Research

Trial name: INVESTIGATION OF CANOLA ESTABLISHMENT METHODS AT YUNA USING FARM SCALE MACHINERY

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Property: McGaurans
Location: Yuna-Tenindewa Rd, South East Yuna
Map-Reference:

Background:

Canola is becoming increasingly important as a break crop in the low rainfall areas of the NAR, especially in the north eastern areas. One of the biggest risks of growing canola is not achieving high enough plant numbers when sowing into marginal moisture. In approximately 6 out of 10 years significant summer rains occur and sowing canola deeper to chase moisture is an option. However, there is no local research data (in 2016) on which growers can confidently make the decision to sown canola deeper than the traditional 1-3 cm. This large scale trial uses farmer seeding machinery to test the effect of different seeding equipment and sowing depths on establishment rates. We aim to determine whether seeding depth is more important or whether the type of bar used has the bigger impact on establishment and ultimately yield.

Aim:

To determine the canola establishment success of 4 different seeding bars at 3 different seeding depths in the Northern WA wheatbelt using farmer scale machinery.

Keywords: **Canola, Establishment, Seeding depth,**

Method:

Site Details:
Soil type: yellow sand, 5.6 pH (CaCl2)
Soil test: 20th March 2016

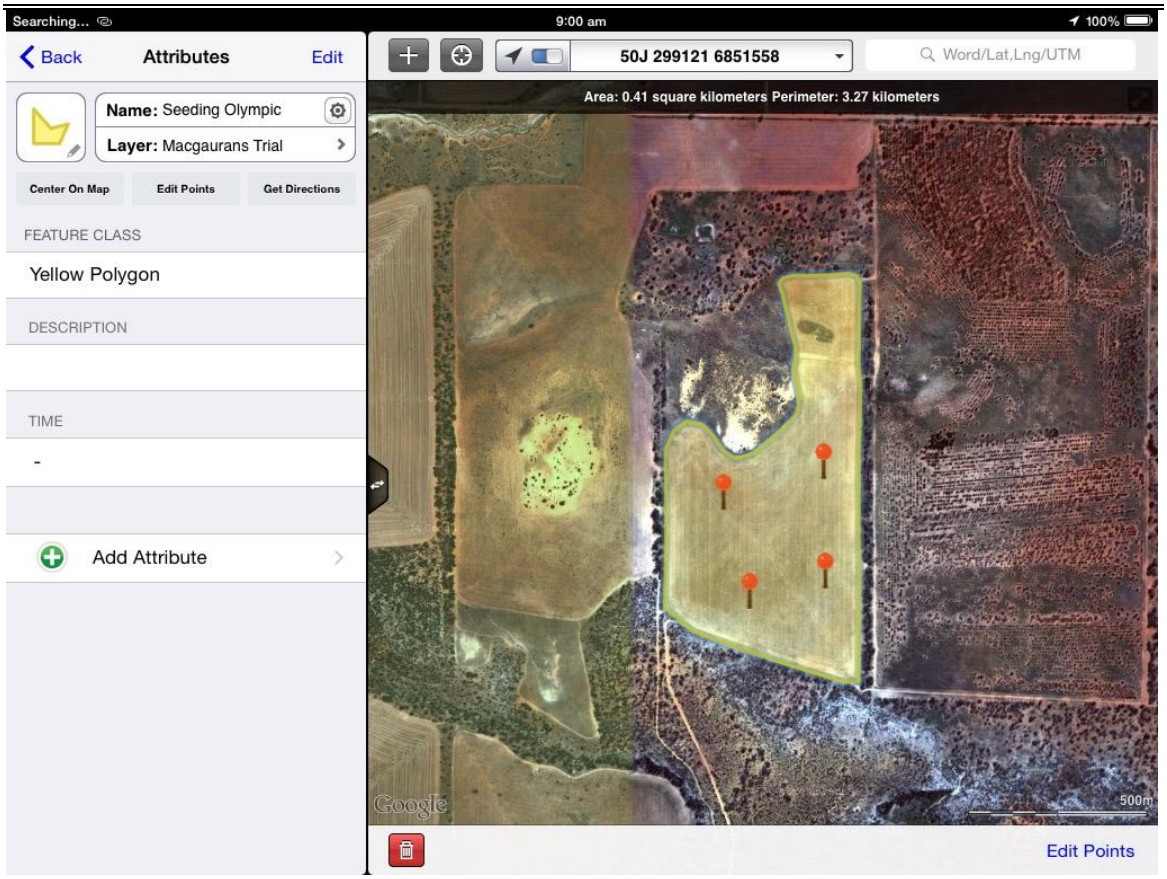
	CaCl pH	Nitrate	Ammon	P ppm	K ppm	S ppm	OC%	PBI
0-10	5.6	7.6	3.5	16	92	4	0.32	13
30-50	6.2	1.0	2.1	2	79	3	0.16	15

