WEST MIDLANDS GROUP
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Nutrient omission in canola

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Purpose: To determine the relative importance of nitrogen (N), phosphorus (P), potassium (K) and sulphur (S) in canola.
Location: Dandaragan
Soil Type: Sandy loam
Soil Test Results: see below (2.0t/ha lime applied pre-seeding in 2015)
Rotation: 2014: Oats; 2013: Pasture; 2012: Oats
Growing Season Rainfall (April- October 2015): 325mm

Depth (cm)	pH	EC	OC	Nit N	Amm N	P	PBI	K	S
0-10	5.2	0.05	1.4	6	5	33	29	53	5
10-20	4.3	0.05	1.0	4	1	36	36	30	3
20-30	4.0	0.03	0.6	2	7	36	34	35	3

BACKGROUND SUMMARY

Omission trials are a good visual way of highlighting the importance of each nutrient. In this trial we looked at each macronutrient and its importance to canola. Soil tests run through NUlogic suggested the potential for deficiencies in nitrogen (N), sulphur (S) and possibly potassium (K).

TRIAL DESIGN

Trt	Description	Banded (L/ha)	Banded (kg/ha)	Early Ros. (kg or L/ha)	2-3 wks later (L/ha)	N	P	K	S
1	Complete	50 Flexi-N	120 K-Till Extra Plus	120 NS41	50 Flexi-N	96	12	16	19
2	No top up NS	-	120 K-Till Extra Plus	-	-	12	12	16	11
3	Mod N	50 Flexi-N	120 K-Till Extra Plus	120 NS41	-	75	12	16	19
4	No P	50 Flexi-N	11 Urea/34 SoA/32 MoP	120 NS41	50 Flexi-N	96	0	16	19
5	No K	50 Flexi-N	86 Agstar Extra	120 NS41	50 Flexi-N	96	12	0	19
6	No S	50 Flexi-N	14 Urea/53 MAPS/32 MoP	91 Urea	50 Flexi-N	96	12	16	0
7	Low S	50 Flexi-N	120 K-Till Extra Plus	91 Urea	50 Flexi-N	96	12	16	8
8	NPS	50 Flexi-N	3 Urea/84 MAPS/32 MoP	91 Urea	50 Flexi-N	96	12	16	13

Plot size: 2.5m x 20m

Machinery use: CSBP Conserva Pac cone seeder

Repetitions: 3

Crop type and varieties used: Gem TT Canola

Seeding rates and dates: 3kg/ha sown on 12 May

Fertiliser rates and dates: June 25: NS41 and Urea, August 4: Flexi N

Herbicide rates and dates: Seeding: 1L/ha Powermax, 2L/ha Treflan, 2L/ha Atrazine, 300ml/ha Lorsban,

Other applications/ treatment rates and dates: 300 ml/ha Prosaro and 500 g/ha Pirimor on 12 August

Harvest: 5 November

RESULTS/STATISTICS

Trt	Description	N	P	K	S	Harvest Yield (t/ha
1	Complete	96	12	16	19	1.62
2	No top up N (or S)	12	12	16	11	1.14
3	Mod N	75	12	16	19	1.50
4	No P	96	0	16	19	1.51
5	No K	96	12	0	19	1.58
6	No S	96	12	16	0	1.64
7	Low S	96	12	16	8	1.59
8	MAPS	96	12	16	13	1.59
					Prob	0.009
					Lsd	0.23

FINANCIAL ANALYSIS OF RESULTS

- Cost of additional 63kg N above the no top up N (Flexi N @ $464/T, NS41 @ $479/T) = $88/ha
- Additional income with a canola yield increase of 360kg (canola @ $550/T) =$198/ha
- ROI of 200%
- No yield response to P, K or S.

OBSERVATION/ DISCUSSION/ MEASUREMENTS

- The site was very responsive to nitrogen (N) fertiliser. Increasing N inputs from 12 to 75 kg N/ha increased yields by about 0.36 t/ha
- NUlogic suggested very little response to P and K after soil testing. It is important to be soil testing at least every 3-4 years so that fertiliser rates recommended are applied for maximum economic returns to the grower.
- Tissue tests on the 3rd July indicated marginal S deficiency in the no S treatments but there was no yield response.
- Wind and rain after seeding caused furrow fill resulting in poor germination (5-15 plants m^2).
- Yield potential probably limited by low soil pH

- Decile 1 rainfall year for the area, interpret results accordingly.
- Quality analysis not yet available.

