AgGrow
AGRONOMY + RESEARCH

2019 AG GROW AGRONOMY SOIL WETTING AGENT TRIALS

Barellan, Beelbangera & Goolgowi

INDEPENDENT AGRONOMY ADVICE + CUTTING EDGE RESEARCH

PRACTICES TO PROMOTE SUCCESSFUL EARLY ESTABLISHMENT OF WHEAT

KEY POINTS

- Growing conditions in 2019 were characterised by a strong break in April/ May, but with significantly below average rainfall in all other months.
- Sowing depth was the greatest influence on establishment, crop vigour, NDVI and grain yield, with deep sowing (10cm) significantly lower than the normal sowing depth (3cm).
- The dry growing season made results variable, as although there were significant differences within the trials between treatments, it was difficult to draw conclusions from the data.
- Further work needs to be carried out to clarify any benefits treatments provide in establishing crops early.

BACKGROUND

Early sowing opportunities in April often present themselves, but they are not without risk. Sowing wheat earlier than the traditional May sowing window means trying to get crops to successfully establish early in warm soils, and often on limited moisture.

To try to manage the risks and look at how we can successfully get crops up early, Ag Grow Agronomy set up trials at 3 sites looking at various management techniques and products that could aid establishment. These included sowing depth, gypsum as granules next to the seed, various seed and liquid inject treatments looking at attracting moisture to seed, and a humectant and wetter crystal that can absorb hundreds of times its own weight.

The aim of these products is to trap moisture close to the root zone, aiding in secondary root development and therefore crop establishment.

TRIAL DETAILS

Three soil wetting agent trials were established by Ag Grow Agronomy and Research in 2019. These trials were set up to evaluate practices that allow early establishment (early April) into warm dry soils.

The sites were established at “Ridgetop” Beelbangera, Phil Bourchier’s “Yarrandale” property at Barellan and Chris Condon’s “Gillabri” property at Goolgowi. Details for each site are in table 1.

Each trial consisted of 16 treatments, which included 8 treatments at 2 sowing depths normal (3cm) and deep (10cm). A full treatment and application list for the trials is shown in table 2.

Each trial was replicated 4 times. The trials were sown with a Morris Contour Drill plot seeder with 25cm row spacings. Plot sizes were 1.75m x 11m (19.25m^2), with appropriate pest, disease and weed control undertaken on each trial.

Table 1: Site details for Barellan, Beelbangera and Goolgowi.

	BEELBANGERA	BARELLAN	GOOLGOWI
Soil Test Results:			
pH (CaCl2)	4.6	5.7	7.7
Total N (0-60)	189.7 kg N/ha	315.8 kg N/ha	157.1 kg N/ha
Colwell P (0-10cm)	71ppm	80ppm	21ppm
Sowing date:	30th April, 2019	5th April, 2019	2nd April, 2019
Variety:	Scepter	Kittyhawk	Kittyhawk
Sowing rate:	25kg/ha	25kg/ha	25kg/ha
Topdressing:	65kg/ha urea	60kg/ha urea	80kg/ha urea
Harvest date:	30.10.2019	19.11.2019	18.11.2019

Table 2: Soil wetting agent Treatment List for the 3 Trials..

Treatment No	Treatment	Sowing Depth	Treatment ID
1	Nil (standard practice)	Normal	Nil
2	Divine Liquid inject	Normal	DivLI
3	Gypsum granules	Normal	Gypsum
4	SE14 Liquid Inject	Normal	SE14LI
5	SE14 Liquid inject SZ + surface	Normal	SE14LI_S
6	Humectant granule	Normal	HumG
7	Humectant liquid inject	Normal	HumLI
8	Cruiser	Normal	Cruiser
9	Nil (standard practice)	Deep	Nil_D
10	Divine Liquid inject	Deep	DivLI_D
11	Gypsum granules	Deep	Gypsum_D
12	SE14 Liquid Inject	Deep	SE14LI_D
13	SE14 Liquid inject SZ + surface	Deep	SE14LI_S_D
14	Humectant granule	Deep	HumG_D
15	Humectant liquid inject	Deep	HumLI_D
16	Cruiser	Deep	Cruiser_D

Product types:

Surfactant	Divine
Surfactants/ retention agent	SE14
Seed Treatment	Cruiser

RESULTS AND DISCUSSION

The 2019 season was characterised by a continuation of the 2018 drought, with the greatest climatic effect upon the region being that of drought. Good rain in April and May provided a strong start to the cropping season, however below average rainfall was recorded for all other months, table 3.