Recommendation – 23N, 6 P, 9 S
70kg/ha Agstar banded, (10N, 10P, 7S)
45 Flexi NS- sprayed po (13N, 2.0S) (actually ended up sprayed with 100l Flexi NS)
Previous crop: Fallow 2015,

Rainfall for 2016 season:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
12.5	0	0	40	21	62.5	61	29.5	9	

Research



Seeding Details – Treatments

A. Machinery x Depth

Seeding Equipment Treatments

1. DBS bar single chute, row spacing 305 mm
2. Modified DBS with splitters and wide press wheel, row spacing 305 mm
3. C2 seeding bar, row spacing 305mm
4. JD Bar, row spacing 381mm

Seed Depth Treatments

1. 1.0cm scratched in, normal seeding depth
2. 3.0cm seeding into damp soil
3. 5cm chasing moisture

Variety – Pioneer 43Y23RR
Seedbed moisture: see graph of soil moisture
Seeding date: 31st May 2016
Seeding rate: 1.8 kg/ha (219800 seeds/kg, 99% germination)

Crop husbandry:

Fertiliser & Rate: drilled at seeding with 70kg/ha Agstar
Applied post 100 l/ha Flexi NS

Pesticides - Knockdown – 2l glyphosate 450 + 150ml Ecopar + Li700 0.3% + Ammonium sulphate

14th May (site dirty with button grass, radish, dgs and capeweed, germinated early April)
Knockdown – 1 l Sprayseed 30th May (seeded on 31st)
Post em – 1)Plantsheild 0.9/kg/ha
2) Plantsheild 0.9kg/ha
3)Alphacypermethrin 200 @ 200/ml ha (high levels of budworm)
4) Reglone @ 1.5/l ha + oil 1%

Trial details:
Experimental Farmer Scale Design Seeding Machinery: 4 seeding machines , 3 seeding depths, 2 replicates.
Replication: 2 randomised seeded replicates
Plot size: C2 seeding bar width = 12.2 m x 500m = 0.61ha
DBS bar single chute = 18.3 m x 500m = 0.92ha
Modified DBS splitters and wide press wheel =18.3 m x 500m = 0.92ha
JD Bar = 12.2m x 500m = 0.61ha
12 plots each rep
Each rep 183mx500m = 9.15ha
Total trial area = 18.30ha
Conditions – Rained 4 days after seeding so canola establishment was excellent.

Machinery plus Seed Depth Treatment randomisation:

