# GOA Trial Site Report

## Canola nutrition – Optimising phosphorus nutrition under high nitrogen strategies, Gilgandra 2020.


**Trial code:** GONU00720-1

**Year:** Autumn 2020

**Location:** Gilgandra, NSW

**Collaborators:** Jon and Tex Kilby



### Keywords

GONU007, canola nutrition, nitrogen, phosphorous, Gilgandra


### Editor's Note

This site was hail affected prior to harvest, please interpret yield and oil results with this in mind. This trial evolved from Grain Orana Alliance (GOA's) nutrition research where canola has been found to be highly responsive to nitrogen (N). It was designed to test whether phosphorous (P) may be more limiting when using higher nitrogen rates to lift yield potential. Although the 2020 season was a very high rainfall year, this site was affected by a hailstorm prior to harvest. An adjacent NVT trial was not harvested at all due to the damage.

### Key findings

- Nitrogen can negatively affect establishment, even when surface applied.
- Phosphorous does not always impact germination, even when placed with the seed
- Yield increased with the addition of N, regardless of N rate.
- Oil content decreased with increasing rates of N.

### Background

Canola areas planted in Central NSW has roughly doubled over the past 10 years[1], as its profitability has improved (improved prices and bonuses for specific varieties) and because of its good fit as a cereal break crop.

As there is a greater tendency to move toward a continuous cropping system, reliance on inherent soil fertility to drive yields is potentially becoming limiting. Trials assessing canola P response have been variable. For example, canola VSAP trials in Nyngan, 2014, showed a response to added P, while no response at Trangie[2] was recorded in the same year. GOA[3] (and other) research has shown that canola is highly responsive to added nitrogen.

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[1] AGSURF Data (apps.daff.gov.au/AGSURF/agsurf.asp)

[2] grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2014/02/canola-agronomy-research-in-central-west-nsw

[3] https://www.grainorana.com.au/documents?download=72

Increasing canola productivity by adding one nutrient, would most likely increase demand for other nutrients. This trial seeks to determine if there is such a relationship between N and P and the implications for canola management.

## Aim

- To determine if increasing canola N rates requires increases in P to maximise yield.

**Table 1.** Trial site details

| | | | |
|---|---|---|---|
| **Establishment date** | Autumn 2020 | **Seeding rate** | 3 kg/ha |
| **Crop and variety** | Canola – Bonito | **Harvest date** | 7/11/2020 |
| **Sowing date** | 21/4/2020 | **Row spacing** | 27.5 cm |
| **Sowing equipment** | Knife point, press wheels | **Soil type** | Light sandy clay |
| **Site nutrition: N** | 0-10 cm: ~26 kg/ha<br>10-60 cm: ~180 kg/ha | **Pre-sowing stubble management** | Standing stubble |
| **Colwell P** | 0-10 cm: 38 ppm<br>10-30 cm: <5 ppm | **Previous crop** | Barley |

## Method

Various rate combinations of N and P.

1. Nitrogen @ 5 rates (0, 25, 50, 100, and 200 kg N/ha)
    a. As urea + the N component of MAP
2. Phosphorous @ 4 rates (0, 10, 20, 40 kg P/ha)
    a. Where N added - 10, 20, 40 kg P/ha as MAP
    b. For 0 N treatments - 10, 20, 40 kg P/ha as Triphos

The trial was established using small plots and a randomised complete block design with 4 replications.

Results were analysed by ANOVA and results compared using an LSD method with a 95% confidence interval. Any references to differences between treatments should be assumed statistically different unless otherwise stated.

## Site rainfall

Table 2: 2020 rainfall versus long term average (LTA) at Gilgandra.

| Month | Jan | Feb | March | April | May | June | July | Aug | Sept | Oct | Nov | Dec | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2020** | 59 | 111 | 107 | 154 | 9 | 19 | 109 | 39 | 31 | 77 | 16 | 109 | 840 |
| **LTA** | 54 | 48 | 64 | 41 | 38 | 51 | 45 | 42 | 47 | 52 | 60 | 62 | 604 |

## Results

<u>Plant counts</u>

- Overall, establishment was low with an average of 13 plants/m2.
- Where no fertiliser was applied, establishment was 19 plants/m2.
- Where N was applied and no P (regardless of rate) there was a significant reduction in establishment (<14 plants/m2).
- Where P was applied without additional N (P as triphos), there was no significant reduction in establishment.

