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**Impact of AMF and Rhizobia on Mungbean Nodulation & Yield**

**Trial ID:** DH2221      **Location:** Narrabri      **Trial Year:** 2022  
**Investigator:** Dean Hancock

Research by USQ in 2020 showed a synergistic response when AMF (arbuscular mycorrhizal fungi) and rhizobia were applied to mungbeans grown in a steam pasteurised vertosol. Observed synergism led to increased uptake of nutrients (N, P, K and Zn), increased rhizobial nodulation together with increased crop biomass and yield. Industry feedback has frequently reported poor levels of rhizobial nodulation in commercial mungbean crops. This project was designed to evaluate the impact of AMF and rhizobia under commercial conditions, particularly where AMF levels may be limited eg following canola in the rotation.

|                             |                                                                                                                                                                                                                                                                          |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Objective:</b>           | <b>To evaluate interactions between AMF and Rhizobia on mungbean nodulation and yield</b>                                                                                                                                                                                |
| <b>Crop &amp; Hybrid:</b>   | <b>Mungbean cv. Opal AU</b>                                                                                                                                                                                                                                              |
| <b>Planting Date:</b>       | <b>6/02/2023</b>                                                                                                                                                                                                                                                         |
| <b>Previous Crop</b>        | <b>Canola 2022</b>                                                                                                                                                                                                                                                       |
| <b>Planting Details:</b>    | <b>Tyne planter on 32 cm row spacing and 25 kg/ha planting rate</b>                                                                                                                                                                                                      |
| <b>Application Details:</b> | <b>AMF: Endofuse at 10 mL/ha in-furrow using planter-mounted sprayer<br/>Rhizobia: GreenRhiz Group I peat inoculant at 1 g/kg seed applied as a slurry<br/>Fertiliser: Granulock Z Extra applied at 50kg/ha with seed (nutrient kg/ha rates: 6 N, 10 P, 2.7 S, 1 Zn)</b> |
| <b>Harvest Date:</b>        | <b>18/05/2023</b>                                                                                                                                                                                                                                                        |
| <b>Trial Design:</b>        | <b>Randomised complete block of 8 treatments x 4 replicates</b>                                                                                                                                                                                                          |
| <b>Plot Size:</b>           | <b>4 m x 12 m</b>                                                                                                                                                                                                                                                        |
| <b>Harvest Area:</b>        | <b>2 m x 10 m</b>                                                                                                                                                                                                                                                        |
| <b>Keywords:</b>            | <b>Mungbean, rhizobia, AMF, nutrition</b>                                                                                                                                                                                                                                |

An initial trial following this protocol was planted in late 2022 at a site near Carroll NSW that had been soil tested for AMF and soil nutrition. Marginal soil moisture conditions resulted in poor and variable plant stands in both the commercial paddock and trial area. The initial trial was abandoned with this site planted near Narrabri without sufficient time for pre-testing AMF or soil nutrition.

A maintenance soil application of chlorpyrifos was applied after planting and before a rain event to help control false wireworms. Plant stand still appeared to be impacted by false wireworm. Damaged seeds were found in the planted row and gaps in establishment between plants were evident.

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| Crop Name<br>Crop Variety<br>Assessment Date<br>Assessment Type<br>Assessment Unit<br>Sample Area<br>Planting-Evaluation Interval |                                                           |                             | Mungbean<br>Opal AU                                             |                                                      |                                               |                                                |                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------|-----------------------------------------------------------------|------------------------------------------------------|-----------------------------------------------|------------------------------------------------|--------------------------------------------------------------|
|                                                                                                                                   |                                                           |                             | 20/02/2023<br>EMERGENCE<br>/m <sup>2</sup><br>4 m row<br>14 DAP | 18/05/2023<br>YIELD<br>t/ha<br>2 m x 10 m<br>101 DAP | 18/05/2023<br>PROTEIN<br>%<br>1 kg<br>101 DAP | 18/05/2023<br>MOISTURE<br>%<br>1 kg<br>101 DAP | 18/05/2023<br>SEED WEIGHT<br>g/1000 seeds<br>1 kg<br>101 DAP |
| Trt No.                                                                                                                           | Treatment                                                 | Product Rate                |                                                                 |                                                      |                                               |                                                |                                                              |
| 1                                                                                                                                 | Untreated                                                 | -                           | 50-                                                             | 1.76-                                                | 14.7-                                         | 8.4-                                           | 69-                                                          |
| 2                                                                                                                                 | Granulock Z Extra                                         | 50kg/ha                     | 46-                                                             | 1.20-                                                | 14.8-                                         | 8.5-                                           | 67-                                                          |
| 3                                                                                                                                 | GreenRhiz Gp I                                            | 1g/kg                       | 54-                                                             | 1.45-                                                | 14.6-                                         | 8.4-                                           | 67-                                                          |
| 4                                                                                                                                 | Endofuse in-furrow                                        | 10ml/ha                     | 55-                                                             | 1.56-                                                | 14.7-                                         | 8.4-                                           | 64-                                                          |
| 5                                                                                                                                 | Granulock Z Extra<br>GreenRhiz Gp I                       | 50kg/ha<br>1g/kg            | 44-                                                             | 1.33-                                                | 14.6-                                         | 8.5-                                           | 63-                                                          |
| 6                                                                                                                                 | Granulock Z Extra<br>Endofuse in-furrow                   | 50kg/ha<br>10ml/ha          | 46-                                                             | 1.42-                                                | 14.5-                                         | 8.5-                                           | 68-                                                          |
| 7                                                                                                                                 | GreenRhiz Gp I<br>Endofuse in-furrow                      | 1g/kg<br>10ml/ha            | 53-                                                             | 1.50-                                                | 14.6-                                         | 8.4-                                           | 68-                                                          |
| 8                                                                                                                                 | Granulock Z Extra<br>GreenRhiz Gp I<br>Endofuse in-furrow | 50kg/ha<br>1g/kg<br>10ml/ha | 46-                                                             | 1.28-                                                | 14.5-                                         | 8.5-                                           | 63-                                                          |
| LSD P=.05<br>Treatment Prob.(F)=                                                                                                  |                                                           |                             | nsd<br>0.1737                                                   | nsd<br>0.1687                                        | nsd<br>0.2116                                 | nsd<br>0.4984                                  | nsd<br>0.0818                                                |