Plot order

PLOT	TRT	REP	Seeder type	Seeder type #	Seed depth (cm)
1	2	1	Modified DBS with splitters and wide press wheel, row spacing 305 mm	2	1
2	11	1	C2 seeding bar, row spacing 305mm	3	5
3	5	1	DBS bar single chute, row spacing 305 mm	1	3
4	3	1	C2 seeding bar, row spacing 305mm	3	1
5	6	1	Modified DBS with splitters and wide press wheel, row spacing 305 mm	2	3
6	12	1	JD Bar, row spacing 381mm	4	5
7	9	1	DBS bar single chute, row spacing 305 mm	1	5
8	8	1	JD Bar, row spacing 381mm	4	3
9	1	1	DBS bar single chute, row spacing 305 mm	1	1
10	4	1	JD Bar, row spacing 381mm	4	1
11	7	1	C2 seeding bar, row spacing 305mm	3	3
12	10	1	Modified DBS with splitters and wide press wheel, row spacing 305 mm	2	5
13	1	2	DBS bar single chute, row spacing 305 mm	1	1
14	2	2	Modified DBS with splitters and wide press wheel, row spacing 305 mm	2	1
15	12	2	JD Bar, row spacing 381mm	4	5
16	9	2	DBS bar single chute, row spacing 305 mm	1	5
17	4	2	JD Bar, row spacing 381mm	4	1
18	6	2	Modified DBS with splitters and wide press wheel, row spacing 305 mm	2	3

19	10	2	Modified DBS with splitters and wide press wheel, row spacing 305 mm	2	5
20	7	2	C2 seeding bar, row spacing 305mm	3	3
21	3	2	C2 seeding bar, row spacing 305mm	3	1
22	5	2	DBS bar single chute, row spacing 305 mm	1	3
23	8	2	JD Bar, row spacing 381mm	4	3
24	11	2	C2 seeding bar, row spacing 305mm	3	5

Layout
Whole site
N ↑ total trial area = 372m E/W x 500m (run length) (randomised)

Seeder type	DBS Mod	C2	DBS	C2	DBS Mod	JD	DBS	JD	DBS	JD	C2	DBS Mod	DBS	DBS Mod	JD	DBS	JD	DBS Mod	DBS Mod	C2	C2	DBS	JD	C2	500m
Seeder type #	2	3	1	3	2	4	1	4	1	4	3	2	1	2	4	1	4	2	2	3	3	1	4	3	
Seed depth (cm)	1	7	3	1	3	7	7	3		1	3	7	1	1	7	7	1	3	7	3	1	3	3	7	
Plot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
TRT	2	11	5	3	6	12	9	8	1	4	7	10	1	2	12	9	4	6	10	7	3	5	8	11	
Rep	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	
	18.3m	12.2m	18.3m	12.2m	18.3m	18.3m	18.3m	12.2m	12.2m	12.2m	12.2m	18.3	18.3	18.3	12.2m	12.2m	12.2m	18.3	18.3	12.2m	12.2m	18.3	18.3	12.2m	
	REP 1 = 186m												REP 2 = 186m												
	372m																								

Rep1
N ↑ **186**m width per rep , replicated 2x, total trial area = 372m E/W x 500m (run length) (randomised)

Seeder type	DBS Mod	C2	DBS	C2	DBS Mod	JD	DBS	JD	DBS	JD	C2	DBS Mod
Seeder type #	2	3	1	3	2	4	1	4	1	4	3	2
Seed depth (cm)	1	5	3	1	3	5	5	3	1	1	3	5
Plot	1	2	3	4	5	6	7	8	9	10	11	12
TRT	2	11	5	3	6	12	9	8	1	4	7	10
Rep	1	1	1	1	1	1	1	1	1	1	1	1
	18.3m	12.2m	18.3m	12.2m	18.3m	18.3m	18.3m	12.2m	12.2m	12.2m	12.2m	18.3

REP 2
N ↑ **186**m width per rep , replicated 2x, total trial area = 372m E/W x 500m (run length) (randomised)

Seeder type	DBS	DBS Mod	JD	DBS	JD	DBS Mod	DBS Mod	C2	C2	DBS	JD	C2
Seeder type #	1	2	4	1	4	2	2	3	3	1	4	3
Seed depth (cm)	1	1	5	5	1	3	5	3	1	3	3	5
Plot	13	14	15	16	17	18	19	20	21	22	23	24
TRT	1	2	12	9	4	6	10	7	3	5	8	11
Rep	2	2	2	2	2	2	2	2	2	2	2	2
	18.3	18.3	12.2m	12.2m	12.2m	18.3	18.3	12.2m	12.2m	18.3	18.3	12.2m