ACKNOWLEDGEMENTS/ THANKS
Ryan Guthrie (Senior Agricultural officer) and the Field Research team

Effect of lime incorporation on the residual value of phosphorus and potassium fertilizer

Craig Scanlan, Ross Brennan and Gavin Sarre

Purpose:	To investigate the effect of a rotary spader and lime on the residual value of phosphorus and potassium fertilizer on a water repellent soil
Location:	Badgingarra Research Station
Soil Type:	Grey sand
Rotation:	2013: Barley, 2014: Wheat, 2015: Canola
Growing Season Rainfall (April- October 2015):	340 mm

Table 1: Soil chemical analysis from soil samples taken June 2013

Depth	Organic carbon (%)	pH ($CaCl_2$)	Colwell P (mg/kg)	Colwell K (mg/kg)	Sulphur (mg/kg)
0 to 10	1.69	6.4	18	49	12
10 to 20	0.66	5.8	9	35	9
20 to 30	0.35	5.6	8	29	5
30 to 40	0.25	5.5	12	25	3

BACKGROUND SUMMARY

The residual value of phosphorus and potassium fertilizer contributes to the profit from these inputs. Where residual value is high, these nutrients remain, or are recycled to the soil via crop residues to provide a yield benefit to crops grown in years after the year of application.

It is possible that strategic (one-off) deep tillage of water repellent soils will improve the residual value of nutrients applied as fertilizer. Soil water repellence leads to uneven wetting and preferential flow which may reduce the capacity of crop roots to access nutrients that have accumulated at the soil surface or in previous crop rows. A reduction in soil water repellence after strategic deep tillage may improve the evenness of soil wetting and the availability of soil nutrients to crops.

TRIAL DESIGN

Split plot design – a complete factorial of main treatments and nutrient treatments. Main treatments are applied as strips.

Main Treatments:

- **No-till control**
- **Rotary spader**
- **Lime (3 t/ha lime sand) + rotary spader**

Sub treatments:

- **Nil control:** 0P and 0K applied every year
- **20 P rundown:** 20 kg P drilled in year 1, 0P years 2 to 4, 80 K year 1, 10 kg K drilled years 2 to 4
- **40 P rundown**: 20 kg P drilled + 20 kg P topdressed in year 1, 0P years 2 to 4, 80 K year 1, 10 kg K drilled years 2 to 4

- **40 K rundown**: 40 kg K topdressed in year 1, 0K applied years 2 to 4, 20P every year
- **80 K rundown**: 80 kg K topdressed in year 1, 0K applied years 2 to 4, 20P every year
- **High control**: 20P applied every year, 80 K year 1, 10 kg K drilled years 2 to 4

Plot size: 20 x 1.54 m

Machinery use: DAFWA plot seeder (7 rows @ 22.5 cm row spacing) and harvester.

Repetitions: 3.

Crop type and varieties used: 2013: Hindmarsh barley, 2014: Calingiri wheat, 2015: 43Y23RR Canola

Seeding rates and dates: 2013: 80 kg/ha on 23 May, 2014: 80 kg/ha on 14 May, 2015: 4 kg/ha on 6 May

