Summer Crops Field Walk

Optimising yield and quality of Summer crops
Maize and sorghum

Optimising Irrigated Grains

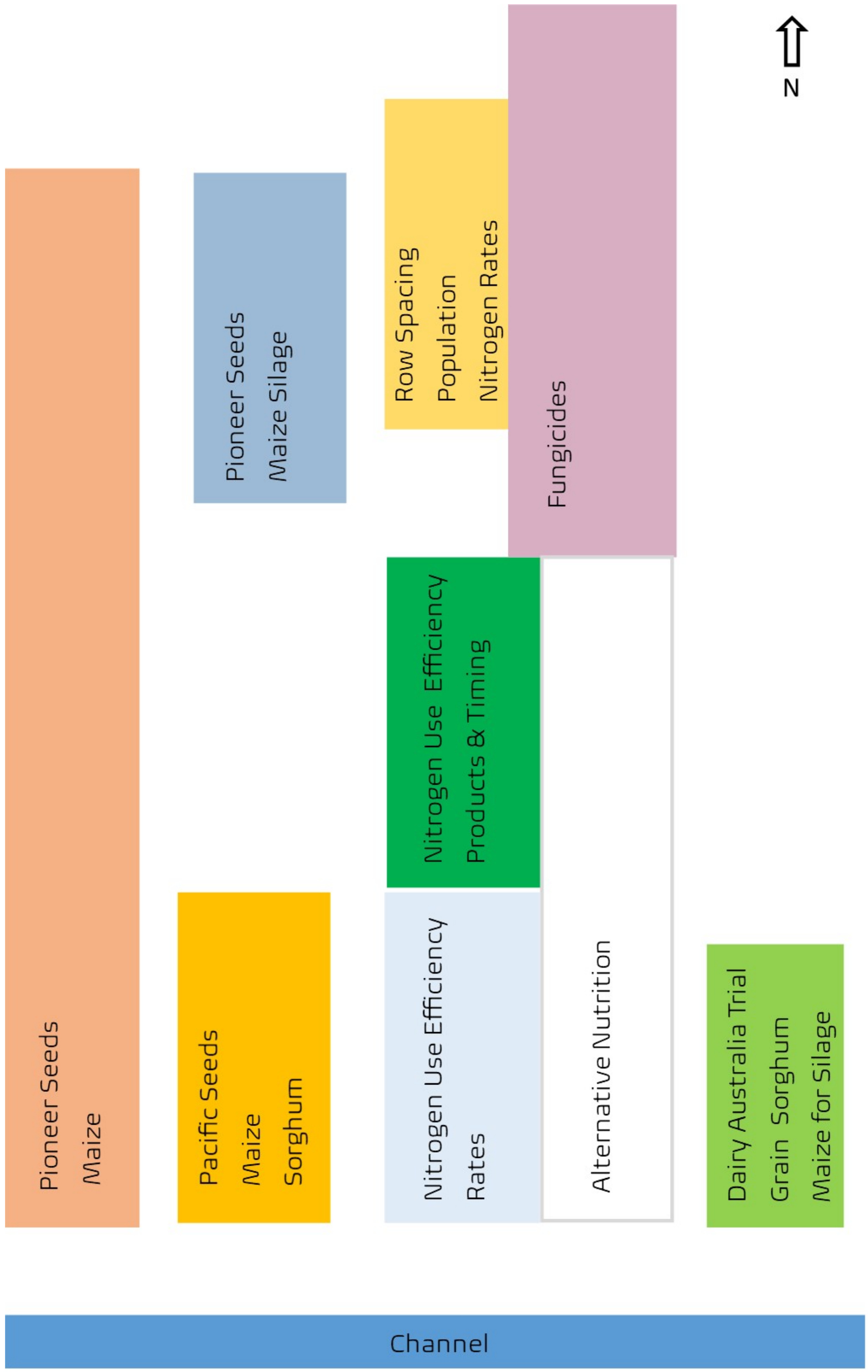
Field Walk Report 2021

Thursday 28th January 2021

9:00 – 11:00am

Cnr Hallinan Rd and Gitsham Lane, Wandella

Summer Trial Site Plan 2020-21



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.