Table 3: 2019 Rainfall and growing season rainfall at the 3 sites.

MONTH	"Ridgetop" Rainfall (mm)	"Yarrandale" Rainfall (mm)	"Gillabri" Rainfall (mm)
January	3.5	33	5
February	25	10	5
March	16.5	15.5	0
April	40	13	45
May	53	74.5	28
June	20	28	10
July	20.5	11	19
August	9	0	8
September	3.5	6	0
October	3	6	0
November	81	49	42
YTD Total	***275***	***246***	***162***
GSR *(1st Apr to 31st*	***149***	***138.5***	***110***

Figure 1: Establishment at Beelbangera (top), Barellan (middle) & Goolgowi (bottom).

Establishment, crop vigour, NDVI, grain yield and quality were all assessed and statistically analysed on each trial.

Establishment & Crop Vigour:

Establishment and crop vigour scores were taken mid-May at each site, when the trials were early tillering, figure 1.

Establishment was scored from 0 to 9, with 0 being very poorly established and uneven and 9 being very evenly established.

Crop vigour was also scored from 0 to 9, with 9 being the most vigorous. This score was an assessment of ground cover and included any visual crop effects such as colour and overall plant health.

At all 3 sites there was no significant differences between the interaction of sowing depth and treatment for both establishment and crop vigour.

However there were significant differences in establishment scores and vigour scores for sowing depths at Barellan and Beelbangera, table 4, with deep sowing having significantly lower establishment and vigour than the normal sowing depth at both sites.

Table 4: Establishment and Vigour scores taken mid-May at the 3 sites – for sowing depth

	BARELLAN		BEELBANGERA		GOOLGOWI	
SOWING DEPTH	Establishment Score	Vigour Score	Establishment Score	Vigour Score	Establishment Score	Vigour Score
Deep	6.0	6.0	3.5	6.2	6.1	5.5
Normal	7.3	7.3	6.2	6.9	7.8	7.5
Mean	***6.7***	***6.7***	***4.8***	***6.6***	***7.0***	***6.5***
Lsd (p=0.05)	***0.3***	***0.4***	***0.6***	***0.5***	***ns***	***ns***

At Beelbangera and Goolgowi there were no significant differences between treatments for both establishment score and vigour score, whilst at Barellan there were significant differences in establishment between treatments, table 5.

Divine Liquid Inject, Humectant liquid inject and both SE14 liquid inject treatments were all greater than the Nil (standard practice) treatment at Barellan.

Table 5: Barellan establishment and vigour scores by treatment, mid-May.

TREATMENT	Establishment Score	Vigour Score
Cruiser	6.6	6.1
Divine Liquid Inject	7.0	7.2
Gypsum granules	6.0	6.3
Humectant granule	6.2	6.3
Humectant liquid inject	6.8	7.1
Nil (standard practice)	6.7	6.7
SE14 Liquid Inject	7.3	7.2
SE14 Liquid inject SZ + surface	6.8	6.7
Mean	***6.7***	***6.7***
Lsd (p=0.05)	***0.7***	***0.7***

NDVI:

Crop biomass was measured around late tillering (mid/late June), and again around flowering (mid/late September), using a handheld NDVI at each of the 3 sites.

The effects of the frosts and drought conditions were evident on plant growth, and had an impact on the results, figure 2.

Figure 2: The effect of the ongoing dry conditions at Goolgowi on plant growth, September 2019.