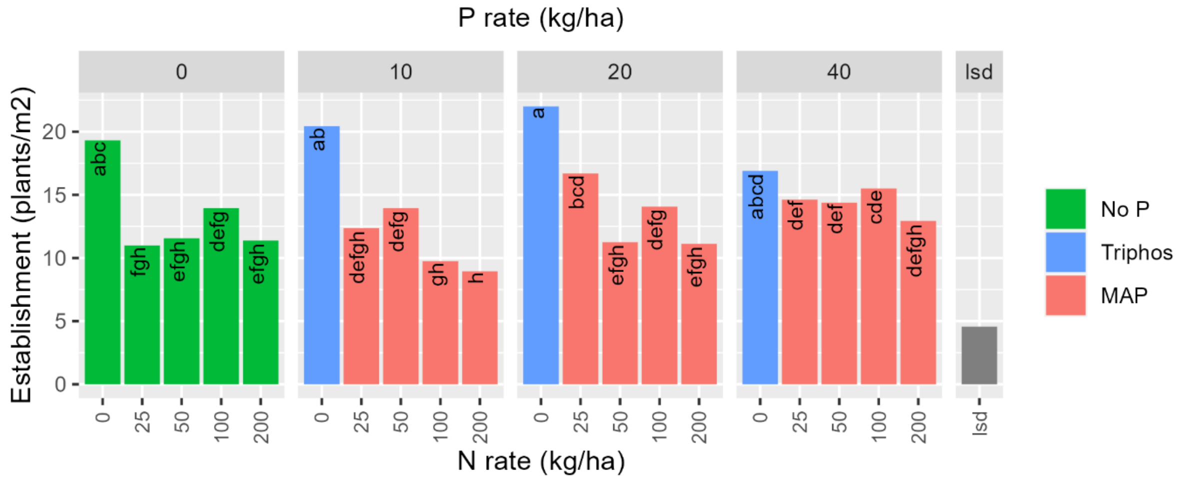


**Figure 1.** Plant establishment in response to increasing rates of N and P. Treatments with the same letter are not significantly different.

<u>Yields</u>

- Yield increased with applied N (regardless of N rate) from 1.7 t/ha (0 N) to 2.0 t/ha (200 kg/ha of N) (**Figure 2**).
- The was little N response from increasing the rate of P.

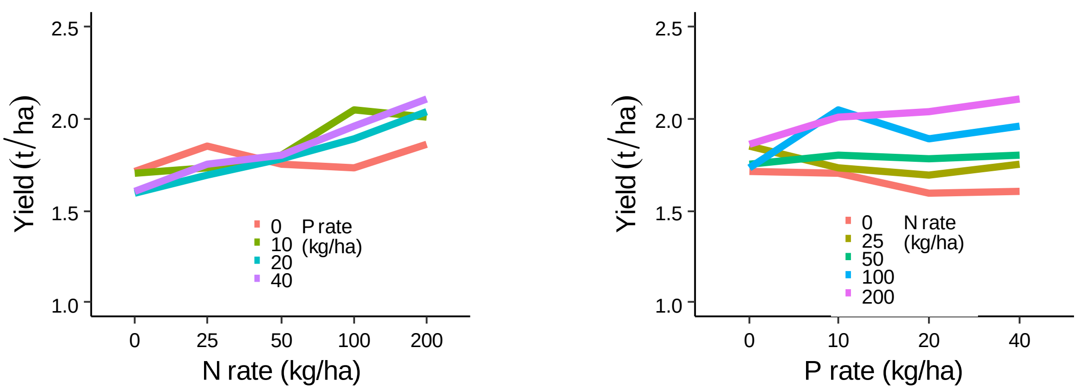


**Figure 2.** Canola yield (t/ha) response to increasing rates of N and P.

<u>Oil</u>

- Oil content decreased with increasing rates of N from 44.6% (no N) to 42.4% where 200 kg/ha N was applied.
- There was effect of P on oil levels (Figure 3).