2020-21 Maize Trial Summary

The paddock was annual pasture, grass dominant prior to site preparation.

- 15-23 October
  - Site preparation: Disced and smudged. 2.5 t/ha gypsum and 60 kg P/ha applied by spreader.
- 3 November
  - Site sown with Pioneer 1756, targeting 89,000 plants/ha.
  - Site watered up.
- 4 December
  - N treatments commenced. Majority of N applications were on 16th December.

Irrigation Summary

Irrigation Date	Ml/ha
November 3	1.7
November 23	0.8
December 4	0.8
December 16	0.9
December 27	0.9
January 5	0.9
January 12	0.9
January 20	0.9
Total to date	7.7 Ml/ha

Rainfall Summary

Month	Rainfall (mm)
November	11.8
December	47.4
January	12.6

Soil N Summary (taken outside of the crop)

Sample Date	Kg N/ha	
	0-10cm	0-60cm
October 15	13	34
November 23	21	71
December 4	35	105

Tissue Test Summary

YEB 27/12/20

Treatment	P	K	S	Ca	Mg	Na	Cl	Mn	Fe	Cu	Zn	B	Total N	Mo
	%	%	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg
Starter N	0.35	2.5	0.22	0.31	0.24	<0.01	0.35	86	104	9.8	29	49	2.85	0.18
Topdressed N	0.36	2.6	0.21	0.26	0.22	<0.01	0.315	77	60	9.1	29	37	2.80	0.15
Critical	0.22	2.25	0.15	0.12	0.1			40	10	3	18	2	2.75	
Satisfactory	0.25 - 0.4	2.5 - 3.5	0.18 - 0.25	0.15 - 0.5	0.12 - 0.4			50 - 160	20 - 250	5 - 15	20 - 30	5-20	3 - 3.5	

The maize trials are part of the GRDC project '**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**' which aims to maximise the profitability of irrigated farming systems in the Murray and Murrumbidgee region, South East South Australia and Tasmania. The research project is led by FAR Australia in collaboration with the Irrigated Cropping Council and is part of a wider set of investments being made by GRDC in irrigated cropping systems.

Maize - Nitrogen Use Efficiency – Plant population x row spacing x nitrogen interaction trial

Protocol objectives

- To evaluates the influence of plant population on nitrogen use efficiency (NUE), dry matter production, grain yield and harvest index in grain maize.
- Investigate the three-way interaction of plant population, row spacing and nitrogen rate interaction and its influence on NUE, dry matter production, grain yield and harvest index in grain maize.

Trial Treatments

Trt.	Plant pop (seeds sown/ha)	Row spacing (mm)	N dose split* Kg N/ha	Total N dose Kg N/ha
	Factor 1	Factor 2	Factor 3	
1	83,000	500	Split 100/200	300
2	83,000	500	Split 150/300	450
3	83,000	750	Split 100/200	300
4	83,000	750	Split 150/300	450
5	103,000	500	Split 100/200	300
6	103,000	500	Split 150/300	450
7	103,000	750	Split 100/200	300
8	103,000	750	Split 150/300	450

* *Split between seedbed and a post emergence stage where post emergence applications can still be applied.*

Key Learnings from 2019-20

- In a variable trial there were no significant differences in grain yield (machine harvested) due to row spacing 500mm v 750mm (20” v 30”), plant population (85,000 v 120,000 pl/ha) or N rate 300 v 450 kg N/ha).
- Overall grain yield average in the trial was 16.47 t/ha.
- Although no yield differences were recorded it was noted that narrower row spacing produced more overall harvest biomass, particularly at the lower plant population.
- Since there were no difference in grain yield associated with narrow row spacing and lower plant population, harvest index was reduced.
- Crop canopies at harvest contained more nitrogen than was applied as fertiliser indicating that at 300 kg N/ha applied as much as 235 kg N/ha was supplied from the soil.
- Increasing N fertiliser applied from 300 to 450 kg N/ha did not result in any greater N offtake in the crop at harvest, indicating that N was either left in the soil or lost.