TRIAL LAYOUT

Buffer	Buffer	Buffer
Plot 101: 40P rundown Spading with lime	Plot 201: 40K rundown Spading with lime	Plot 301: 80K rundown Spading with lime
Plot 102: Nil control Spading with lime	Plot 202: High control Spading with lime	Plot 302: 20P rundown Spading with lime
Buffer	Buffer	Buffer
Plot 103: 20P rundown Spading no lime	Plot 203: 40P rundown Spading no lime	Plot 303: 40K rundown Spading no lime
Plot 104: High control Spading no lime	Plot 204: Nil control Spading no lime	Plot 304: 80K rundown Spading no lime
Buffer	Buffer	Buffer
Plot 105: 40P rundown No-till control	Plot 205: 40K rundown No-till control	Plot 305: 20P rundown No-till control
Plot 106: Nil control No-till control	Plot 206: 80K rundown No-till control	Plot 306: High control No-till control
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Plot 107: 40P rundown Spading no lime	Plot 207: 80K rundown Spading no lime	Plot 307: 20P rundown Spading no lime
Plot 108: 40K rundown Spading no lime	Plot 208: High control Spading no lime	Plot 308: Nil control Spading no lime
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Plot 109: 80K rundown No-till control	Plot 209: 40P rundown No-till control	Plot 309: 40K rundown No-till control
Plot 110: 20P rundown No-till control	Plot 210: High control No-till control	Plot 310: Nil control No-till control
Buffer	Buffer	Buffer
Plot 111: 20P rundown Spading with lime	Plot 211: 80K rundown Spading with lime	Plot 311: 40K rundown Spading with lime
Plot 112: High control Spading with lime	Plot 212: 40P rundown Spading with lime	Plot 312: Nil control Spading with lime
Buffer	Buffer	Buffer
Plot 113: High control No-till control	Plot 213: 20P rundown No-till control	Plot 313: 80K rundown No-till control
Plot 114: 40K rundown No-till control	Plot 214: Nil control No-till control	Plot 314: 40P rundown No-till control
Buffer	Buffer	Buffer
Plot 115: 40K rundown Spading with lime	Plot 215: 20P rundown Spading with lime	Plot 315: 40P rundown Spading with lime
Plot 116: 80K rundown Spading with lime	Plot 216: Nil control Spading with lime	Plot 316: High control Spading with lime
Buffer	Buffer	Buffer
Plot 117: Nil control Spading no lime	Plot 217: 20P rundown Spading no lime	Plot 317: High control Spading no lime
Plot 118: 80K rundown Spading no lime	Plot 218: 40K rundown Spading no lime	Plot 318: 40P rundown Spading no lime
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20 m	20 m	20 m