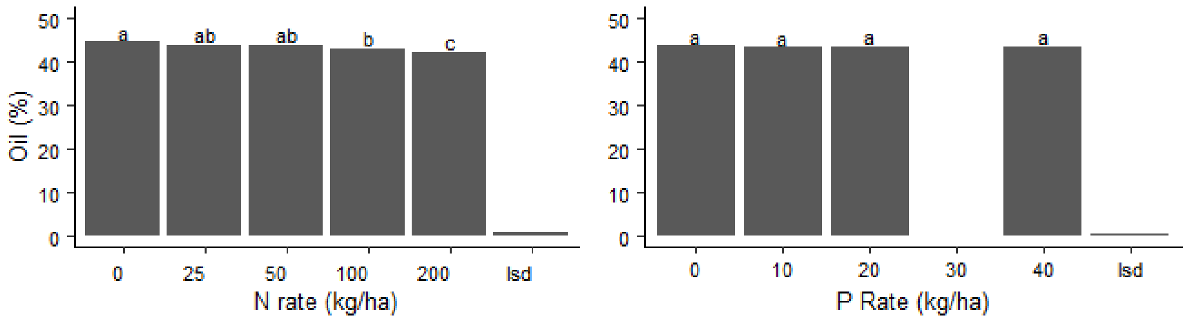


**Figure 3.** Canola oil % response to increasing rates of N and P (regardless of the rate of the other nutrient). Treatments with the same letter are not significantly different.

## Discussion

Establishment was negatively impacted by the addition of N even at a low rate of 25 kg/ha (~54 kg/ha urea). N was applied using scatter plates and incorporated by sowing. A significant rain event occurred just after sowing which is likely to have exacerbated the impact of the urea. Where both P and N were added there was not a further decrease in establishment, indicating that most of the damage was caused by N. Application of urea at sowing, even on the surface, should consider rain predictions.

<u>Yields:</u> 2020 was a record year for many crops in the region, and the yields reported from this trial most likely reflect a significant yield loss through hail.

Soil testing indicated that there were moderate P levels in the topsoil at 38 ppm (Colwell P <30 ppm likely to get a response), this would account for little or no P response.

There was a response to N. A 2 t/ha canola crop requires approximately 200 kg N/ha, close to what was found in the soil sampling. It is likely that yield loss was due to hail, which may account for the response to the higher rates. Like previous work by GOA, the canola did not 'blow up' at the very high rates (~200 kg N/ha in the soil plus an additional 200 kg N/ha). This trial would suggest that responses are more likely from the most limiting nutrient, and that soil testing may help to inform fertiliser management decisions.

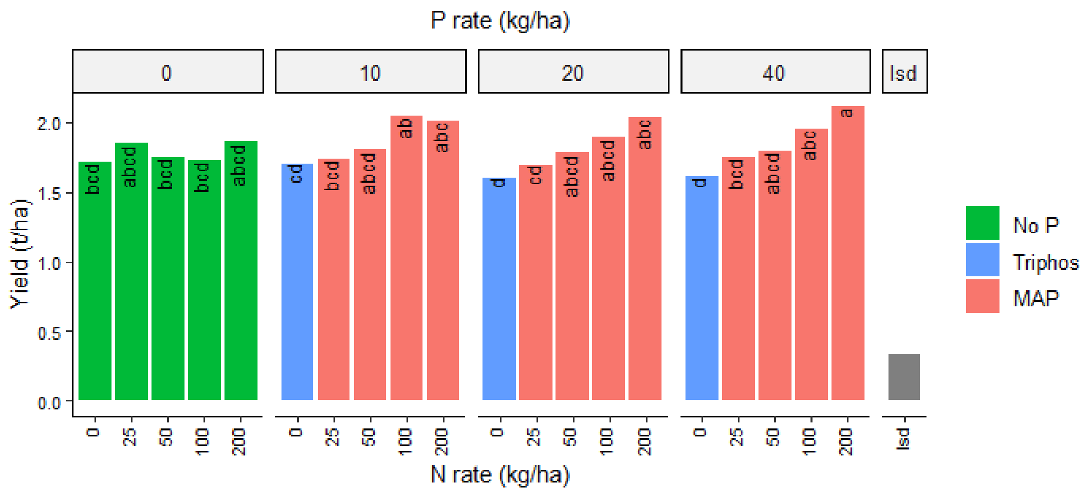

**Figure 5.** Canola yield response to increasing rates of N and P. Treatments with the same letter are not significantly different.