Measurements:

Establishment counts were done 2, 3 and 4 weeks after emergence. 20 measurements per plot taken using a 1 metre stick placed between the crop row and counting the plants in the rows on both sides of the stick.
Tissue tests were completed in season and due to some unexpected results these were followed up with in crop soil testing.
Harvest yields were plotted on each run using point data from yield monitors and analysed using ANOVA through GENSTAT. Seed quality (% oil) was measured by CBH testing services.

Results and Discussion:

Seeding Date:
The trial was seeded on the 31st May, into a drying profile. Prior to this the last rain was on the 24th May. Soil moisture readings were taken on the day of seeding:

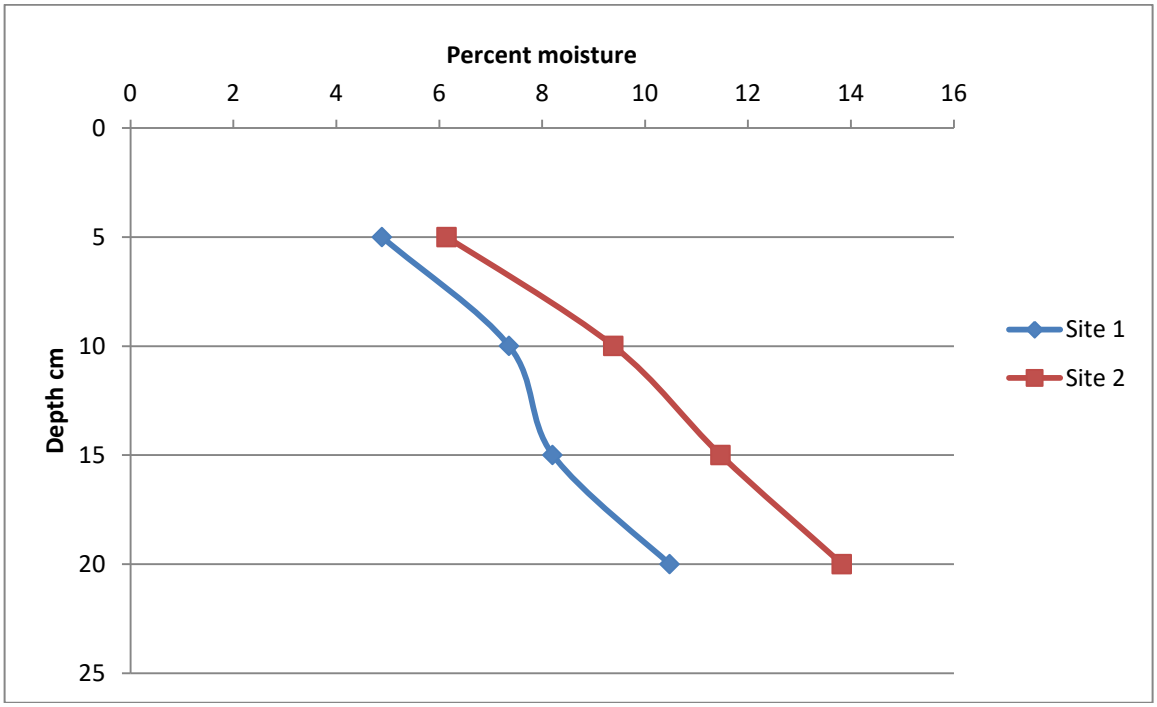
A substantial rainfall event occurred 5 days after seeding the trial on the 4/5th June and on the 7th/8th June. The canola at depth emerged more quickly (5cm) as the moisture had moved down the profile at seeding.

Both DBS bars had a degree of furrow fill although the trial was seeded at 8km/hr. The seed used was 219,800 seeds/kg at 99% germination. Total seed rate aimed for was 1.8kg/ha.