2020-21 Season to date

- The target plant populations were a bit higher at 89,000 and 110,000 pl/ha.

Maize - Optimum timings and rates for the nitrogen (N) forms applied in irrigated crops of maize

Protocol Objective

To evaluate nitrogen use efficiency in 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 – 560kg 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.

Trial Treatments

Trt.	Pre-drill (Urea 46%N) kg N/ha	Post – em kg N/ha*	Total
1	0	0	0
2	40	40	80
3	80	80	160
4	120	120	240
5	160	160	320
6	200	200	400
7	240	240	480
8	280	280	560

** 4-6 leaf stage (to coincide with irrigation timing – before week 8)*

Key Learnings from 2019-20

- The highest grain yield (machine harvested) achieved was 16.43 t/ha with the applied N rate of 240 kg N/ha in a crop producing 29 t/ha dry matter at 49% harvest index.
- N applications above 240kg N/ha were uneconomic in the trial.
- The nil control treatment yielded 10.91 t/ha in a crop producing 22t/ha dry matter at 43% harvest index.
- Available Soil N prior to sowing and watering up was 34 kg N/ha (0-60cm). The nil control N offtake at harvest was 241 kg N/ha, suggesting in-crop mineralisation resulted in 207 kg N/ha of the N taken up.
- At the highest level of N (560kg N/ha) there was no advantage to applying 80 Kg N/ha of the dose very late at tasselling.

Maize - Disease management for irrigated crops – products, rates and timings

Protocol objectives

Broad spectrum fungicides such as group 3 DMI triazoles, group 7 succinate dehydrogenase inhibitors and group 11 QoIs (strobilurins) are routinely used in irrigated cereal crops but the effects of these fungicides on grain maize is less well defined. In Protocols 7 & 8 objectives are related to disease management and green leaf retention.

Specifically, the individual objectives are as follows:

- To identify any foliar disease evident during the growing season (e.g. Northern Corn Leaf Blight - NCLB)
- To identify the influence of protectant and curative fungicide properties (using group 3 DMI triazoles and group 11 QoIs (strobilurins) on disease in grain maize
- To assess whether fungicides are associated with greater green leaf retention in grain maize hybrids in the absence of disease.

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 (8 leaf)
3	DMI – Propiconazole (Tilt) (125g/ha)	Timing 1 (8 leaf)
4	QoI – Pyraclostrobin (Cabrio) (200g/ha)	Timing 1 (8 leaf)
5	DMI/QoI – Prothioconazole + Pyraclostrobin	Timing 1 (8 leaf)
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)

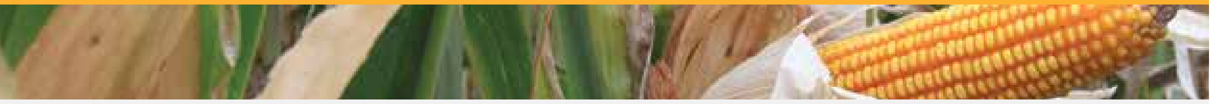
***** *Foliar timings maybe adjusted according to safe operating height of boom sprayer for plot spraying equipment*

Key Learnings from 2019-20:

- Application of three different fungicide active ingredients (four products) at either V8 (8 leaf) or VT tasselling produced no yield response at the Kerang site.
- Application of a fungicide at either 8 leaf or tasselling did not result in an extended period of green leaf retention during grain fill.
- No disease was evident in the trial for the duration of the season.

