# COMPARISON OF LUPIN INOCULANTS

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## AIM

To evaluate new Lupin inoculation initiatives in high background populations of naturalised *Rhizobium* strains in medium–low rainfall cereal/lupin rotation.

## BACKGROUND

It has become common practice to rely on the naturalised background strains of root nodule bacteria for the nitrogen fixation needs of lupin cropping in the WA northern agricultural grain belt. A survey conducted throughout the northern agricultural region in 2005 by the Centre for *Rhizobium* Studies (CRS) at Murdoch University collected, isolated and measured the nitrogen fixation efficiency of naturalised strains resulting in elite strains being identified and subsequently field evaluated.

Growth promoting microbes with beneficial attributes other than *Rhizobium* are also being isolated and evaluated by programs within the CRS. These developments coupled with improvements in the convenience and efficacy of new microbe delivery methods combine to have the potential to improve grower returns from lupin/cereal rotations.

## TRIAL DETAILS

| | |
|---|---|
| **Property** | Steve and Lee Anne Carter, Xantippe |
| **Plot size & replication** | 18m x 1.54m x 4 replications (plot demesions represent seed yield harvest cut) |
| **Soil type** | Sandy loam |
| **Sowing date & details** | 1/6/07: knife points & press wheels, at depth 2.5 cm, low-adequate moisture. |
| **Seeding rate** | 100 kg/ha Mandelup narrow leaf lupin |
| **Fertiliser (kg/ha)** | 1/6/07: 150 kg/ha Single super phosphate (banded at sowing) |
| **Paddock rotation** | 2003 = Wheat, 2004 = Pasture, 2005 = Pasture, 2006 = Pasture |
| **Herbicides** | 1/6/07: 2 L/ha Sprayseed<br>1/6/07: 1 L/ha Chlorpyrifos<br>1/6/07: 1.1 kg/ha Simazine<br>24/7/07: 200 mL/ha Brodal |
| **Growing Season Rainfall** | 113mm |

## TREATMENT DETAILS

| Trt no | Treatment | Treatment detail/objective |
|---|---|---|
| 1 | Nil (no inoculation) | • Primary control plot<br>• Common seeding practice in NAR.<br>• Benchmarks efficacy of background strain in established cereal/lupin rotation |
| 2 | ALOSCA NIB only @ 8 kg/ha | • Secondary control assessing efficacy of NIB interaction with background strain only |
| 3 | Peat WSM471 | • Industry standard peat based treatment<br>• Carrier comparison |
| 4 | ALOSCA WSM471 @ 8 kg/ha | • Standard ALOSCA Lupin inoculation treatment<br>• Carrier comparison<br>• Control for NIB treatment 5 |
| 5 | ALOSCA WSM471 + NIB @ 8 kg/ha | • Standard ALOSCA Lupin inoculation treatment combined with NIB<br>• Benefits measured in 2006 work |
| 6 | ALOSCA WSM4024 @ 8 kg/ha | • New strain treatment<br>• Yield & quality responses 10-20% over control measured in low yielding trial in 2006<br>• Control for NIB treatment 7 |
| 7 | ALOSCA WSM4024 +NIB @ 8 kg/ha | • New strain & NIB treatment<br>• Yield & quality responses circa 30% over control measured in low yielding trial in 2006 |

## RESULTS

**Table 1:** Root nodulation scores, winter shoot dry weight, seed percentage total nitrogen and seed yield, expressed as percentage of the Nil (no inoculation) Control. Bold figures represent treatments returning results significantly better than the Nil control taking into account standard error calculation across the replicates.

| Trt no. | Treatment | Winter Dry weight 23/07/07 | Nod-score 23/07/07 (0-10) | Nod-score 31/08/07 (0-10) | Seed % total Nitrogen | Seed Yield (t/ha) |
|---|---|---|---|---|---|---|
| 1 | Nil (Mandelup) control | 100% | 100% | 100% | 100% | 100% |
| 2 | ALOSCA NIB only | **124%** | 98% | 92% | 99% | 118% |
| 3 | Peat WSM471 | **121%** | 89% | 97% | 103% | 108% |
| 4 | ALOSCA WSM471 | 104% | 96% | 99% | 105% | 128% |
| 5 | ALOSCA WSM471 + NIB | **124%** | 106% | 101% | 94% | 103% |
| 6 | ALOSCA WSM4024 | **124%** | 97% | 95% | **110%** | 78% |
| 7 | ALOSCA WSM4024 + NIB | **121%** | 81% | 84% | 102% | 114% |

The results reveal few instances whereby the applied treatments significantly out performed the Nil control (treatment 1). Given this, the applied treatments did generally trend positively over the Nil control and suggest inoculation may return a yield (Figure 1) and seed quality (Figure 2) benefit under the low growing season rainfall conditions. Nodulation scoring (23/7 & 31/8) was compromised by staggered plant germination and made representative root sampling difficult. The considerable error bars with the seed yield data (Figure 1) reflect the variance across the treatment replicates which was amplified by the yield limiting conditions.