Yield cv 19%

Means followed by same letter or symbol (-) do not significantly differ (P=.05, LSD).

Mean comparisons performed only when AOV Treatment P (F) is significant at mean comparison OSL.

nsd – No significant difference

Non-replicated plant mapping was conducted on key treatments at ~6 weeks after planting (22/03/2023) to examine for other plant growth effects and rhizobial nodule presence.

| Crop Name<br>Crop Variety<br>Assessment Date<br>Planting-Evaluation Interval<br>Assessment Type<br>Assessment Unit<br>Sample Area<br>Planting-Evaluation Interval |                                      |                  | Mungbean<br>Opal AU<br>22/03/2023<br>44 DAP          |                                                   |                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|------------------|------------------------------------------------------|---------------------------------------------------|-----------------------------------------------|
|                                                                                                                                                                   |                                      |                  | PLANT TOP WEIGHT<br>g/4 Plants<br>4 Plants<br>14 DAP | INTERNODE NUMBER<br>/Plant<br>4 Plants<br>101 DAP | INTERNODE LENGTH<br>mm<br>4 Plants<br>101 DAP |
| Trt No.                                                                                                                                                           | Treatment                            | Product Rate     |                                                      |                                                   |                                               |
| 1                                                                                                                                                                 | Untreated                            | -                | 122                                                  | 8                                                 | 49                                            |
| 2                                                                                                                                                                 | Granulock Z Extra                    | 50kg/ha          | 158                                                  | 8                                                 | 50                                            |
| 3                                                                                                                                                                 | GreenRhiz Gp I                       | 1g/kg            | 132                                                  | 7                                                 | 44                                            |
| 4                                                                                                                                                                 | Endofuse in-furrow                   | 10ml/ha          | 124                                                  | 7                                                 | 58                                            |
| 7                                                                                                                                                                 | GreenRhiz Gp I<br>Endofuse in-furrow | 1g/kg<br>10ml/ha | 128                                                  | 7                                                 | 53                                            |

Indicative data only. Not analysable

No rhizobial nodules were present on any plants.

DAP = Days after Planting

## Impact of AMF and Rhizobia on Mungbean Nodulation & Yield

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### Conclusions:

This trial was conducted to evaluate potential synergism between Endofuse – containing AMF (arbuscular mycorrhizal fungi) and Group I Rhizobia (GreenRhiz) on mungbean growth and yield. Granulock Z Extra was applied as a benchmark treatment for comparison alone, with either Endofuse or Rhizobia and in combination with both.

An initial site was planted in late 2022 but poor establishment resulted in both the commercial crop and trial being abandoned. This second site was planted at short notice in a field following canola in 2022. Canola is a non-host crop for AMF and likely to provide a more responsive situation to observe potential AMF and Rhizobia synergism. Limited preparation time did not allow for soil testing of AMF level or soil nutrition.

Mungbeans established successfully in all plots with no significant differences between treatments. However, there was a trend for reduced emergence counts (~10-15%) where starter fertiliser was applied. This suggested the starter rate was marginally high for the 32 cm row spacing.

Frequent site visits and non-replicated plant mapping did not reveal any difference in crop vigour or plant structure. Inspection of roots did not find Rhizobia nodules in any treatments. Despite this, the plants looked healthy and grew vigorously.

The trial was harvested at 101 DAP (101 days after planting) in mid-May 2023. There was no significant difference in yield with the highest yield recorded in the untreated. Grain protein, moisture and 100 grain weight were all assessed with no significant differences apparent.

In this situation, despite planting into canola stubble from winter 2022, there was no indication of any synergism between AMF and Rhizobia in crop production or level of nodulation. However, the lack of Rhizobial nodulation combined with the vigorous crop development suggests the background level of N (and other nutrients) was adequate to provide good crop growth.

Any future effort to evaluate synergism between AMF and Rhizobia in mungbeans needs to preferably be conducted following a non-Rhizobial host crop (or long fallow) and in a low nutrition background. Given mungbeans commercial fit as an opportunistic double-crop option, suitable sites are likely to be hard to secure and the commercial benefit of any measured synergism may be limited.

### Rainfall:

|                       |                  |
|-----------------------|------------------|
| Weather Station Name: | Narrabri Airport |
| Distance:             | 5 km             |

| Month    | Rainfall Total | Unit | Comments                                                                                  |
|----------|----------------|------|-------------------------------------------------------------------------------------------|
| Jan 2023 | 57             | mm   |                                                                                           |
| Feb 2023 | 10             | mm   | Planting and treatment application 6/02; chlorpyrifos spray 09/02; emergence counts 20/02 |
| Mar 2023 | 146            | mm   | Plant mapping 22/03                                                                       |
| Apr 2023 | 30             | mm   |                                                                                           |
| May 2023 | 0.2            | mm   | Harvest 18/05; sampled for grain quality                                                  |