## Conclusion

- Soils with moderate Colwell P levels may not always respond to additional P fertiliser, it is suggested to manage P in this situation to maintain soil P levels.
- Canola is responsive to N when P levels are adequate.
- The best way to establish starting N levels is via soil testing, both shallow and deep, from which N budgets can be calculated.

## Acknowledgements

Research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and Grains Research and Development Corporation (GRDC). The authors would like to thank them for their continued support. Special thanks to Jon and Tex Kilby from Gilgandra who hosted this trial.

## DISCLAIMER — TECHNICAL

## Appendix

**Table 2.** The effects of plant populations, P and N rates on yield and % oil of canola. Results followed by the same letter are not significantly different.

| Phosphorous | Nitrogen | | | NDVI | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rate | | Plant establishment | | Mid | | Early | | Yield | | Oil | | Protein | |
| (kg/ha) | | (plants/m2) | | (Vegetation index) | | | | (t/ha) | | | | | |
| | 0 | 19.3 | abc | 0.34 | abcde | 0.21 | abcd | 1.7 | bcd | 44.4 | abcd | 20.1 | def |
| | 25 | 11.0 | fgh | 0.29 | de | 0.19 | cd | 1.8 | abcd | 44.1 | abcdef | 20.4 | cdef |
| 0 | 50 | 11.6 | efgh | 0.31 | cde | 0.20 | bcd | 1.8 | bcd | 43.9 | abcdef | 20.4 | cdef |
| | 100 | 13.9 | defg | 0.32 | bcde | 0.20 | abcd | 1.7 | bcd | 43.5 | bcdef | 21.4 | abcde |
| | 200 | 11.4 | efgh | 0.29 | e | 0.19 | d | 1.9 | abcd | 42.9 | efg | 21.8 | abcd |
| | 0 | 20.4 | ab | 0.35 | abcde | 0.20 | abcd | 1.7 | cd | 44.5 | abc | 19.8 | ef |
| | 25 | 12.4 | defgh | 0.35 | abcde | 0.21 | abcd | 1.7 | bcd | 44.0 | abcdef | 20.6 | cdef |
| 10 | 50 | 13.9 | defg | 0.37 | abcd | 0.22 | a | 1.8 | abcd | 43.8 | abcdef | 21.1 | bcde |
| | 100 | 9.8 | gh | 0.34 | abcde | 0.20 | abcd | 2.0 | ab | 43.0 | defg | 21.8 | abcd |
| | 200 | 8.9 | h | 0.34 | abcde | 0.20 | abcd | 2.0 | abc | 42.0 | g | 22.9 | a |
| | 0 | 22.0 | a | 0.33 | abcde | 0.20 | abcd | 1.6 | d | 45.2 | a | 19.2 | f |
| | 25 | 16.7 | bcd | 0.37 | abcd | 0.22 | abc | 1.7 | cd | 43.0 | cdefg | 20.7 | cdef |
| 20 | 50 | 11.2 | efgh | 0.35 | abcde | 0.21 | abc | 1.8 | abcd | 44.1 | abcdef | 20.4 | cdef |
| | 100 | 14.1 | defg | 0.41 | a | 0.22 | abc | 1.9 | abcd | 43.3 | bcdefg | 21.3 | abcde |
| | 200 | 11.1 | efgh | 0.31 | cde | 0.20 | abcd | 2.0 | abc | 42.7 | fg | 21.9 | abc |
| | 0 | 16.9 | abcd | 0.35 | abcde | 0.20 | abcd | 1.6 | d | 44.2 | abcde | 20.1 | cdef |
| | 25 | 14.6 | def | 0.36 | abcde | 0.22 | abc | 1.8 | bcd | 44.6 | ab | 20.1 | cdef |
| 40 | 50 | 14.4 | def | 0.38 | abc | 0.22 | ab | 1.8 | abcd | 44.1 | abcdef | 20.2 | cdef |
| | 100 | 15.5 | cde | 0.40 | ab | 0.22 | ab | 1.9 | abc | 43.4 | bcdefg | 21.3 | abcde |
| | 200 | 12.9 | defgh | 0.37 | abcde | 0.20 | abcd | 2.1 | a | 42.0 | g | 22.8 | ab |
| lsd | lsd | 4.6 | | 0.08 | | 0.03 | | 0.3 | | 1.5 | | 1.8 | |