Trial Site Report

Assessing the impact of residual N from canola on wheat

Trial Code:	GONU01015-2
Year:	Autumn 2015
Location:	'Gwandallen', Peak Hill
Collaborators:	Paul Bell

Keywords

GONU010, Canola nutrition, wheat nutrition, yields, residual nitrogen, mineral nitrogen.

Take home message

Where fertiliser was applied to a failed canola crop, applied nitrogen remained available for the subsequent wheat crop.

Evidence of this was increased crop biomass, increased protein and increased screenings.

Background

GOA established 5 trials in 2014 investigating canola nitrogen responses with rates up to 200 kg N/ha. These trials generally showed a positive linear yield increases as nitrogen rate increased. However, relative efficiency of conversion of N to grain declined as N fertiliser rate increased. This indicated there would be potential residual nitrogen to benefit following crops.

Of the 2014 canola trials, two sites provided good results (Geurie and Tullamore) however, this site (Peak Hill) had very low yields (less than 0.5 t/ha) and the trial was abandoned. Given the very low yields it could be assumed that the canola crop may not have utilise all of the applied nitrogen, and to determine any carry over might be useful.

This trial will test whether various rates of (unutilised) fertiliser nitrogen applied in 2014 (canola nutrition trial) has any impact on 2015 cereal yield, and therefore reflect residual benefit.

Aim

- Determine residual N levels ahead of cereal sowing in 2015 in relation to rates of applied fertiliser N applied at sowing in 2014.
- Determine the impact on yields of subsequent rotation crop (wheat) of any residual N.

Methods

The trial directly overlayed the previous year's canola trial which used a randomised complete block design with 3 replicates in 6 ranges. Small plots of approximately 2 by 10 meters were bulk sown with a plot seeder. Yields were assessed with a plot harvester, guard rows and plot ends were removed before harvest to eliminate any edge effects. Trial details are outlined in Table 1 below.

Table 1. Trial site details

Trial Establishment Date	Autumn, 2015		
Crop and Variety	Wheat - Sunmate	Seeding rate	45 kg/ha
Sowing date	26/5/2015	Harvest Date	19/11/2015
Seedling equipment	Kinfe point, press wheel (DBS)	Row Spacing	27.5 cm
Crop Nutrition (kg/ha)	100 Triphos	Soil type	Clay Loam
Previous Crop (and yield)	Canola (trial)	Pre Sowing Stubble Management	Direct Drilled

Trial treatments were:

- 2014
  - High and low biomass canola lines (Y84 and C80)
  - 5 N rates (0, 50, 100, 150 and 200 kg N/ha)
  - 3 application timings; sowing, budding and split
- 2015 – several N management approaches were tested however, this report only analyses results where no additional nitrogen was applied in 2015.

Results

Vegetation index: The crop vegetation index (measured using a handheld NDVI) increased as rates of nitrogen applied in 2014 increased (Figure 1).