Of the 3 sites there were significant differences in NDVI between the interaction of sowing depth and treatment at Beelbangera at tillering and Barellan at flowering, tables 6a and 6b. All other sowing depth by treatment interactions were insignificant.

Tillering: At Beelbangera the treatment which had the highest NDVI for both sowing depths at tillering was the Humectant liquid inject treatment with an NDVI of 0.31 for deep sowing and 0.44 for normal.

Flowering: At Barellan the treatment which had the highest NDVI for both sowing depths at flowering was the SE14 liquid inject SZ + surface treatment with an NDVI of 0.58 for deep sowing and 0.65 for normal.

For all 3 sites there were significant differences in NDVI for sowing depths alone at tillering and flowering, with deep sowing having significantly lower NDVI than the normal sowing depth, table 7.

There were also significant NDVI treatment differences at all 3 sites, with the exception of NDVI at tillering at Goolgowi, table 8.

It was difficult to draw conclusions from the NDVI data as to which treatments consistently gave better results.

Table 6a: Beelbangera NDVI at tillering – interaction sowing depth by treatment

	BEELBANGERA	
	Sowing Depth	
Treatment	Deep	Normal
Cruiser	0.27	0.35
Divine Liquid Inject	0.24	0.38
Gypsum granules	0.26	0.40
Humectant granule	0.23	0.32
Humectant liquid inject	0.31	0.44
Nil (standard practice)	0.29	0.41
SE14 Liquid Inject	0.22	0.38
SE14 Liquid inject SZ + surface	0.26	0.41
mean	***0.26***	***0.39***
Lsd (p=0.05)	***0.073***	***0.073***

Table 6b: Barellan NDVI at flowering – interaction sowing depth by treatmentt

	BARELLAN	
	Sowing Depth	
Treatment	Deep	Normal
Cruiser	0.54	0.58
Divine Liquid Inject	0.50	0.57
Gypsum granules	0.45	0.58
Humectant granule	0.48	0.62
Humectant liquid inject	0.49	0.60
Nil (standard practice)	0.53	0.58
SE14 Liquid Inject	0.56	0.57
SE14 Liquid inject SZ + surface	0.58	0.65
mean	***0.52***	***0.59***
Lsd (p=0.05)	***0.067***	***0.067***

Table 7: NDVI at tillering and flowering at the 3 sites – for sowing depth

	BEELBANGERA		BARELLAN		GOOLGOWI	
Sowing Depth	NDVI GS30	NDVI Flowering	NDVI GS30	NDVI Flowering	NDVI GS30	NDVI Flowering
Deep	0.26	0.38	0.42	0.52	0.37	0.33
Normal	0.39	0.46	0.53	0.60	0.49	0.34
mean	***0.32***	***0.42***	***0.47***	***0.56***	***0.43***	0.33
Lsd (p=0.05)	***0.059***	***0.024***	***0.020***	***0.041***	***0.034***	***ns***

Table 8: NDVI at tillering and flowering at the 3 sites – for treatments

	BEELBANGERA		BARELLAN		GOOLGOWI	
TREATMENT	NDVI GS30	NDVI Flowering	NDVI GS30	NDVI Flowering	NDVI GS30	NDVI Flowering
Cruiser	0.31	0.43	0.44	0.56	0.46	0.34
Divine Liquid Inject	0.31	0.41	0.51	0.54	0.44	0.33
Gypsum granules	0.33	0.36	0.43	0.52	0.42	0.33
Humectant granule	0.28	0.39	0.46	0.55	0.41	0.35
Humectant liquid inject	0.37	0.46	0.48	0.55	0.39	0.32
Nil (standard practice)	0.35	0.47	0.48	0.56	0.44	0.30
SE14 Liquid Inject	0.30	0.43	0.49	0.56	0.43	0.33
SE14 Liquid inject SZ + surface	0.34	0.43	0.50	0.62	0.46	0.34
mean	***0.32***	***0.42***	***0.47***	***0.56***	***0.43***	***0.33***
Lsd (p=0.05)	***0.055***	***0.049***	***0.044***	***0.047***	***ns***	***0.039***

Grain Yield & Quality:

The drought conditions experienced throughout 2019 had an impact on the grain yield and quality results of the trials, with most months experiencing lower than average rainfall, with the exception of April and May.

