Designer seed for enhancement of yield in black gram (*Vigna mungo* L.)

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**ABSTRACT**

Field experiments were carried out during 2012 and 2013, to identify the yield performance of black gram designer seed. The treatment consisted of seeds fortified with KCl 1% for 6 h followed by polymer coating @ 3ml/kg + Carbendazim @ 2g/kg + imidachloprid @ 2ml/kg + *Tichoderma viride* @ 4g/kg + *Azospirillum lipoferum* @ 40g/kg. The effect was more beneficial through increased pods/plant, pod yield/plot (g) and seed yield/ plant (g), earlier days to 50% flowering and pest and disease incidence compared to untreated control.

**Key words:** *Azospirillum lipoferum*, Black gram, Designer seed, Polymer coating, *Tichoderma viride*.

**INTRODUCTION**

Black gram an important Indian pulse crop and occupies 12.7% of total area under pulses and contributes 8.4% of total pulses production. However, area and production of black gram has declined from 3.01 m.ha. and 1.30 million tons in 2000 to 2001 to 2.97 m. ha. and 1.23 million tons, respectively in 2009 to 2010 (ASSOCHAM, 2012). Moreover, nearly 70 per cent of the black gram area is under rain fed ecosystem, which is affected by erratic rainfall induced moisture stress. In order to overcome these situations, the best solution is to develop a method by which the higher level of vigour and viability of farm saved seeds can be maintained.

Designer seed is an integrated pre-sowing seed treatment that involves addition of nutrients, plant protectants and bio inoculants to enhance seed quality viz., field emergence and yield attributing parameters. Seed fortification with plant growth regulators and inorganic nutrients has already been reported (Ponnuswamy et al., 2011). Biologically active products like microbial inoculants, containing active strains of selective microorganisms like *Azospirillum* help in increasing the plant growth by biological nitrogen fixation, phosphate mobilization and nutrient uptake *Trichoderma* *spp.* are endophytic plant symbionts that are widely used as seed treatments to control diseases and to enhance plant growth and yield (Harman, 2006). Polymer coating technology is a sophisticated process of applying precise amount of active ingredients along with a liquid material directly on to the seed surface without obscuring its shape and total seed weight may increase up to 1 to 2 per cent. It ensures dust free handling of treated seed, both user and environment friendly. With this background the present study was undertaken with designer seed of black gram, for maximizing its productivity.

**MATERIALS AND METHODS**

Black gram, cv. ADT 3 seeds were coated with polymer (Polykote (TM) M/s. Little’s Oriental Balm and Pharmaceuticals Ltd., Chennai). The Polymer is a liquid impermeable to water vapour, easily water soluble fast drying and biodegradable and available in various colours. The black coloured polykote had been used due to its suitability for black gram seeds. Treatment details are as under

1. Dry seed (Control),
2. Dry seed - Polymer @ 3ml/kg + Carbendazim @ 2g/kg,
3. Dry seed - Polymer @ 3ml/kg + Carbendazim @ 2g/kg + imidachloprid @ 2ml/kg + *Tichoderma viride* @ 4g/kg + *Azospirillum* @ 40g/kg,
4. Dry seed - Polymer @ 3ml/kg + Carbendazim @ 2g/kg + imidachloprid @ 2ml/kg and soil application of *Tichoderma viride* @ 1.6 kg/ac + *Azospirillum* @ 8000g/ac,
5. Fortified seed - Seed Fortification with 1% KCL for 6 hr and drying back to original moisture content,
6. Fortified seed - Polymer @ 3ml/kg + imidachloprid @ 2ml/kg + Carbendazim @ 2g/kg,
7. Fortified seed – Polymer @ 3ml/kg + imidachloprid @ 2ml/kg + Carbendazim @ 2g/kg + *Tichoderma viride* @ 4g/kg + *Azospirillum* @ 40g/kg,
8. Fortified seed – Polymer @ 3ml/kg + Carbendazim @ 2g/kg + imidachloprid @ 2ml/kg and soil application of *Tichoderma viride* @ 1.6kg/ac + *Azospirillum* @ 8000g/ac.