2020-21 Season to date

- The 8 leaf application was on 30th December
- Tasseling was 24th January
- No disease noted (and I can safely say I will not have any skin fungal diseases either for the next few weeks)



MAKING QUALITY SILAGE

Jason Scott National Corn and Microbial Lead

Why grow corn silage

Corn silage provides 2 pools of energy

1. Green Pool – Stover
2. Yellow Pool – Grain

Corn silage also contains functional fibre to aid rumen function and digestibility. Corn silage with its good quality fibre and quantity of energy compliments high protein pasture diets and high energy concentrates. It also provides a balanced ration for efficient use of spring pastures. Corn silage when used in the dairy rotation assists with herd health by reducing the incidence of bloat in legume dominant pastures, reducing blood nitrogen levels, increasing fertility and lifting milk yields. Corn silage fills the feed gaps, is a cost competitive feed source and can help reduce feed costs.

Producing quality feed

Producing quality feed is a continuum ranging from;

- Seed selection and agronomics
- Harvest maturity and processing
- Correct storage and fermentation
- Ration balancing and feed bunk management
- Feed delivery

Growing corn for silage

1. Set a yield goal
2. Follow the recipe
3. Good harvest management
4. Timeliness – water & nutrients

Paddock selection

- What is the soil structure like?
- How much weed pressure is there?
- Do I have enough irrigation water available?
- Accessibility for machinery?

Hybrid selection

1. Agronomic package – solid base
   i. Relative maturity
   ii. Disease
   iii. Early growth
2. Yield – 60% of selection value
3. Starch & NDFD 40% of selection value

Although corn silage hybrids are selectively bred &/or characterised for high digestibility of the stover, high grain yield is an essential criterion for high energy corn silage. Grain supplies 80% more energy than stover on a kg for kg basis.

Approximately 65% of the energy from corn silage is derived from the grain.

Corn developmental timeline

Figure 1 below shows the developmental timeline for a Maize crop, the maximum crop yield potential is set by day 35-38 everything else we do as crop managers is helping to achieve this whilst the environment is sometimes trying to work against us.

From day 38 the crop goes through a rapid growth phase; it has a large requirement for Nitrogen and Potassium during this period for good strong plant growth and healthy development of the pollen and silks. From approximately day 60 the tassel appears and this needs to be synchronised with the silks for pollination of the ovules to occur, the pollination period lasts for up to 12 days depending on weather, once the ovule is pollinated the corn kernels develop and this is where the second energy pool is derived from, the starch energy out of the kernels.

As we keep progressing along the timeline we get to when the grain is laying down starch and a milk line develops in the kernel. This is where the drier starch meets the milky dough and can be easily assessed when breaking open a cob.

Traditionally we suggested harvest should occur at around ½ to ¾ milk line this was correct for the older hybrids, but with the advancement in breeding and the newer hybrids having better Staygreen we can push further towards black layer or physiological maturity to gain extra starch, whilst still maintaining the correct total crop dry matter of between 32-38%. For a more accurate assessment of dry matter and harvest timing you need to take a complete plant, chop it down and do a dry matter assessment this way.