Yield: The yield of each treatment and sowing depth for each trial is shown in figure 3.

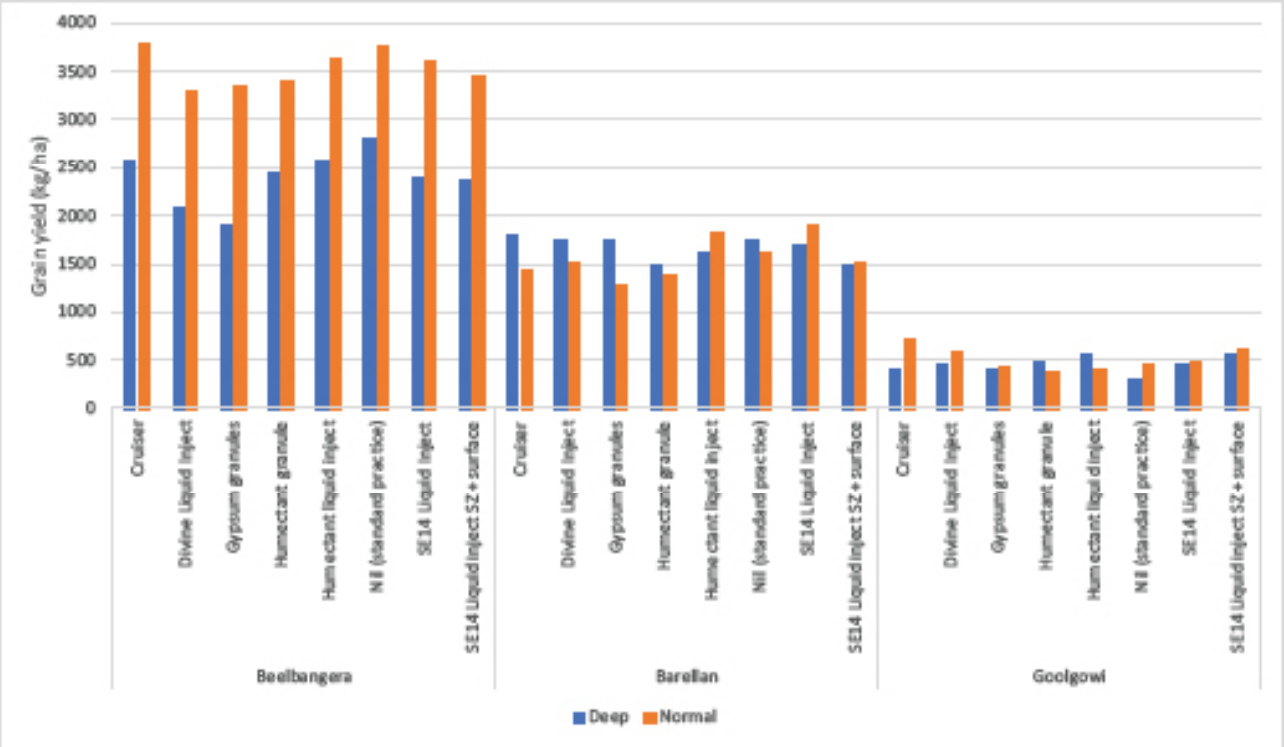
The only trial which had a significant difference in yield for the interaction between sowing depth and treatment was the Barellan trial, with the treatments Humectant liquid inject (1828 kg/ha) and SE14 Liquid Inject (1899 kg/ha), in the normal sowing depth significantly different to the lowest yielding treatment of Gypsum Granules (1283 kg/ha).

Beelbangera: The Beelbangera trial had the highest average grain yield, and was also the site which had the highest growing season rainfall out of the 3 sites. For Beelbangera the average trial yield was 2976 kg/ha, with the deep sowing averaging 2395 kg/ha and the normal sowing depth yielding 3531 kg/ha.

