GOA Trial Site Report

Canola – Nitrogen timing and plant population

Trial Code: GONU00816-3

Year: Winter 2016

Location: 'Larry's Plains' Geurie

Collaborators: Garry Evans

Keywords

GONU008, Canola nutrition, plant population, nitrogen timing

Take home messages

Canola can compensate yield with lower plant populations; however, under favourable seasonal conditions application of N to correct deficiencies should occur no later than budding stage.

If plant stands are adequate in a wet year, there is no harm in delaying N application till flowering.

Background

GOA Research in recent years has found that canola has a significant response to nitrogen (N) application when deficiencies exist. There has been some scepticism that good N responses in research trials have been under 'ideal' conditions and that canola may behave differently in the field, particularly where low plant populations commonly occur. Previous research also only investigated two application timings (sowing and budding), where no response was found. Therefore, the need to assess canola's ability to compensate if N was applied later and on low plant populations.

Aim

- Investigate the influence of plant population and N application timing on canola yield and oil content.

Methods

Treatments:

1. Population – 15 and 45 plants/m
2. Nitrogen application timing (200 kg/ha nitrogen as urea, hand broadcast); sowing, budding, flowering.

Table 1: Trial application details

N Timing	Date	Comments
Sowing	03/05/2016	Broadcast urea prior to planting then IBS, good soil moisture at planting, 40mm ~ 3 weeks post planting)
Bud visible	18/7/2016	rained every day for a week post application, total of ~48 mm
Flowering	18/8/2016	~ 35 mm rain on 23/24th Aug

Table 2: Trial site details

Trial Establishment Date	Autumn, 2016		
Crop and Variety	Canola – 44Y89	**Seeding rate**	0.8 & 2.5 kg/ha
Sowing date	03/05/2016	**Harvest Date**	18/11/2016
Seedling equipment	Double Boot Tyne	**Row Spacing**	27.5 cm
Crop Nutrition (kg/ha)	150 Triphos	**Soil type**	Clay Loam
Previous Crop (and yield)	Wheat (Lancer) 4 t/ha	**Pre-sowing stubble management**	Stubble burnt
Soil test value (at sowing)	Colwell P ~ 21 ppm, Sulphur ~ 9 ppm	**Nitrogen**	0-60cm ~ 168 kg/ha,

A randomised complete block design with 3 replications across 6 ranges was used. Results were analysed by ANOVA and compared using a LSD method with a 95% confidence interval. Any references to differences between treatments should be assumed to be statistically different unless otherwise stated.

Results

Plant Population: Against targeted population of 45 and 15 plants/m^2, 60 and 26 were established for the high and low treatments respectively.

Vegetation Index: During the growing season plant development was tracked using Normalized Difference Vegetation Index (NDVI). At first measurement (83 days after sowing, just before budding N application timing) treatment differences were apparent. Vegetation index (VI) were higher in the higher population treatments and where N was applied at sowing.

At the later NDVI reading (101 days after sowing and just prior to flowering application) budding N treatment had a higher VI than sowing N treatment. Flowering treatment had a significantly lower VI. However, at this assessment there were no statistical differences in VI between plant populations and N rate response remained similar to the earlier reading.

Yield: A very nitrogen responsive site. For example, 100 kg N/ha at sowing, in the low plant population treatment yield was 1.07 t/ha higher than nil N (Figure 1).