Bar Settings

Seeder	1cm	3cm	5cm
Mod DBS	4A	3A	4B
DBS single chute			
JD Bar			
C2 Morris			

GRAPH 1: Soil Moisture at Seeding (31ST May 2017):



Analysis of Plant Counts

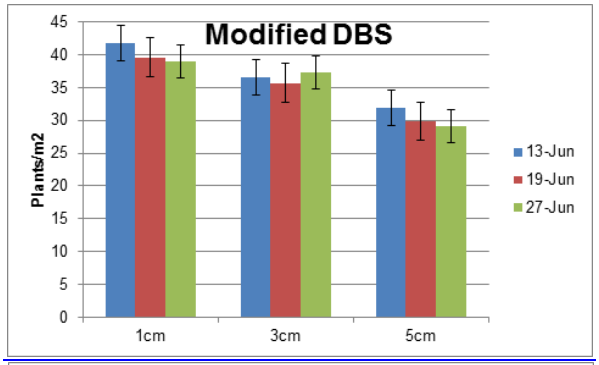
Statistical analysis of the plant emergence data was done using GenStat Analysis of Variance function. Machinery by seed depth: The ANOVA structures are as follows:

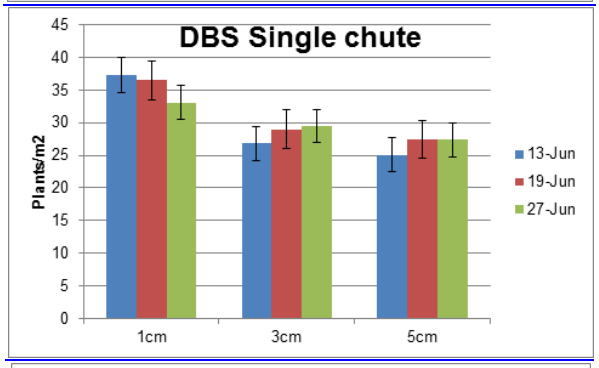
Treatment structure: SeederType*SeederDepth

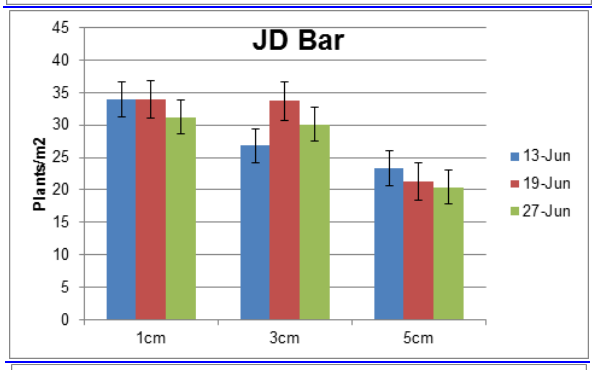
Block structure: Rep

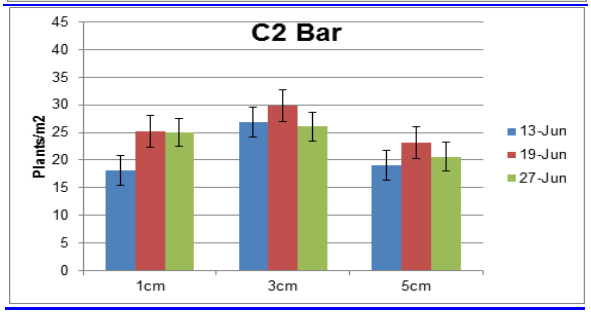
Due to the high number of plot counts the LSD was low and the emergence data was significantly different. This eliminated the possibility of any spatial trend across the site.

