Pea inoculum trial

Background

Legume grain crops are typically grown on neutral to alkaline soil in SA. Inoculants for these crops are designed for these conditions, not the acid soils found on Kangaroo Island.

It is thought that traditional rates of peat based inoculants suffer poor survival in hostile acid conditions resulting in poor nodulation and an associated reduction in nitrogen fixation and yield. Trial work in acid soils in the South East of SA has shown benefits of higher inoculant concentration.

A trial was conducted to investigate the effect of different types of inoculant on nodulation and yield in field peas grown in KI conditions.

What was done

Site Selection

The trial was conducted on Stanton's property on the corner of East West One and Timber Creek Roads. The site consisted of a lateritic sandy loam over clay acid soil. The site was a relatively well drained sloped area. Soil test results can be seen in table 1 below.

TABLE 1
Soil test results

	Result	Comment
Colwell P	57 ppm	High
Colwell K	431 ppm	High
pH ($CaCl_2$)	5.4	Acidic

The trial was sown into a canola stubble from the previous year. The trial site received 517 mm rainfall for 2010, which is approximately average.

Trial design

The trial consisted of Kaspa peas inoculated with six different treatments. The trial was replicated in 4 neighbouring 'blocks', with each of the six treatments appearing once in each block (4 times). Each plot was sown with the trial cone seeder and was 8.5 m by 1.1 m wide.

The six treatments are as follows:

- **Start control:** a control or nil inoculant treatment sown before any other treatments.
- **Lime pellet:** standard rate of peat based inoculants plus sticker, coated in builders' lime.
- **Granular:** Allosca^{tm} 'Nodulator' granular inoculant at 6 kg/ha.
- **Peat:** peat based inoculum at a standard rate.
- **High peat:** 20 times the standard rate of peat based inoculum.
- **End control:** another control, sown last as a contamination check.

What was measured

Soil test, biomass scores, grain yield

Crop agronomy

- 15 June trial sown with 100 kg/ha certified seed and 90 kg/ha Granulock^{TM} (11% N, 22% P, 4% S and 1% Zn).
- 14 August vigour scores showed no significant difference.
- 14 September plants dug up and nodules photographed.
- 14 December trial harvested with trial plot harvester.

Results

TABLE 2
Pea inoculum trial results (see trial design section for explanation of treatments)

Treatment	Average yield (t/ha)	Yield relative to start control	Standard deviation (t/ha)	Visual nodulation	Inoculant $/cost/ha
Start control	3.92	100	0.67	Poor	$ -
End control	4.12	105	0.60	Poor	$ -
Granular	4.38	112	0.45	Good	$33.00
High peat(20x)	4.64	118	0.55	Good	$120.00
Lime pellet	3.91	100	0.56	Poor	$8.00
Peat	3.89	99	0.39	Good	$6.00

Discussion of results

Table 2 shows that the standard deviations associated with the yields were high. This means that the results were not statistically significant.

The results indicate that there were yield benefits associated with the use of inoculants. This is because the average for the inoculants treatments was higher than the two controls.

The lime pellet treatment performed very similarly to the controls. This was also supported by nodulation results which were poor for the controls and lime pellet.

This lime result was counterintuitive as alkaline lime should reduce acidity around the seed and rhizobia, improving survival of a bacterial inoculant suited to alkaline conditions. This required further investigation. Upon discussion with SARDI rhizobioligist Ross Ballard we discovered that building lime can be toxic to rhizobia. Hence lime pelleting should be done with products designed specifically for seed treatment.

IMAGE 1
Control treatment roots showing few nodules

Whilst the results indicated a yield increase associated with the use of high peat or granular inoculants, the difference was quite small. This could be explained by non-rhizobial forms of N such as residual N, organic mineralization and fertilizer. If peas were sown without N it is likely that the difference between the control and the inoculation treatments would have been

greater. All treatments in the trial were sown with N as this is common practice, and the P+N fertiliser came with little additional cost to Phosphorus alone.

IMAGE 2
Standard Peat inoculant showing many nodules

The results indicate that the standard rate of peat inoculant yielded slightly less than the control. This could be explained by noise in the results and alternative sources of N mentioned earlier. Importantly, nodulation results were poor with the controls, indicating that there would be little rhizobial N fixation occurring. It would not be wise to draw the conclusion that there was no yield benefit in inoculating peas. We must also consider the benefits of N fixation on following crops.

Inoculant costs are shown in table 2. Granular and high peat treatments were the most expensive, while standard rate of peat was the cheapest. The higher cost of granular inoculants would have been easily justified with only 100 kg/ha extra yield if peas were $270/tonne. The high peat treatment was very expensive. The treatment was used as it was the maximum that could be practically coated on the seed. It was designed to investigate the concentration/rate effect of peat based inoculants and is unlikely an economic ideal.

Future direction

- More work with high rates of peat based inoculant to find an economic optimum.
- Trial work comparing, seed coat grade lime to standard peat inoculants.

For further information contact

- Keith Bolto and Erica Marshall on 8553 0349 or 0427311754
- Lyn Dohle, Rural Solutions SA, Kingscote on 8553 4999 or email lyn.dohle@sa.gov.au

Take home messages

- Benefits from inoculating peas far outweigh cost.
- Higher rates of inoculants may be worth considering.
- Granular inoculant yielded better than peat but not statistically significant.
- Lime pellets must use seed coat grade lime.

Funding/Sponsors/Acknowledgment

- GRDC, Woolworths and federal government "Caring For Our Country" funded research administered by AgKI
- R, K, M, W and J Stanton for providing land for trial and assistance.
- Ross Ballard of SARDI for the analysis of results
- Wayne Hawthorne of Pulse Australia for assistance with trial set up and interpretation of results.