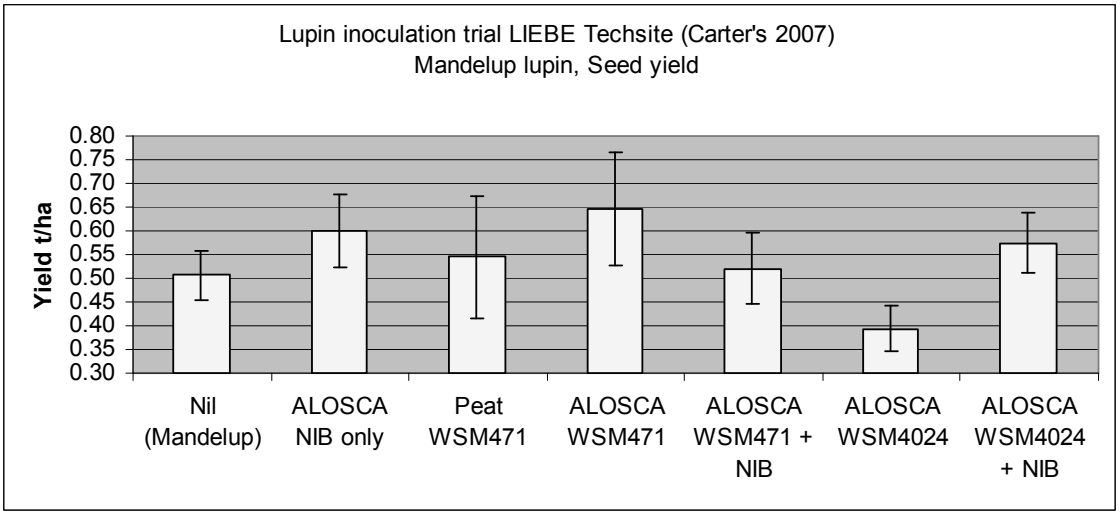


**Figure 1:** Mandelup Lupin, seed yield.

The seed % total nitrogen analysis (see figure 2 below) may offer the best insight into how results may have presented had seasonal conditions not impacted so negatively with treatments 1,3 and 4 showing an improvement trend with inoculation and the use of dry granules and treatment 6 going onto highlight the benefit of the new WSM4024 strain.

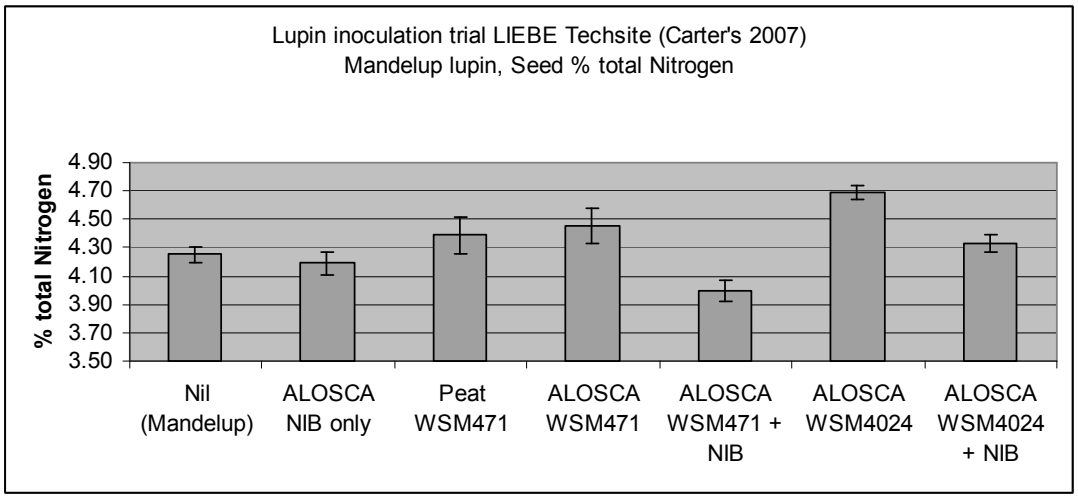


**Figure 2:** Mandelup Lupin, seed % total Nitrogen.

## ECONOMIC ANALYSIS

**Table 2:** Yield based economic analysis ($/ha).

| Treatment | Yield (t/ha) | Gross Return ($/ha) | Additional treatment cost ($/ha) | Return on treatment ** ($/ha) |
|---|---|---|---|---|
| Nil (Mandelup) | 0.51 | 151.77 | 0.00 | $0.00 |
| ALOSCA NIB only | 0.60 | 179.70 | Not on market | NA |
| Peat WSM471 | 0.54 | 163.43 | 4.00 | $7.66 |
| ALOSCA WSM471 | 0.65 | 193.70 | 10.00 | $31.93 |
| ALOSCA WSM471 + NIB | 0.52 | 156.30 | Not on market | NA |
| ALOSCA WSM4024 | 0.39 | 118.25 | 10.00 | -$43.52 |
| ALOSCA WSM4024 + NIB | 0.57 | 172.46 | Not on market | NA |

Based on Price $300/tonne; **Note no quality parameters taken into account

## COMMENTS

Overall the results returned from this trial were confounded by low growing season rainfall and high temperatures during spring. This was reflected in the poor seed yields and significant variation across the treatment replicates reducing the confidence with which results can be drawn from the data.

Despite the difficulties presented by low growing season rainfall over the past two years, the picture for potential benefits of improved lupin *Rhizobium* strains and other beneficial microbes is becoming clearer. Further controlled environment (glasshouse) work with DPI NSW supports earlier WSM4024 strain evaluations done at the Centre for *Rhizobium* Studies (CRS), Murdoch University with improvements measured over the existing commercially Group G (WU425) strain. Field evaluation is indicating there are benefits to be gained from lupin inoculation and lupin inoculation in combination with other beneficial microbes however the challenge lies with how to improve occupancy of the new strain/microbe, that is, to have it infect the plant before the less effective naturalised/background strain satisfies the nodulation initiation process.

## ACKNOWLEDGEMENTS

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