GRAPH 2: Seeding Machine vs Plant Counts (plants/m2):









GRAPH 3: Graph of Seeding Depth(cm) vs Plant Counts (plants/m2)

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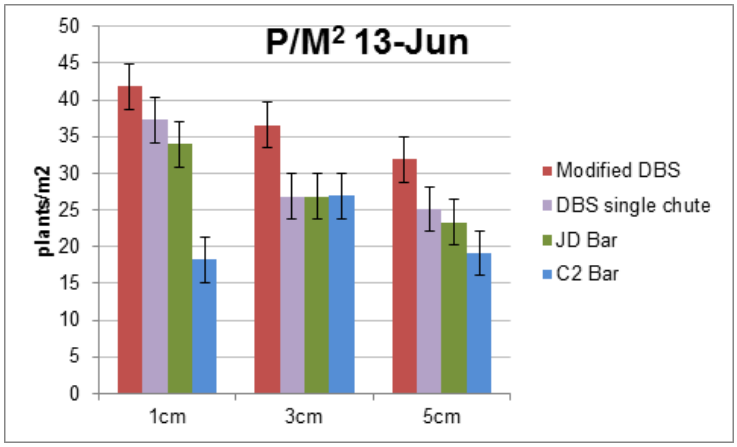

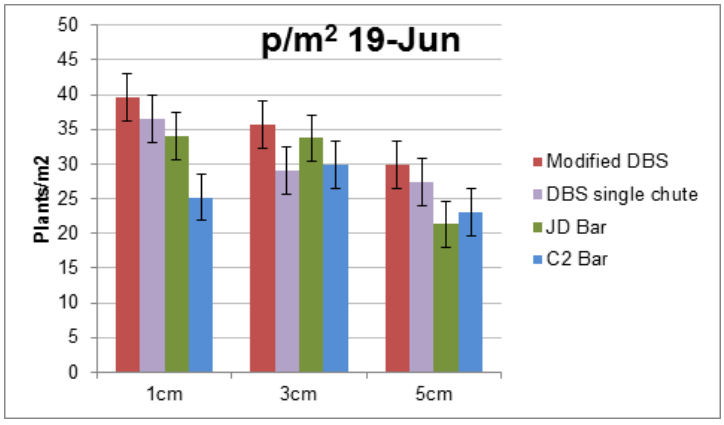

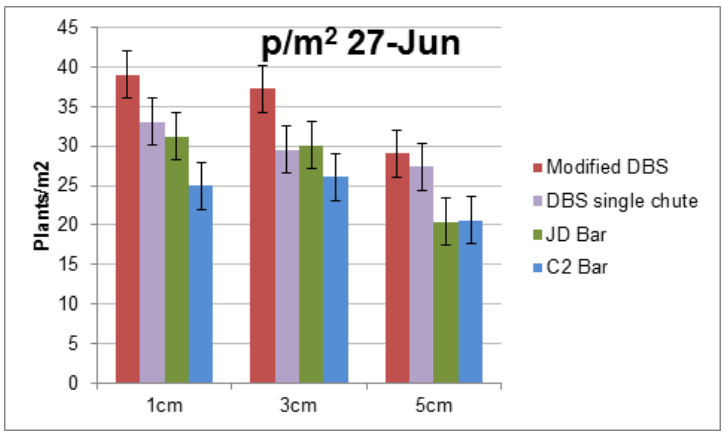

Nutrition:
Analysis of Soil Tests; Tissue tests and follow up Nitrate and Sulphur testing
Table 1: Soil test results
Soil test: 20th March 2016

	CaCl pH	Nitrate	Ammon	P ppm	K ppm	S ppm	OC%	PBI
0-10	5.6	7.6	3.5	16	92	4	0.32	13
30-50	6.2	1.0	2.1	2	79	3	0.16	15

Table 2: Tissue test results
Tissue tests: Sampled on the 26/07/2017 (Average of 3 sites)