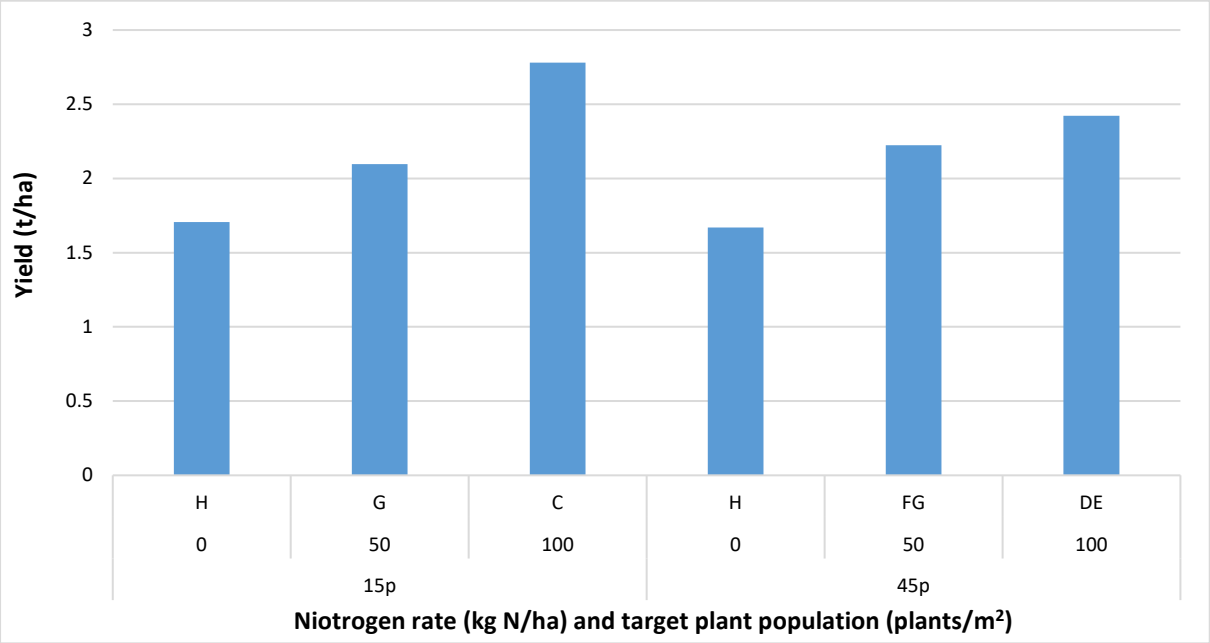

Figure 1. Yield (t/ha) response to N rate and plant population where N was applied at sowing only. Treatments with the same letter are not significantly different.

Timing had a considerable effect on grain yield. For example, 100 kg N/ha applied to the higher population treatments at flowering yielded an additional 1 t/ha compared to N applied at sowing (**Figure 2**). Oil and protein levels reflected yield differences. As yield increased oil content dropped and protein increased (see Appendix 1).

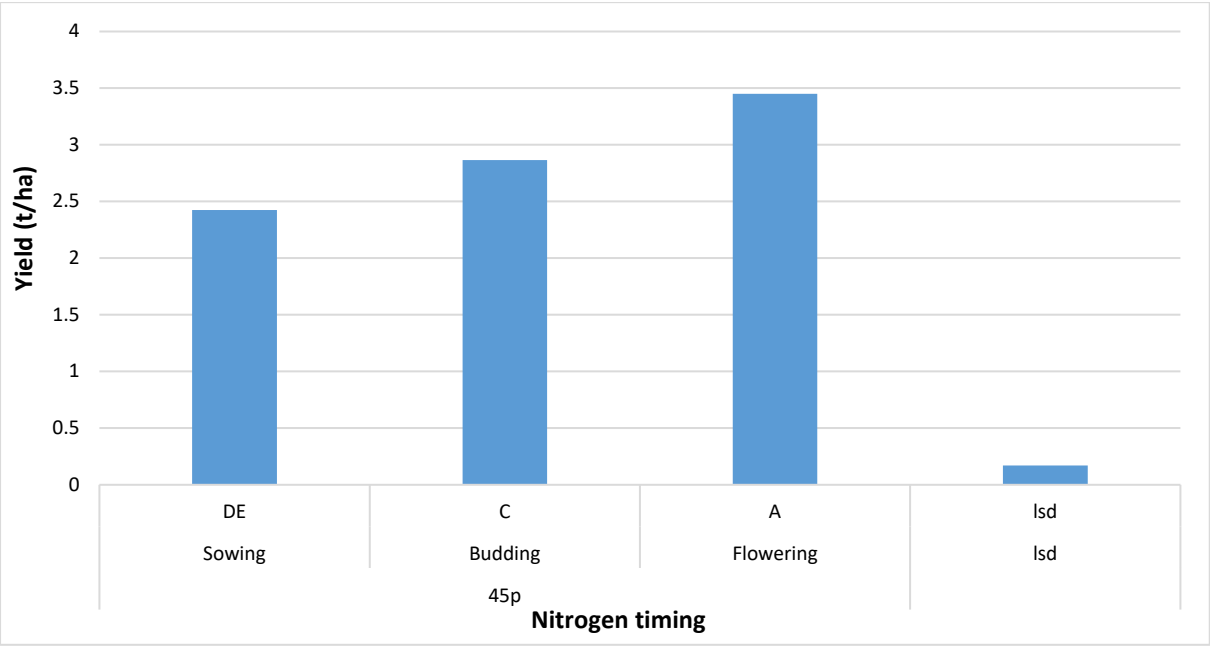

Figure 2. Yield (t/ha) where 100 kg/ha N was applied to the higher population treatments. Treatments with the same letter are not significantly different.

There was a yield interaction between plant population and timing of N application. Applying N at sowing, to the lower plant population (15p) yield was 0.25 t/ha higher than N applied at the same time to the high population treatment (45p). Applying N at budding yielded no differences between the two populations. Applying N at flowering, higher population (45p) treatment yielded 0.28 t/ha more than the corresponding low population (15p) treatment (Figure 3). There was no effect on the oil and protein levels between plant population and application timing treatments.

