	500
6	120,000 (12/m^2)	750

- Trial was wind damaged at emergence.
- No dry matter differences observed at V6 across either row spacing or plant population.

Trial 5. **Influence of modern fungicides on the yield potential of grain maize**
Location: Howlong, NSW
Trial treatments: 4 fungicide programs x 2 fungicide timings (V8 & V14) x 4 replicates
Sowing Date: November 29
Hybrid: Pioneer Hybrid 1756

Treatment List:

Trt.	Fungicide Product (active)	Timing *
	Factor 1 (rate of active ingredient)	**Factor 2 (timing)**
1	Untreated	----
2	DMI – Prothioconazole (Proline) (100g/ha)	Timing 1 (V8)
3	DMI – Propiconazole (Tilt) (125g/ha)	Timing 1 (V8)
4	QoI – Pyraclostrobin (Cabrio) (200g/ha)	Timing 1 (V8)
5	DMI/QoI – Prothioconazole + Pyraclostrobin	Timing 1 (V8)
6	Untreated	
7	DMI – Prothioconazole (Proline) (100g/ha)	Timing 2 (VT – Tasseling)
8	DMI – Propiconazole (Tilt) (125g/ha)	Timing 2 (VT – Tasseling)
9	QoI – Pyraclostrobin (Cabrio) (200g/ha)	Timing 2 (VT – Tasseling)
10	DMI/QoI – Prothioconazole + Pyraclostrobin	Timing 2 (VT – Tasseling)

- Applications applied on 8/1/20 and 24/1/20.
- No visual damage at V14 from V8 application.