Seeding Bar	**Mod DBS**	**C2**	**DBS Single chute**	**JD Bar**	**Nutrient Level**
Crop stage	Early bud formation	Early bud formation	Early bud formation	Early bud formation	
Nutrient					
Nitrogen %	4.86	5.39	4.87	4.84	Low
Phosphorous	0.63	0.68	0.64	0.62	Low-Adequate
Potassium %	3.83	3.81	3.92	3.94	Low-adequate
Sulphur %	0.28	0.32	0.33	0.31	Deficient
Calcium %	1.27	1.46	1.23	1.33	Deficient
Magnesium %	0.35	0.36	0.33	0.34	Deficient
Copper mg/kg	4.0	4.37	4.17	4.03	Adequate
Zinc mg/kg	34	40	37	35	Adequate
Manganese mg/kg	51.2	50.8	61.0	50.8	Adequate - High
Iron mg/kg	142	146	166	168	Adequate-High
Boron mg/kg	33	33	32	34	Adequate-High
Sodium mg/kg	0.11	0.09	0.20	0.17	Deficient
Nitrate mg/kg	1814	3460	1236	1445	Deficient
Chloride mg/kg	0.63	0.67	0.64	0.78	Adequate

Due to the low levels of nitrogen and sulphur in the plant tissue even after the application of FlexiNS follow up soil tests were done in 10cm increments to a depth of 60cm to determine the whereabouts of the applied nitrogen and the sulphur.

Table 3. Results of testing for nitrogen and sulphur (25/08/2016)

	Ammonium Nitrate(mg/kg)	**Nitrate Nitrogen (mg/kg)**	**Sulphur (mg/kg)**	**Total Nitrogen %**
Depth				
0-10	**4**	**3**	**0.5**	**0.05**
10-20	**9**	**3**	**0.8**	**0.05**
30-40	**4**	**2**	**0.7**	**0.04**
50-60	**4**	**3**	**2.3**	**0.04**

Analysis of Yield Results
Statistical analysis of the emergence data and yield data was done using GenStat Analysis of Variance function. Header yield monitor data was also statistically analysed.

Table 4: Yield results at harvest

Treatment Seeding depth cm	Seeding Bar	Yield Average t/ha	Yield S.E t/ha Standard Error
1cm	DBS Single Chute	1.50	0.000
1cm	Modified DBS	1,26	0.432
1cm	C2 Bar	1.34	0.040
1cm	JD Bar	1.44	0.125
3cm	DBS Single Chute	1.35	0.112
3cm	Modified DBS	1.43	0.185
3cm	C2 Bar	1.48	0.197
3cm	JD Bar	1.41	0.058
5cm	DBS Single Chute	1.35	0.016
5cm	Modified DBS	1,46	0.016
5cm	C2 Bar	1,14	0.377
5cm	JD Bar	1.29	0.011

Oil %= 43.5%

Discussion:

The main points to emerge from this farmer scale research are:

1) Depth: You can chase moisture to 3cm in good conditions but to achieve 25 plants/m2 you may need to increase your seeding rate.
2) Seeding Bars: There were large statistical differences in plant establishment between bars and between depths. The ability to achieve precise seed placement with different machines allows flexibility in adapting your seeding rate to the current seeding conditions if you know your seed size, germination percentage and establishment percentage achieved by your bar.
3) Although plant numbers ranged from 20 plants/m2 to 40 plants/m2, there was no statistical difference in yield, so you need to aim for 20-25 plants/m2 to increase your chances of sucessful establishment in marginal conditions.

Ideas for the future:

1) With the increased probability of summer rain in the lower rainfall areas of the NAR, we may need to measure soil moisture and aim to seed into that moisture early to establish canola in marginal conditions. Possible moisture thresholds for amount and depth could be established.
2) The nutrition aspects of this trial were interesting, as the site is low rainfall but the nitrogen and sulphur appear to have moved out of the root zone very quickly. Why?

Extension
Results were extended beyond the YFIG group to the broader industry through field walks, twitter, YFIG website, crop updates and media releases.

Acknowledgments: Coggo Funding, Martin Harries DAFWA, Peter Bostock Pioneer Seeds, CSBP, McIntosh & Son, Geraldton.