A field experiment was conducted at Agricultural Research Station, Vaigai Dam, Tamil Nadu during *rabi* 2012 and *rabi* 2013 also laid adopting factorial randomized block design with three replications. The Plot size adopted was 4 x 3 m (12 sq.m.) with the spacing 30 x 10 cm. All the recommended package of practices was followed. Ten plants in each replication for all the treatments were tagged at random for recording the morphometric characters. The data collected from experiments were subjected to an analysis.

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of Variance and treatment differences tested (t test) for significance (P=0.05) using pooled analysis after Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Field emergence potential of seeds is the most important practical aspect of seed quality as it decides the performance of the resultant crop. Among the treatments, fortified seeds coated with Polymer @ 3ml/kg + Carbendazim @ 2g/kg + imidachloprid @ 2ml/kg + Tichoderma viride @4g/kg+ Azospirilum @ 40g/kg (T_3), improved the field emergence over uncoated control by 9 and 10 per cent for 2012 and 2013 respectively (Table 1). The treated seeds took minimum days (33 and 32 days for 2012 and 2013 respectively) for 50 per cent flowering compared to untreated control (38 and 36 days for 2012 and 2013 respectively) (Table 1). Increased plant growth and yield due to KCl fortification of seed which is favourable for the development of plasma colloids. Potassium has a prevalent action in plants and is involved in maintenance of ionic balance in cell and bounds ironically to enzyme pyruvate kinase which is essential in respiration and carbohydrate metabolism (Aisha et al., 2007). The beneficial effect might be due to polymer and nutrients. The improvement in field emergence could also be ascribed to activation of cells, which result in the enhancement of mitochondrial activity leading to the formation of more high energy compounds and vital bio-molecules, which made available during the early phase of germination (Kavitha, 2002). Duan and Burris (1997) reported that higher germination and field emergence percentage could be seen in polymer coated sugar beet seeds, and it was mainly due to increase imbibition rate where the fine particles in the coating acts as “wick” or moisture attracting material to improve germination. Polymer coating increased the absorption of water, gases, micronutrients and the activity of hormones which help rapid and quick seedling emergence, faster growth and early panicle emergence in paddy.

Pest and disease incidence was less in T_3 treated seeds (6.2 and 1.5 % for 2012 and 2013 respectively) compared to untreated control seed (16.7 and 5.26% for 2012 and 2013 respectively) (Figure. 3).

In black gram, pest and disease may cause yield reduction. Polymer coating of seed improved physical properties of the seed and provide protection from biological enemies (Bennett et al., 1992). This might be due to the presence of polymer which improved the resistance of seeds towards pest and disease in the much warranted juvenile stage, besides improving seedling vigour. Chen et al. (2004) reported that corn seeds coating with super absorbent polymer played an important role in improving the growth and inducing the activity of pest and disease resistance-related enzymes in seedlings for its keeping water ability and it would be beneficial to the pest and disease control.

The yield attributes viz., pods/plant; pod yield/plot (g) and seed yield/ plant (g) were found to be significant. Among the treatments, T_3 (Fortified seed- Polymer @ 3ml/kg + Carbendazim @ 2g/kg + imidachloprid @ 2ml/kg + Tichoderma viride @ 4g/kg + Azospirilum @ 40g/kg), recorded higher pods/plant, pod yield/plot (g) and seed yield/ plant (g) The percentage increase over control was 30, 30 and 23, respectively for 2012 and 39 pods/plant, 32 pod yield/plot and 25% seed yield/ plant, for 2013 (Table1 and Figure 1&2). The reason for the increased yield might be due to the increased photosynthetic efficiency through stabilization of chlorophyll, higher production of photosynthates resulting in increased translocation of organic material from the source to sink in the treated plants. Similar findings are also reported by Chachalis and Smith (2001 in soybean, Sabir- Ahamed (2003) in maize and Rana et al. (2001) in Indian mustard, Rajasekaran (2004) in brinjal, Vinitha (2006) in tomato, Marimuthu (2007) in rice and Suresh Vegula (2008) in maize. Yield increase due to

