Australian soils do not contain rhizobia that are specific for nodulation of chickpeas. This essentially means that the rhizobia (Group N) need to be added to the root zone of the chickpea crop. In the past this has primarily been through the use of peat slurry applied to seed. Recently there have been developments in the use of granular clay and peat carriers and liquid slurry injection.

Research into the efficacy of these inoculant delivery methods was identified as a research priority by growers in northern NSW at Northern Grower Alliance (NGA) research planning meetings. Due to this, in 2010 two trials were conducted in the Edgeroi/Bellata region of northern NSW, which involved collaboration between NSW DPI and NGA.

2010 trials

Two trials were conducted in 2010 (Argyle and The Clump Rd), both in the Edgeroi/Bellata districts. Treatments applied included:
- Standard peat slurry applied to seed (PS);
- Peat slurry injected into the seed furrow with water as a carrier (PS Wi);
- Attapulgite clay granules mixed with seed in furrow (ACG);
- Freeze dried rhizobia slurry injected into seed furrow with water as a carrier (FD Wi).

Both trials also looked at the effect of the fungicides thiram and thiram + thiabendazole (P Pickle-T). The replicated trials were sown with a small plot seeder.

On October 6, 2010, 10 random plants were dug up from each plot to determine the effectiveness of nodulation. A score from zero (no nodules) to 10 (many nodules) was allocated to the ‘crown’ of the chickpea plant (more accurately, the region of the roots within three cm of the sown seed), as well as a score of 10 for ‘beyond crown’ roots (further than three cm from sown seed).

Argyle site

Peat slurry (PS), Peat slurry water inject (PS Wi) and freeze dried water inject (FD Wi) resulted in significantly greater nodulation around the crown than nil treatment and the attapulgite clay granules (Figure 1). The two water inject treatments resulted in significantly greater nodulation beyond the crown than all other treatments. Yield of the water inject treatments and attapulgite clay granules were significantly greater than the untreated. There was no significant effect of fungicide on yield or nodulation.

The Clump Rd site

All treatments resulted in significantly greater nodulation around the crown than the nil treatment (Figure 2). There was no significant effect of treatment on nodulation beyond the crown or on yield. There was also no significant effect of fungicide on yield or nodulation.

FIGURE 1: Effect of inoculant treatment on nodulation of chickpeas and chickpea yield – Argyle, Edgeroi 2010

FIGURE 2: Effect of inoculant treatment on nodulation of chickpea roots and chickpea yield – The Clump Rd, Bellata 2010
What we found

Limited trial data has shown that the most effective of the new technologies to improve chickpea nodulation appears to be the application of rhizobia ‘in-furrow’ with water (water inject), either as the freeze dried rhizobia or the traditional peat rhizobia. This will reduce the need to mix and apply slurry to the seed, but will require the need for large volumes of water being available at sowing, as well as a liquid tank and plumbing to be incorporated into the seeder.

In the 2010 trials, clay granules resulted in nodulation either equal to (The Clump Rd) or less than (Argyle) the traditional peat slurry treatment.

Clay granules appear best suited to situations where chickpeas are a regular crop in the rotation (where rhizobia may be already present in the soil), so that the reduced efficacy provided compared to the standard slurry treatment may be less pronounced. Granules can also reduce labour and downtime at sowing, so could be considered where real efficiency gains can be made.

The use of standard slurry treatment (peat slurry) still appears to be a reliable method of application. In some cases nodulation may be less than with the ‘water inject’, as seen at the Argyle site with less nodules in the ‘beyond crown’ region. This needs to be balanced with the extra machinery cost of liquid injection.

Be careful of fungicide interaction

A separate trial conducted in 2009 showed that nodulation from the traditional slurry applied to seed method was significantly affected by fungicide (thiram plus thiabendazole), where the fungicide and slurry were applied within an hour of each other.

In trials where fungicide did not affect nodulation, the seed had been treated with fungicide at least several days before inoculation. This highlights the need to apply fungicide to seed first then leave a period of ideally one week or more before inoculating seed with rhizobia.

Granular inoculant products appear not to be significantly affected by seed applied fungicides due to their isolation from the seed coat. This is also likely to be the case with the use of liquid injection.

Each of these trials was conducted in paddocks with no known history of chickpea production. Where chickpea cultivation has been regular, it is likely that the response to inoculation will be less pronounced than reported here.

To sum up

For growers planting small areas of chickpeas or who are content with current treatments methods, the traditional method of peat slurry application still appears reliable.

For situations where the requirement for nitrogen fixation is high (for example, chickpeas cropped straight into sorghum stubble), liquid injection may improve outcomes. Liquid injection (once set up on a machine) may also provide logistical benefits.

For situations where chickpeas have been a regular crop in the rotation, granules may provide adequate nodulation and give logistical benefits such as reduced labour requirement.

These results present only one year of data. To gain a full understanding of the individual treatments used, the trials need to be replicated over several seasons and as part of different farming systems.

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