Barellan: For Barellan the average grain yield of the trial was 1613 kg/ha, with the deep sowing averaging 1666 kg/ha and the normal sowing depth yielding 1561 kg/ha.

Goolgowi: For Goolgowi the average trial yield was 473 kg/ha, with the deep sowing averaging 445 kg/ha and the normal sowing depth yielding 501 kg/ha.

Figure 3: Grain Yield (kg/ha) for Barellan LSD (p=0.05) = 445.6; Beelbangera; and Goolgowi for each treatment and for each sowing depth



There were significant treatment differences for grain yield at Barellan and Beelbangera, table 9.

At Beelbangera the treatments Nil (standard practice) (3263 kg/ha) and Cruiser (3202 kg/ha) were significantly higher than the lowest yielding treatment (Divine Liquid Inject - 2729 kg/ha).

At Barellan the lowest yielding treatment (Humectant granule - 1437 kg/ha) was significantly lower than the highest yielding treatment (SE14 Liquid Inject - 1800 kg/ha).

Table 9: Grain yield (kg/ha) for Barellan, Beelbangera and Goolgowi for each treatment.

Treatment	Beelbangera	Barellan	Goolgowi
Cruiser	3202	1625	563
Divine Liquid Inject	2729	1633	509.6
Gypsum granules	2771	1512	400.7
Humectant granule	2930	1437	416.2
Humectant liquid inject	3077	1719	474.6
Nil (standard practice)	3263	1683	374.8
SE14 Liquid Inject	2963	1800	467.7
SE14 Liquid inject SZ + surface	2872	1497	575.4
mean	***2976***	***1613***	***472.7***
Lsd (p=0.05)	***353.8***	***304.4***	***ns***

Grain Quality:

Protein, screenings and test weight for the Beelbangera and Barellan trials for sowing depth are summarised in table 10. There was insufficient sample to test the grain quality of the Goolgowi trial.

There were significant differences in screenings at Beelbangera and grain protein at Barellan for sowing depths, with deep sowing having significantly higher screenings than normal sowing depth at Beelbangera and deep sowing having significantly lower protein at Barellan than normal sowing depth.

Beelbangera: There were no significant differences between the interaction of sowing depth and treatment for grain quality at Beelbangera.

Grain protein at Beelbangera averaged 13.1%, the average screenings at Beelbangera was 6.5% and the average Test Weight was 80 kg/hL.

Barellan: At Barellan there were significant treatment by sowing depth interactions for protein, table 11.

Grain protein at Barellan averaged 13.9%, the average screenings at Barellan were 5.6%, and the the average Test Weight was 83.7 kg/hL.

Table 10: Grain quality - Protein (%), Screenings (%) and Test Weight (kg/hL) for Barellan and Beelbangera, for sowing depth.

	BEELBANGERA			BARELLAN		
Sowing Depth	Grain Protein (%)	Screenings (%)	Test Weight (kg/hL)	Grain Protein (%)	Screenings (%)	Test Weight (kg/hL)
Deep	12.8	7.6	80.05	13.5	5.5	83.89
Normal	13.3	5.5	80.07	14.4	5.7	83.44
mean	***13.1***	***6.5***	***80.06***	***13.9***	***5.6***	***83.67***
Lsd (p=0.05)	***ns***	***0.53***	***ns***	***0.16***	***ns***	***ns***

Table 11: Grain quality - Barellan Protein (%) for treatment by sowing depth interaction.

TREATMENT	DEEP DEPTH	NORMAL DEPTH
Cruiser	13.0	14.2
Divine Liquid Inject	13.5	15.0
Gypsum granules	12.2	14.0
Humectant granule	13.7	14.5
Humectant liquid inject	13.7	14.6
Nil (standard practice)	14.1	14.7
SE14 Liquid Inject	13.5	14.0
SE14 Liquid inject SZ + surface	13.7	14.3
Mean	***13.5***	***14.4***
Lsd (p=0.05)	***0.65***	***0.65***

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