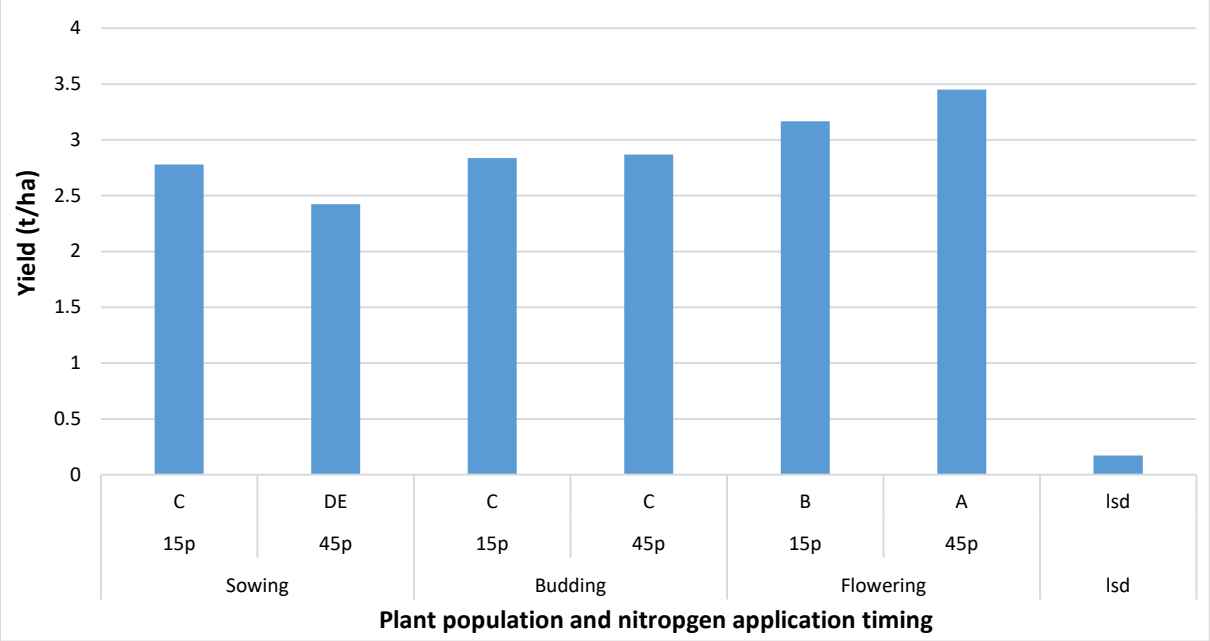

Figure 3. Yield (t/ha) where 100 kg/ha N by plant population and N application timing. Treatments with the same letter are not significantly different.

Discussion

This was a very N responsive site, even for a site with high starting soil nitrogen levels. Magnitude of the N response was influenced by plant population and application timing. Applying N early (sowing), allowed time for the lower population to compensate and ultimately out-yield the higher population treatment. At later N application. Lower plant population did not appear to have sufficient time to adequately respond to late N application.

There was a considerable advantage to late application of N, resulted in almost 1 t/ha additional yield for the higher population treatment (difference at the lower population was much less, but still significant at close to 0.4 t/ha). This indicates that N efficiency improved with late applications. However, it is noted that 2016 had a very soft finish, which would have favoured late N application. 2016 was also a very wet year (approximately 630 mm[1] of in-crop rainfall), and it is possible that wet conditions contributed to lower N efficiencies of earlier application timings (i.e. conditions were conducive to waterlogging, leaching and denitrification (and possibly surface runoff).

[1] SILO weather station DUBBO (WILBERTREE), station number 65082

Conclusion

The results of this trial suggest that further testing is required.

- Canola can compensate for lower than desired plant establishment, however, it is better to get nitrogen on early, budding or before.
- Canola is hugely N responsive, regardless of timing.
- In a very wet year with a soft finish, late N applications drove higher yields. If seasonal conditions are wet, later N, or multiple lower rate applications may drive higher efficiencies.

Acknowledgements

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Appendix 1. Results

Nitrogen timing	Nitrogen rate	Target population	Yield		Oil		Protein	
	kg/ha	plants/m2	t/ha		%		%	
Control	0	15p	1.7	H	46.7	A	18.2	G
Sowing	50	15p	2.1	G	46.2	ABC	18.4	FG
Sowing	100	15p	2.8	C	46.6	AB	19.8	CDE
Budding	50	15p	2.4	EF	46.3	ABC	18.8	EFG
Budding	100	15p	2.8	C	45.2	DEF	20.7	BC
Flowering	50	15p	2.6	D	45.1	EF	20.1	CD
Flowering	100	15p	3.2	B	44.9	EF	21.7	AB
Control	0	45p	1.7	H	46.5	AB	18.1	G
Sowing	50	45p	2.2	FG	46.1	ABCD	18.3	FG
Sowing	100	45p	2.4	DE	45.7	BCDE	19.9	CDE
Budding	50	45p	2.5	DE	45.8	ABCDE	19.5	DE
Budding	100	45p	2.9	C	45.5	CDEF	20.2	CD
Flowering	50	45p	2.9	C	45.8	BCDE	19.3	DEF
Flowering	100	45p	3.5	A	44.6	F	22.2	A
lsd			0.2	lsd				