50.4 m

RESULTS/STATISTICS

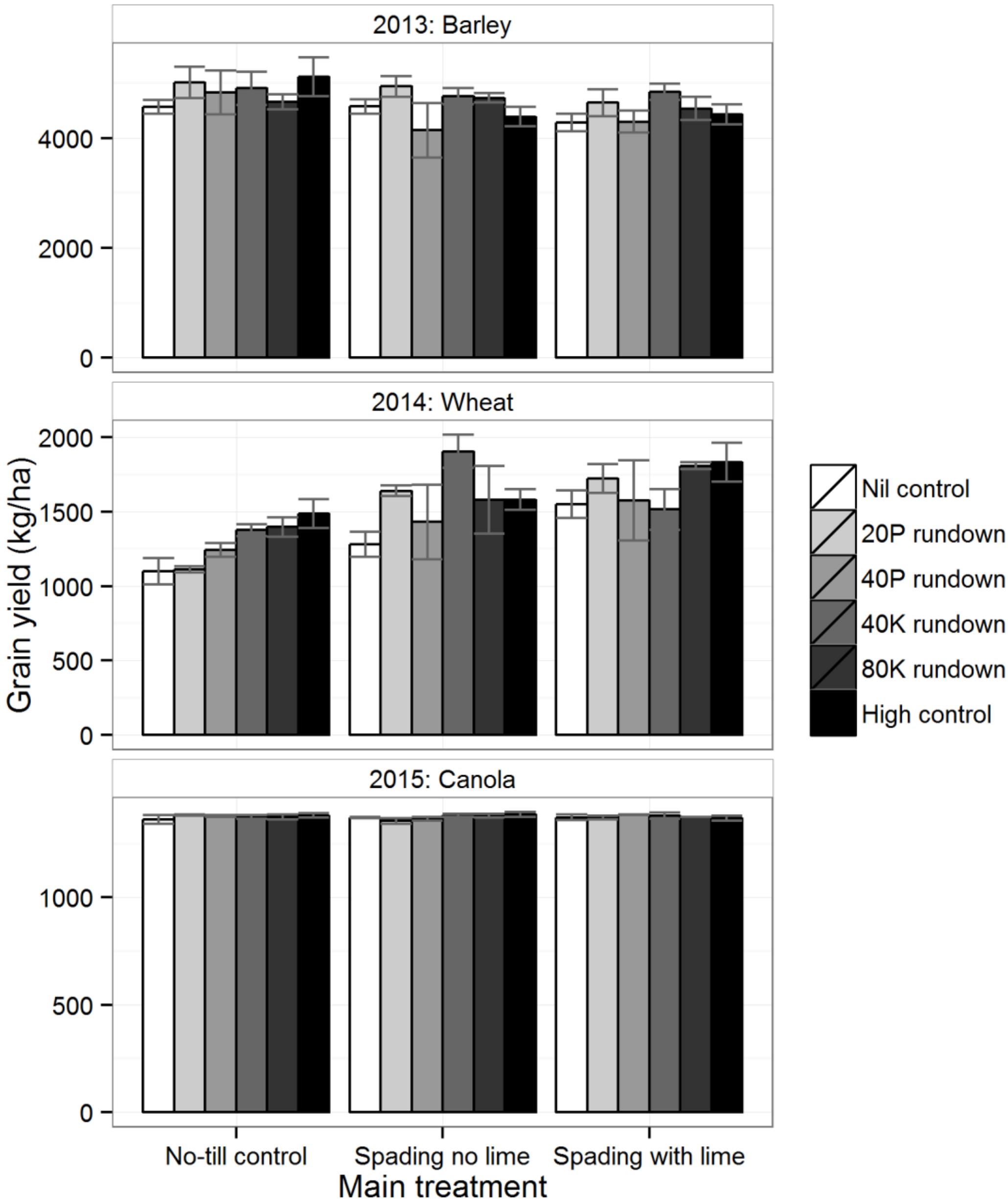
Soil water repellence

The rotary spader caused a significant reduction in soil water repellence measured in April 2014. The MED (molarity of ethanol droplet) for the no-till control, rotary spader and lime + rotary spader was 3.2, 0.9 and 0.9 respectively. The water repellence rating for the no-till control is very severe and is low for the rotary spader and lime + rotary spader treatments.

Barley grain yield 2013

There were no significant effects of main treatment or nutrient treatment on grain yield in 2013 (Figure 1). There was no interaction between main and nutrient treatments. The average grain yield was 4655 kg/ha.

Figure 1: Grain yield for barley (2013), wheat (2014) and canola (2015). The spading and lime treatments were applied in 2013 only. The nutrient treatments have been applied to the same plots each year. Error bars are standard error



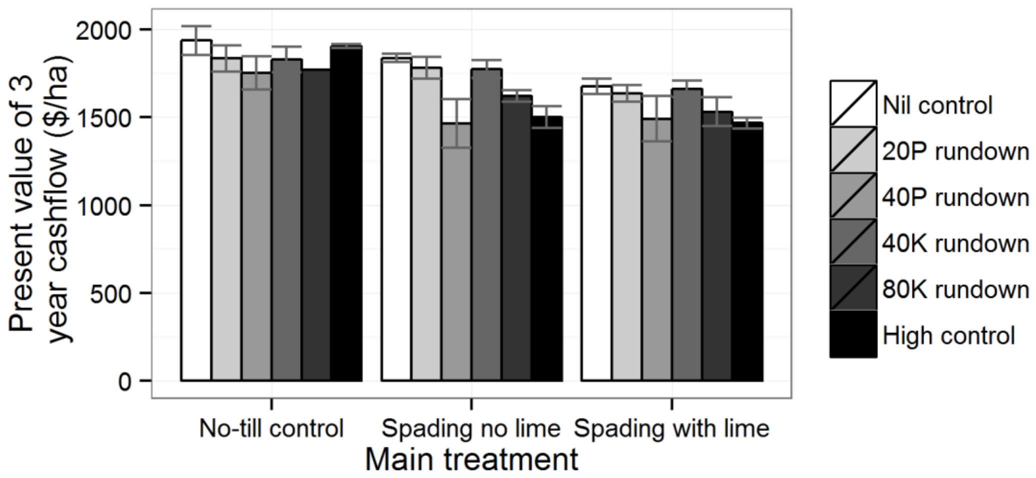
Wheat grain yield 2014

Main treatment and nutrient treatment both had significant effects on grain yield in 2014 although there was no interaction between these. The average grain yield for the no-till control, rotary spader and lime + rotary spader was 1291, 1570 and 1668 kg/ha respectively. The average grain yield for the nil control, 20 P rundown, 40 P rundown, 40 K rundown, 80 K rundown and high control was; 1310, 1493, 1417, 1599, 1596 and 1645 kg/ha respectively. These results suggest that phosphorus availability was limiting growth more than potassium availability; the 40K rundown, 80K rundown and high control had similar yields, all had 20 P applied but different potassium histories. The nil control, 20 P rundown and 40 P rundown did not receive phosphorus in 2014 and were at least 100 kg lower yielding than treatments that did receive phosphorus.