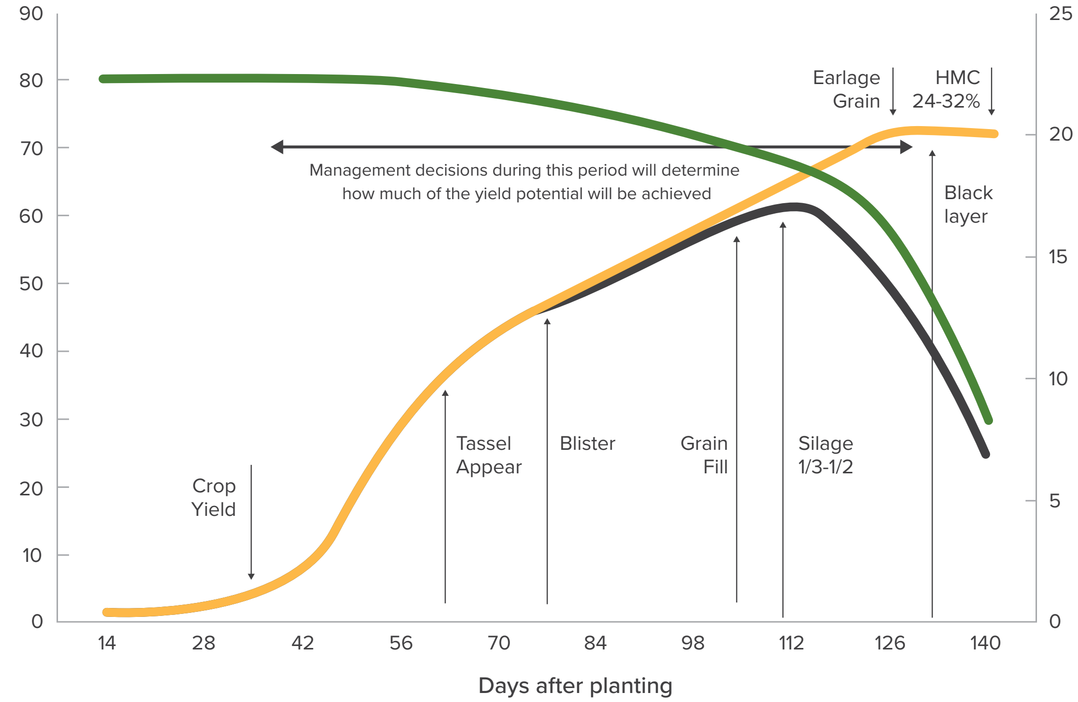
Fig. 1

Wet Weight Yield

Plant Moisture

Dry Matter Yield

This developmental timeline will vary in length according to maturity but the stages will still remain.



Over the summer of 2020-21, Pacific Seeds in conjunction with the Irrigated Cropping Council (ICC) are running an irrigated forage sorghum trial. The replicated trial is looking at several different facets of irrigated forage sorghum production, including:

1. Hybrid X Maturity X Cutting Time X Total Dry Matter Yield X Quality
2. Seeding rate vs Total Dry Matter Yield
3. A New Experimental Hybrid

Trial Overview:

The trial contains 10 treatments replicated 4 times. The treatments are as below:

Hybrid	Sorghum Type	Maturity	Cutting height	Seeding Rate
Sprint (Pacific Seeds)	Sudan x Sudan	Quick	500mm	18kg/ha
Sprint (Pacific Seeds)	Sudan x Sudan	Quick	500mm	30kg/ha
BMR Rocket (Pacific Seeds)	Sorghum x Sudan	Quick	500mm	18kg/ha
BMR Rocket (Pacific Seeds)	Sorghum x Sudan	Quick	500mm	30kg/ha
BMR Octane (Pacific Seeds)	Sorghum x Sudan	Late	1000mm	18kg/ha
Superdan2 (Pacific Seeds)	Sudan x Sudan	Mid-Late	1000mm	18kg/ha
PACF8530 (Pacific Seeds)	Sudan x Sudan	Late	1000mm	18kg/ha
Speedfeed (Pacific Seeds)	Sorghum x Sudan	Quick	500mm	18kg/ha
SSS (Pioneer Hi Bred)	Sudan x Sudan	Quick	500mm	18kg/ha
Chomper (S&W)	Sorghum x Sudan	Quick	500mm	18kg/ha

The trial was planted 10th November2020 and the hybrids will be cut as they reach the assigned cutting height (pending their maturity class) and samples will be taken for quality analysis. Typically total biomass produced over a growing season does not necessarily vary by number of cuts, and not always between high performing hybrids of differing maturity class,e.g. Quick maturity Sprint may produce the same amount of total dry matter over 3 cuts when compared to Late Maturity BMR Octane cut only once. This trial looks to quantify this, but also look at the hay quality differences between hybrids and between cutting time. In general, the “Sudan” type hybrids produce finer stems and are very suited to hay production (and sheep) compared to the longer season Sorghums that are better suited for cattle/dairy and silage use. Previous research by Pacific Seeds has shown there is an inverse relationship between plant height and protein levels, which has an impact on the feed value available to the stock at the recommended grazing height of the sorghum (due to different Prussic Acid levels of different sorghums).

