Sorghum following Canola – Is there an issue ?

Anthony Mitchell, Brendan Burton and Richard Daniel, Northern Grower Alliance

Key words

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Take home messages

1. Field observations suggest that sorghum can be less thrifty when following canola in the rotation

2. Duplicate trials were planted in adjacent canola and durum stubble, with a 3-5 fold difference in levels of Arbuscular Mycorrhizae (AM) fungi shortly prior to planting

3. Sorghum following canola had delayed head emergence and yields were ~1.4t/ha less than same trial following durum

4. Application of Granulock Z Extra to 80kg/ha at sowing did not have any impact

5. These trials strongly suggest AM may be involved but need to be repeated in a planned design to allow proper evaluation

The issue?

Liverpool Plain's agronomists have commented that sorghum performance following canola often appears less thrifty than after other crops. Some of the possible causes for difference include soil moisture quantities, soil nutrition, presence of imidazolinone herbicide residues following use of Clearfield chemistry or differential levels of Arbuscular Mycorrhizal (AM) fungi (previously known as VAM).

AM form symbiotic relationships with the crop root system and can improve the access to scarce or immobile nutrients such as phosphorous and zinc. AM are commonly associated with Long Fallow Disorder, where levels of these fungi decline during periods without cropping and the performance of the next crop can suffer. Linseed, cotton, sunflower, corn, mungbean and chickpea are considered highly dependent on AM with sorghum and soybean considered moderately dependent.

Canola and lupins are two species that are not dependent on AM but also do not host the fungi. As a consequence, AM levels after canola may be low and be of similar impact as a Long Fallow.

Trial establishment

Two trials were established in a paddock near Mullaley in November 2015 which had been previously farmed as one management unit. In 2014, canola was planted under marginal moisture conditions with establishment impacted. Areas of canola were sprayed out and 'replanted' with durum. Although not ideal, this provided a scenario with canola and durum stubble side by side.

In October 2015, soil samples were taken from twelve sampling points (in two transects) following each previous crop. Soil depths were assessed in 15cm intervals to 30cm depth and then in 30cm intervals to 120cm.

- **Soil moisture**: Gravimetric soil measurements indicated both profiles were full with ~ 270mm of PAW.
- **Nutrition**: Comprehensive soil test did not indicate any obvious difference in nutrition between the samples. Colwell P means ranged from 22-24mg/kg in the 0-15cm layer with levels of 5-6mg/kg following both crops at 15-60cm. There was also a bulge at depth with ~13 mg P/kg at 60-90cm and ~18mg/kg at 90-120cm. BSES P was 140-147 in the 0-15cm layer and 120-150 between 15 and 60cm. PBI was ~200 at all depths. DTPA Zn means varied from 0.9 to 1.3mg/kg. Nitrate levels were ~130kg N/ha down to 120cm, excluding mineralisation quantities.
- **Herbicide residues**: Testing did not reveal any herbicide residues including imazapyr and imazamox.
- ***Root-lesion nematodes***: PreDicta B testing indicated low to medium levels of *Pratylenchus thornei* with no clear difference in numbers between the previous crops. Sorghum performance is generally unaffected by this nematode. There was no detection of *Pratylenchus neglectus.*
- **Arbuscular Myccorhizae**: Soil samples were submitted for both microscopic examination and PreDicta B assessment. Manual counts showed the durum samples had ~3-4 fold increases in AM spore counts. PreDicta B assessment showed similar differences for AMFa and AMFb populations.

Key point: Testing of the factors considered most likely to vary only showed differences for AM magnitude between the two trial sites. However there may be other factors that differed between the sites which were not assessed.

Trials 2015/16

Treatments evaluated were a factorial combination of two sorghum hybrids (MR Buster and G33) four fertiliser rates. Granulock Z Extra (12N, 20P, 5S and 2Zn) was applied at 0, 20, 40 and 80kg/ha with the seed. Urea was applied to 'balance' the applied N rate for all Granulock Z Extra treatments but sulphur was not balanced (rates varied from ~1-4kg S/ha). The untreated did not receive any additional nutrition.

Results

Because the two trials were separate (even if only 12m apart), we cannot statistically compare the results between trials. However:

- There was no significant difference in plant stand between hybrids or fertilizer treatments in either trial. In both trials the mean population was ~4 plants/m^2
- A count of emerged heads at 74 days after planting showed no significant difference between hybrids or fertilizer treatments in either trial. However the mean number of heads in the durum trial was 6.8/m^2 compared to 4.3/m^2 following canola

- A count of heads at 102 days after planting showed no significant difference between hybrids or fertilizer treatments in either trial. The final number of heads in the durum trial was 10.7/m^2 and similar to 10.0/m^2 following canola
- There was no significant difference in yield between hybrids or fertilizer treatments in either trial. However the mean yield in the durum trial was 8.4t/ha compared to 7.0t/ha following canola
- Plant samples from both trials were taken ~8 weeks after planting to evaluate the extent of AM colonization of sorghum root material. These results were not available at the time of paper preparation.

Conclusions

The enforced design did not permit easy statistical comparison between the two trials. However it was a good opportunity to generate 'proof of concept' data.

Plant stand establishment appeared similar between the two trials but the sorghum following canola trial appeared to delay head emergence compared to the same treatments following durum. Although the final head counts were similar between the trials, sorghum following canola was 16% lower yielding (-1.4t/ha) than the identical treatments following wheat.

The application of Granulock Z Extra (to 80kg/ha) had no apparent impact on yield in either trial. These treatments were applied to evaluate whether high rates of P and Zn at planting may be a management tool to reduce the impact of low AM levels following a non-host crop. There was no suggestion of any benefit in this situation.

The next step is to establish trial designs which allow for more effective evaluation of the impact of the previous crop. This is underway in winter 2016 and should enable sorghum evaluation in 2017/18.

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Contact details

Richard Daniel
Northern Grower Alliance
Ph: 07 4639 5344
Email: richard.daniel@nga.org.au

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