Canola grain yield 2015

There were no significant effects of main treatment or nutrient treatment on grain yield in 2015. There was no interaction between main and sub treatments. The average grain yield was 1454 kg/ha.

Figure 2: Present value of the 3-year cashflow for each treatment. Cashflow has been calculated as income for grain yield minus tillage, lime and nutrient costs. Data shown are the mean of 3 replicates. Error bars are standard error



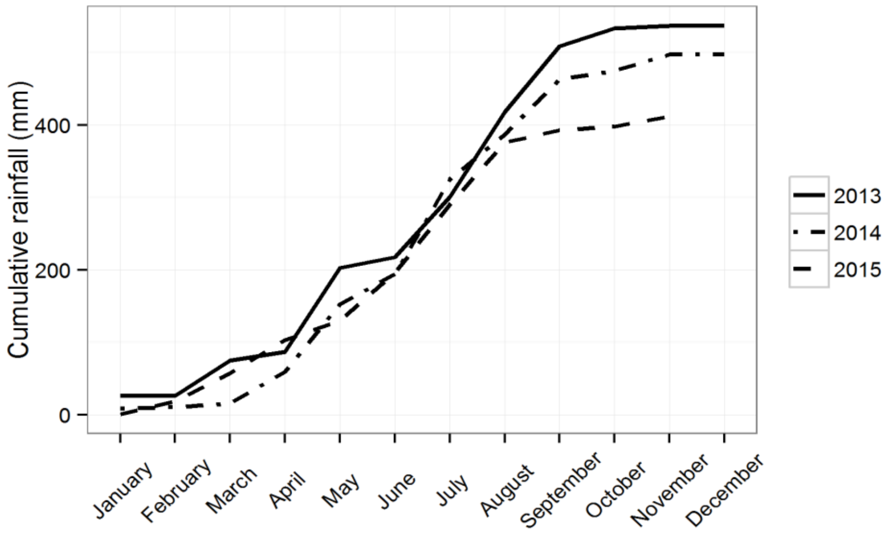
FINANCIAL ANALYSIS OF RESULTS

Our economic analysis showed that main treatment and sub (nutrient) treatment had a significant effect on present value of each cashflow. We performed an analysis of variance on the present value of the cashflow from each plot based on grain yield, grain prices and input costs. Considering main treatments only, the most profitable treatment was the no-till control ($1836/ha) followed by rotary spader ($1664/ha) and lime + rotary spader ($1574/ha). Considering nutrient treatments only, the nil control was the most profitable ($1820/ha) and the high control was the least profitable ($1590/ha). For the combination of main and nutrient treatments, the no-till control: Nil control treatment was the most profitable ($1937/ha) followed by the no-till control: high control treatments ($1906/ha).

OBSERVATION/ DISCUSSION/ MEASUREMENTS

Our results so far suggest that there is an important interaction between year (timing and distribution of rainfall) and soil and nutrient management. There were no significant treatment effects on grain yield in 2013 and 2015, but there were in 2014 and this may be related to autumn rainfall. At the end of March, 75 and 57 mm had fallen in 2013 and 2015 respectively (Figure 3), however, only 16 mm had fallen at this time in 2014. In 2014, soil water repellence as measured in a laboratory test was significantly higher in the no-till control treatments compared to the rotary spader treatments. Seedling density in 2014 was highest in treatments that had the highest soil water repellence, however, this effect did not carry through to grain yield which was lowest in the no-till control. This trial will continue for at least one more year.

Figure 3: Cumulative rainfall for Badgingarra for 2013, 2014 and 2015



PEER REVIEW/REVIEW

Bill Bowden (West Midlands Group) and Stephen Davies (DAFWA).

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