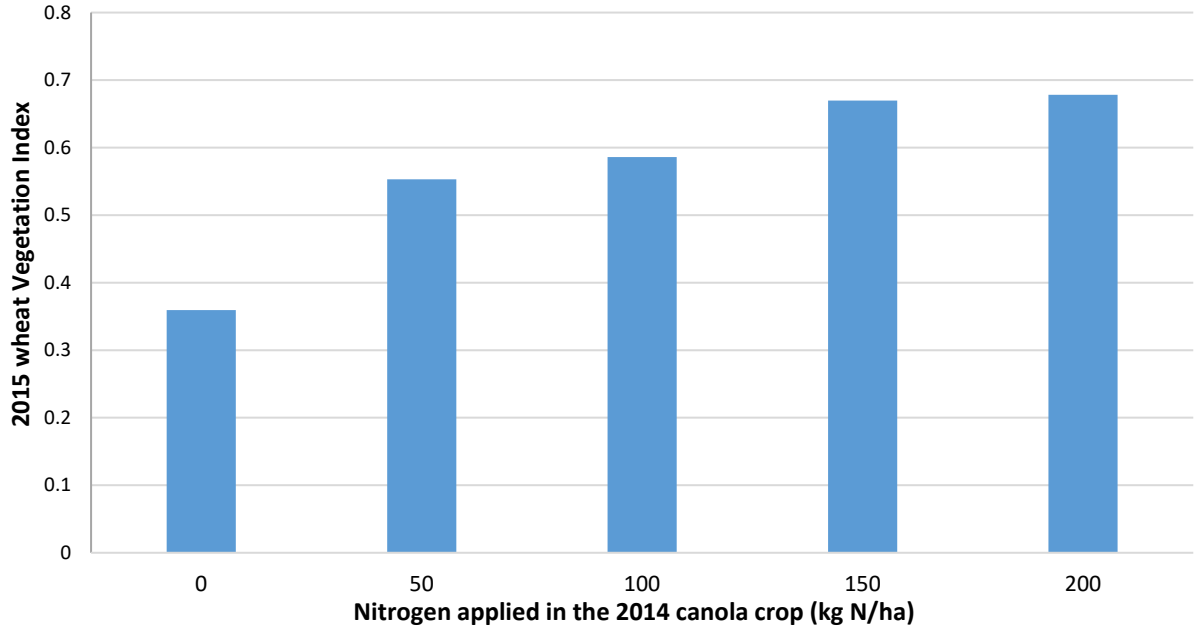

Figure 1. Wheat Vegetation Index response to nitrogen applied to the 2014 canola crop at various rates. NDVI readings were taken 125 days after sowing.

Grain yield and quality: Wheat yields tended to decrease in response to nitrogen applied to the 2014 canola crop. Conversely protein and screenings increased (**Figure 2**). Nitrogen applied in 2014 resulted in yield penalties of 0.5 t/ha, and a threefold increase in screenings. Protein levels also increased significantly.

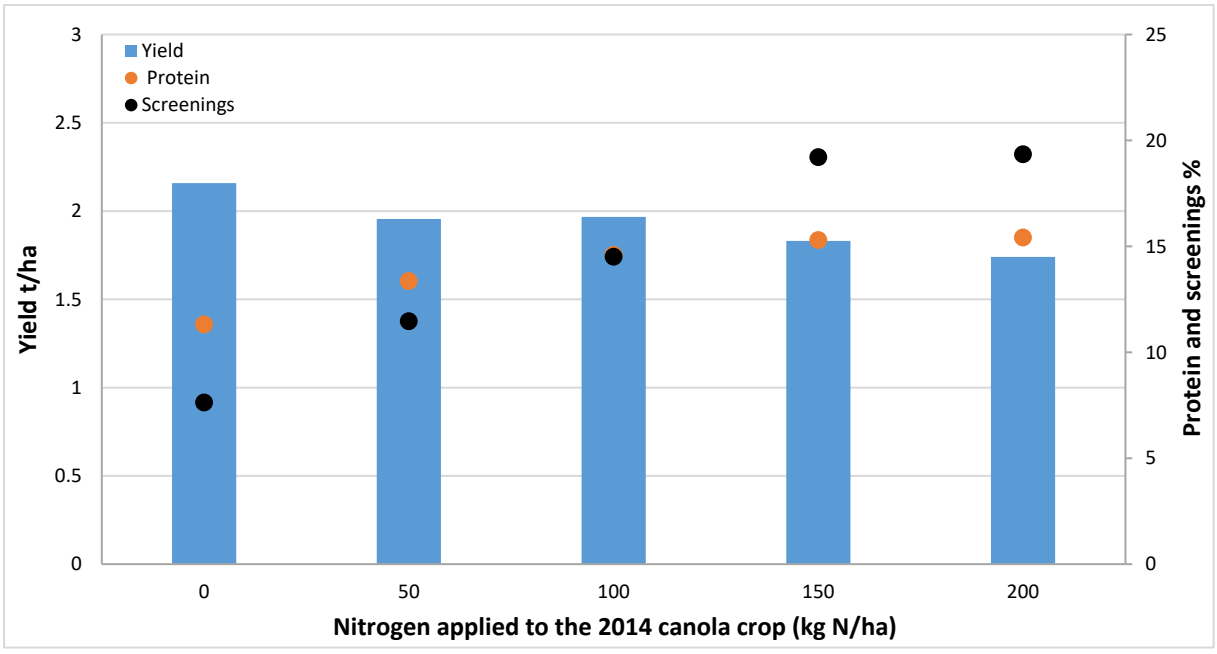

Figure 2. Wheat yield, screenings and protein levels in response to nitrogen applied in 2014 at various rates

