The Role Of Seed Coatings In Enhancing Rhizobium Colonisation & Yield Increases In Pulse Crops In The Northern Mallee Of South Australia

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Abstract: The colonisation of pulse crops by rhizobium in the northern Mallee of South Australia is at times highly variable and in many cases inadequate for optimum plant growth. The aim of this work was to collate recent research publications to develop a seed coating that would enhance colonisation of rhizobium onto roots in low rainfall cropping regions such as the Northern Mallee of South Australia. The coating of chickpeas, peas and lentils in this trial, based out of Loxton, with a product based on **Seasol**™, zinc, manganese, molybdenum and bacterial suspensions (Foundation™) at 5L per ton of seed had significant benefits in plant growth and development.

There was also a visual reduction in the incidence of root disease in treated plants. Statistically significant yield results were seen with Lentils (614kg/ha control to 677kg/ha coated), Field peas (729kg/ha control to 911kg/ha coated). Increases in Chickpeas were not statistically significant (602 to 640kg/ha) but this may have been as a result of the lower seeding rate and severe frosts at flowering. Plants that had coated seeds in conjunction with rhizobium had greater numbers of efficient colonies and reduced root pathogens suggesting that good colonisation by rhizobium suppresses pathogenic infection points. Trial results over recent years have suggested that appropriate seed coats that enhance root colonisation by rhizobium are highly cost effective in maximising the symbiotic relationship between rhizobium and the host species.

Fig 1: Enhanced rhizobium colonisation lentils LHS, control RHS

Methods: Seed Coating

Trials plots of chickpeas, lentils and peas were coated with a product formulated with 30% liquid kelp (**Seasol**™), 3% Foundation™, 2.4% zinc as zinc sulphate, 2.2% manganese as manganese sulphate, and 0.08% Molybdenum as SJB Lig Moly™. Product was applied at 5L per ton of seed to all varieties in conjunction with the recommended rhizobium for each variety. Control plots were only coated with the appropriate rhizobium strain.

Details of sowing depth, varieties as noted in **Table 1.**

Table 1. Sowing Date and Crop Details

Seasonal rainfall conditions were 40mm less than the long term average for April-October and 67mm less for September October. Severe frosts during the late August early September period were also seen to influence crop yields across many areas within the district.

	Varieties	Sowing Equipment	Trial Strips
09-11 May 2015	Blitz Lentils	42' John Deere	8 (fp & cp) to 12 replicates
	Twilight Peas	Conserva Park	
	Striker Chickpeas	Seeder	

Lentils and peas were harvested on the 28/10/15 & Chickpeas on the 21/11/15.

Results and Conclusion

Fig 2: Enhanced rhizobium colonisation LHS, control RHS

Results:

Inspection of crops over the growing season showed significantly greater visual plant growth vegetative responses between the seed coated and conventionally sown crops. In the case of the lentils plant colour was also increased in the coated seeds. There was also a noted reduction in rhizoctonia infections on the coated plants suggesting a possibly biological suppression as a result of increased rhizobium colonisation. **Fig 2**, best highlights the difference in plant performance between the coated seeds in terms of plant growth and development which resulted in significant yield increases at harvest. Inspection of root nodules in all crops also showed increased nodulation and greater colour intensity within the nodules suggesting increased nitrogen fixation within the pulse crops.

Table 2:
Compiled yield data across varieties Bulla Burra Field Site Loxton South Australia, yield in kg/ha

Crop	Control	Treatment	Yield Increase %	P <0.05	LSD (5%)	CV %
Lentils	614	777	26.5%	0.0012	115	10.5
Peas	729	911	25.0%	0.0053	159	12.2
Chickpeas	602	640	6.3%	0.2733	75	14.3

Conclusion:

Increases in plant vegetative growth and yield were seen in pulse crops coated with the seed coating mix described in this paper. The cost of coating is estimated at between $2-3/ha on top of rhizobium coating costs. Similar responses have been seen in sites through the Upper South East of South Australia and Southern South Australian Mallee suggesting that in low rainfall low soil fertility environments seed coating to enhance the colonisation of rhizobia species on pulse crops is worth considering. Further work to investigate specific variances between species and coatings to enhance rhizobium colonisation of pulse crops in acidic soils needs also to be considered. The potential of biological nutritional coatings as part of integrated management in disease suppression also is worth further investigation.

Fig 3: Enhanced rhizobium colonisation chickpeas LHS, control RHS

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