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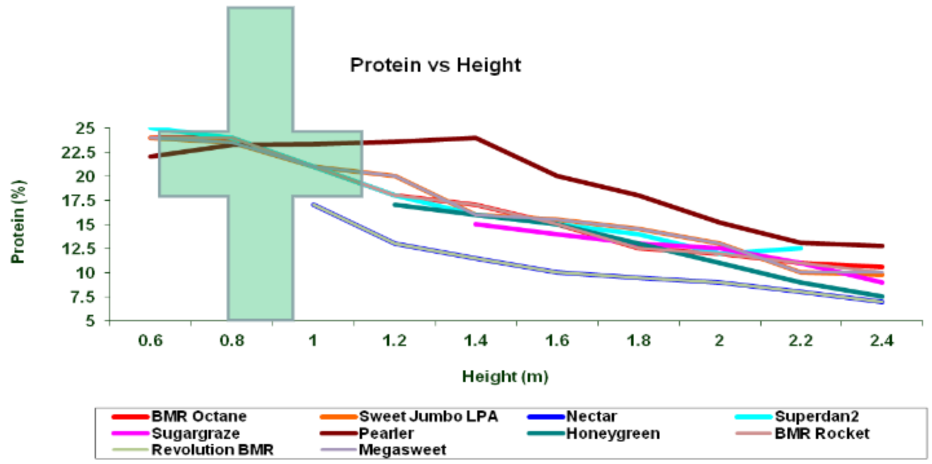
Pacific Seeds
Growing possibilities

Protein Management



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Another component of the trial is looking at seeding rate vs total dry matter yield and also effect on quality of the two quick maturity Forages Sprint and BMR Rocket. Higher plant populations can cause the plants to have finer stems, which may or may not have an impact on feed quality from both nutritional value but also potentially physically more palatable, resulting in a more attractive feed for certain classes of livestock.

The 3rd component of the trial is testing a new Sudan-type forage hybrid. PACF8530 is a mid-late maturity similar to Superdan2, but higher total dry matter production potential.

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Maize -Nitrogen Use Efficiency Trial – Impact of timing

Protocol Objective

To evaluate nitrogen use efficiency in grain maize under different rates and timings of applied N fertilizer. The individual objectives are as follows:

- Evaluating nitrogen use efficiency under different N rates and timings in grain maize (0 – 560kg 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.

Trial Treatments

**Based on a N rate of 300 Kg N/ha*

Trt.	Timing (1st N dose)	Timing 2nd N dose)	Timing 3rd N dose	Timing 4th N dose
	Seedbed	V2 (2-3 leaf)	V4 (3-4 leaf)	V6 (6-8 leaf)
1	---	---	---	---
2	300			
3	300 (Slow release Entec2)			
4	100	100	100	
5	100	---	100	100
6	100	66	66	66
7	200	---	---	100
8	200 (slow release Entec2)	---	---	100

Key Learnings from 2019-20

- Although increasing the frequency of N applications appeared to slightly increase grain yield (machine harvested) compared to all “up front” in seedbed yield differences were not statistically significant.
- As a general comment, timing of N application did not affect the grain yield, whether it be all up front or split over 4 timings up to V6.
- The nil applied N treatment yielded 9.68t/ha.
- N content of the grain at harvest was greater where split applications involving later timings were compared to all the nitrogen applied at sowing indicating greater N fertiliser efficiency.
- However, unless there is a premium for the maize protein in the grain resulting from later N timings the difference may be of little value to the grower.
- Soil N prior to sowing and watering up was 25 kg N/ha (0-60cm). The nil treatment contained a total of 147 kg N/ha.

2020-21 Season to date

- Soil N levels are in the notes. NDVI picked up the 0 and 80 treatments in the ‘rates’ trial, and only the 0 in the ‘timing’ trial.