Discussion

Site History: The 2014 canola crop yielded low with no significant treatment yield effects. However the 559TT variety yielded almost double that of low biomass variety Stingray. Overall trial average yield was about 300 kg/ha (trial was replanted late because of establishment problems and never fully recovered). While soil sampling in April 2015 (not tested) it was noted that there was very little moisture below 30 cm, and in many places no deeper than 20cm. The site had a heavy weed infestation which likely confounded the trial by utilizing moisture and possibly some of the residual N.

Residual nitrogen left over from the 2014 canola trial was evident in the 2015 wheat crop with increased biomass (Figure 1). However, the wheat crop was unable to convert this to grain (**Figure 2**) most likely because of moisture constraints. Further indications of residual nitrogen was protein and screenings which increased relative to the amount of N applied to the 2014 crop.

These results tend to suggest that application of 50 kg N/ha in 2014 was more than enough to have a negative yield impact in the 2015 moisture stressed crop. Soil tests conducted prior to planting the 2014 canola trial indicated that starting soil N levels were 120 kg/ha. It was evident in the 2015 crop that this longer-term residual (plus mineralisation of canola and weed residues) was enough to maximise wheat yields under the prevailing moisture conditions. These results tend to indicate that residual mineral nitrogen can have a similar effect on yields (and grain quality) as N applied at sowing or during the cropping season. Results also tend to support management practice of fertiliser application based on yield potential related to soil moisture. In this case where there was no significant subsoil moisture prior to sowing the 2015 wheat crop and application of N fertiliser in the previous year was wasted. While data has not been collected aerial images of the 2016 crop clearly showed vegetative responses to fertiliser applied in 2014. This tends to indicate that under the right conditions unutilised mineral nitrogen from applied fertiliser can remain in the soil for at least two years.

Conclusion

Application of urea in the 2014 canola trial resulted in carry over N for the 2015 wheat crop.

In the absence of adequate fallow moisture higher N fertiliser rates can adversely impact on wheat yield and grain quality, even if N fertiliser has been in the soil for more than a year.

Acknowledgements

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and support of GRDC. The authors would like to thank them for their continued support. Special thanks to Paul Bell who hosted this trial.

Appendix

Statistical analysis (ANOVA). Note: analysis conducted on a larger data set, results are grouped by letter, where there is no significant differences within a group.

2014 N (kg/ha)	2014 Canola Variety	2015 Wheat Variety	NDVI		Screening (%)		Protein (%)		Wheat Yield (t/ha)	
0	559TT	Sunmate	0.32	L	5.3	GH	11.9	DE	2.22	A
50	559TT	Sunmate	0.52	J	9.8	FGH	12.8	CDE	2.02	ABCD
100	559TT	Sunmate	0.58	GHIJ	14.9	DEF	14.3	ABCD	1.97	ABCDE
150	559TT	Sunmate	0.63	CDEFGH	17.8	ABCDE	14.9	ABC	1.67	BCDEFGH
200	559TT	Sunmate	0.64	BCDEFGH	17.3	BCDEF	15.2	ABC	1.69	BCDEFGH
0	Stingray	Sunmate	0.40	K	10.0	FGH	10.7	E	2.10	AB
50	Stingray	Sunmate	0.56	IJ	13.1	EF	14.0	BCD	1.89	ABCDEF
100	Stingray	Sunmate	0.56	HIJ	14.2	DEF	14.9	ABC	1.96	ABCDE
150	Stingray	Sunmate	0.66	ABCDEF	20.7	ABCD	15.7	AB	1.99	ABCDE
200	Stingray	Sunmate	0.68	ABCD	21.4	ABCD	15.6	ABC	1.79	BCDEFG
		L.S.D.	0.08		7.5		2.9		0.55	