Chickpea, Inoculation, L/MRZ North Central (Pyramid Hill), Victoria

Aim
To compare a range of inoculant products on chickpea root nodulation, yield and nitrogen (N) fixing ability.

Treatments
Nil, Alosca® granular, freeze dried liquid injection (below seed), Nodulator® granular, Peat slurry applied to seed, TagTeam® granular.

Other Site Details

Variety	PBA Monarch
Sowing Date	31 May
Stubble (height cm)	Slashed
Row Spacing (cm)	30
Fertiliser (kg/ha)[1]	60

1. Granulock Z (N 11, P 21.8, S 4, Zn 1)

Results and Interpretation

- **Key Messages:** There is a benefit in inoculating chickpeas where there are limited rhizobia present in the soil. Granular inoculants present an opportunity to potentially improve nodulation under dry sowing conditions and assist with sowing logistics, with no reduction in nodulation or grain yield. It is important to understand how your seeding system may impact on efficacy of inoculants, including liquid placement, seed dressings and seed box.
- **Nodulation and Crop Vigour:** The nodulation and vigour assessments undertaken at flowering time showed significant benefits of inoculating seed at sowing, however there were no differences observed between the inoculant types. Given the moist conditions at sowing time, differences between the peat slurry and the granular inoculants were potentially diminished.
- All inoculants excluding the freeze dried resulted in significantly greater nodulation and increased vigour than those not inoculated (Table 1). The freeze dried inoculum was applied by liquid injection approximately 2 cm beneath the seed, which may be the cause of its poor performance. In demonstration strips performed alongside the trials (data not presented), where the freeze dry inoculum was applied with the seed, nodulation and vigour was similar to the peat slurry method of inoculation.
- TagTeam® granular inoculant resulted in the greatest nodulation, followed by Nodulator® then Alosca®. It is suggested the particle size of the better performing inoculants was smaller, resulting in improved distribution of inoculum within the furrow, increasing the probability of getting the inoculant as close to the seed as possible.
- There is potential that the combination of the seed dressing (P-Pickel T®) and the peat applied as slurry to seed has resulted in slightly reduced nodulation from the peat treatment, where all other products were separate from the fungicide treated seed.

Table 1. Nodulation and crop vigour scores taken at flowering, maximum score is 10 indicating greatest nodulation and vigour.

Inoculant	Nodulation Score	Vigour Score
Alosca®	5.2	7.3
Nil	0.5	5.0
Freeze dried	0.7	6.0
Nodulator®	6.1	7.0
Peat	4.9	7.0
TagTeam®	7.2	7.0
Sig. Diff.	**P<0.001**	**P<0.001**
LSD (P=0.05)	**1.7**	**0.6**
CV%	**28**	**6**

- **Grain Yield and Grain Quality:** The observed differences in nodulation and vigour at flowering did not fully translate to grain yield and grain quality, however similar trends were present with all inoculants yielding greater than those not inoculated (Table 2).

- If there had been greater rainfall throughout the season and hence a higher yield potential, it is anticipated that greater differences may have been observed between treatments. Furthermore, the presence of high levels of soil available N (140kg N/ha to 70cm depth) may have contributed to the closer yields across treatments.

Table 2. Grain yield and grain quality data.

Inoculant	Grain Yield (t/ha)	Protein (%)	100 Seed Weight (g)
Alosca®	0.39	19.2	40.8
Nil	0.30	19.0	40.8
Freeze dry	0.30	19.0	41.8
Nodulator®	0.31	19.3	42.1
Peat	0.36	19.3	40.9
TagTeam®	0.36	19.4	41.2
Sig. Diff.	**P=0.07**	**P=0.33**	**P=0.635**
LSD (P=0.05)	**NS**	**NS**	**NS**
CV%	**13.5**	**1.1**	**3.2**

- **Residual Soil Nitrogen:** While not statistically significant, similar trends observed in nodulation and yield were observed in residual soil N content, with improved nodulation generally resulting in increased levels of soil N (Table 3). It is important to consider the N removed in grain as increased yields will result in greater depletion of the soil N content. When this is considered, the trends were much more evident with the TagTeam® and Alosca® granular inoculants resulting in higher levels of N removed in grain and remaining in the soil. Once again, it is anticipated that a lower starting N would have resulted in these differences being exacerbated.

Table 3. Residual soil N and N removed in grain.

Inoculant	Residual Soil N (kg/ha)	N removed in grain and remaining in soil (kg/ha)
Alosca®	67	87
Nil	60	75
Freeze dry	55	71
Nodulator®	64	80
Peat	57	76
TagTeam®	74	93
Sig. Diff.	**P=0.901**	
LSD (P=0.05)	**NS**	
CV%	**39.4**	

- **Economics:** Given the higher input costs of using granular inoculants, efficiencies would need to increase significantly to make input costs worthwhile in this season (Table 4).
- An improvement in inoculant efficacy and consequently nodulation, may have some indirect benefits for following crops, in particular, reducing the depletion of soil mineral N, and potentially increasing N. In this instance, the inoculants providing the best nodulation resulted in approximately 15kg N/ha remaining in the soil which will be approximately $5/ha that could be saved on urea costs for the following crop.
- It is important to consider paddock history when choosing inoculants, as it is anticipated that had there been chickpeas grown in this paddock in the recent past, differences observed would have been less evident, however given a better season these differences would have likely been heightened in this situation. It is also important to consider paddock condition, product availability, cost, ease of use and practicalities of applying the different forms (machinery) as these will all be factors contributing to this decision.

Table 4. Partial gross margin of various products.

Inoculant	Return on investment relative to untreated ($)
Alosca®	32
Freeze dry	-10
Nodulator®	-6
Peat	36
TagTeam®	24
Nil	-