Maize - Alternative Nutrition Strategies – Macro and micro nutrient monitoring

This trial is new to the 2020-21 season. At the January 2020 field days, it was evident that there was a multitude of different strategies for maximising the productivity of grain maize. This trial has been set up to explore some of these alternative approaches where monitoring of the key leaves is used to determine the appropriate nutrition input.

Protocol objectives

- To evaluate the influence of macro and micro nutrient rates and timings on dry matter production, grain yield and harvest index in grain maize.
- To evaluate the fluctuations in macro and micro nutrient tissue levels that occur both naturally in grain maize and in response to alternative strategies for nutrition.

Trial Treatments

Trt.	Pre-drill (Urea 46%N) kg N/ha	Post – em kg N/ha	Total
1	0 (control)	250 (split V4 & V6)**	250
2	0 (Alternative 1 tbc)*	250 (split V4 & V6)**	250
3	0 (Alternative 2 tbc)*	250 (split V4 & V6)**	250
4	0 (Alternative 3 tbc)*	250 (split V4 & V6)**	250
5	125 (control)	125 (V4)	250
6	125 (Alternative 1 tbc)*	125 (V4)	250
7	125 (Alternative 2 tbc)*	125 (V4)	250
8	125 (Alternative 3 tbc)*	125 (V4)	250

** Alternative strategies 1 – 3 are based on leaf tissue monitoring combined with added micro nutrients. The theory is to have an underpinning level of nitrogen nutrition that represents optimum levels of nitrogen nutrition observed in 2019/20 trials.*

Standard monitoring of leaf tissue will be conducted on the control treatment in comparison to any alternative strategies introduced.

*** Split 50:50 between V4 and V6*

2020-21 Season to date

- To date the tissue tests have not shown many issues, all nutrients are above the critical levels. The tissue test summary is outlined in the opening pages of these notes.
- As a start for treatments, a general micronutrient cocktail was applied on 20th January.

Ear leaf tissue test results taken at silking.

Treatment	P	K	S	Ca	Mg	Na	Cl	Mn	Fe	Cu	Zn	B	Total N	Mo
	%	%	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg
Starter N	0.27	2.1	0.24	0.52	0.34	<0.01	0.35	86	104	14	33	59	2.85	0.18
Topdressed N	0.27	2.1	0.23	0.52	0.33	<0.01	0.315	77	60	12	24	54	2.80	0.15
Critical	0.2	1.6	0.13	0.1	0.08			15		2	15	2	2.5	0.10
Satisfactory	0.22 - 0.30	2.5 - 3.5	0.15-0.22	0.12-0.30	0.12-0.25			20-150		3-10	18-25	3-10	2.7-3.25	0.20

Maize and Grain Sorghum Comparison Trial

ICC site Kerang 2020/21

Aim: To determine the relative yield and quality of grain sorghum varieties compared to maize grown under both optimum and deficit irrigation, that have potential use in dairy systems as a silage source

Murray Dairy, in collaboration with the Irrigated Cropping Council (ICC), are conducting a trial in Kerang to compare maize and grain sorghum as fodder for silage.

Low water allocations and high temporary water prices have seen increasing change of dairy farm systems across the region. As a result, there is increased interest in alternative crops such as maize and grain sorghum as farmers strive to achieve higher returns for each megalitre of water.

Trials on grain sorghum grown at Gatton in Queensland have shown promising nutritional quality and yields comparable to maize.

These trials have demonstrated that sorghum can achieve yields in excess of 30 tonne DM/ha with starch levels around 30%.

The 3 sorghum varieties being assessed include White Grain Sorghum (Liberty), Red Grain Sorghum (Sentinel), and a Forage Sorghum (Megasweet). These varieties are being compared with both a medium and short season maize variety (PAC440 and PAC606).

Three irrigation treatments have been applied. A high irrigation treatment to meet the water requirements of maize, a medium irritation treatment to meet the water requirements of sorghum and a deficit irrigation treatment to determine how both crops respond to water stress conditions.

For more information, contact Shane Byrne on 0402 971 593