Table 1: Performance of designer seed on field emergence (%), days to 50% flowering (days) and no. of pods/ plant.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Field emergence (%)</th>
<th>Days to 50% flowering</th>
<th>No. of pods/plant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012</td>
<td>2013</td>
<td>Mean</td>
</tr>
<tr>
<td>T_1</td>
<td>87.00 (68.02)</td>
<td>88.00 (71.56)</td>
<td>87.50 (69.73)</td>
</tr>
<tr>
<td>T_2</td>
<td>90.00 (68.02)</td>
<td>92.00 (73.57)</td>
<td>91.00 (70.63)</td>
</tr>
<tr>
<td>T_3</td>
<td>91.00 (72.54)</td>
<td>94.00 (75.82)</td>
<td>92.50 (74.66)</td>
</tr>
<tr>
<td>T_4</td>
<td>91.00 (72.54)</td>
<td>92.00 (73.57)</td>
<td>91.50 (73.57)</td>
</tr>
<tr>
<td>T_5</td>
<td>92.00 (73.57)</td>
<td>94.00 (73.57)</td>
<td>93.00 (73.57)</td>
</tr>
<tr>
<td>T_6</td>
<td>93.00 (75.82)</td>
<td>94.00 (74.66)</td>
<td>93.50 (75.82)</td>
</tr>
<tr>
<td>T_7</td>
<td>96.00 (77.08)</td>
<td>98.00 (77.08)</td>
<td>97.00 (77.08)</td>
</tr>
<tr>
<td>T_8</td>
<td>94.00 (75.82)</td>
<td>95.00 (74.66)</td>
<td>94.50 (78.52)</td>
</tr>
<tr>
<td>Mean</td>
<td>91.15 (72.62)</td>
<td>93.35 (74.25)</td>
<td>92.56 (73.74)</td>
</tr>
</tbody>
</table>

| Sed        | 0.45 | 0.22 | 0.64 | 0.34 | 0.68 | 0.96 | 0.32 | 0.65 | 0.92 |
| CD (0.05)  | 0.93** | 0.46** | 1.31** | 0.70** | 1.40** | 1.98** | 0.67** | 1.34** | 1.90** |

(Figures in parentheses are arc sine transformed values)

T- Treatment, S- Season, T x S – Treatment x Season. **- Significant at 5% level.

The yield increase could be attributed to the presence of inoculants, protectants, nutrients and polymer in the coating treatment. Growth promotion by *Trichoderma* which was attributed to solublization and sequestration of many plant nutrients such as P, Mn, Fe and Zn and supply to the plants, which in turn into increased plant growth (Lal et al., 2013). The increased yield was attributed to increase in plant stand and plant establishment with suppression of seed borne pathogens. Inhibition of the activity of the pathogen resulted in more total dry matter production which facilitates more availability of photosynthates for sink and ultimately resulted in increased yield. Similar findings were observed by Sunil Kumar et al. (2009) in soybean, Altintas and Bal in cucumber. *Azospirillum* inoculation is mainly attributed to increased growth due to increase root biomass and accumulation of nitrogen and the production of gibberellins and cytokinin like substances which promote the growth of the seedlings. There were many reports that seed inoculation of *Azospirillum*, increased biomass and grain yield (Woodard and Bly, 2000) increased cob length and cob weight (Cavallet et al., 2000).

**CONCLUSION**

It can be concluded that pre-sowing treatment given with seeds fortified with KCl 1% + Polymer @ 3 ml/kg of seeds + Carbendazim @ 2g/kg + imidachloprid @ 2ml/kg + *Trichoderma viride* @ 4g/kg + *Azospirillum* @ 40g/kg recorded higher yield attributing characters and less incidence of pest and disease among the treatments during rabi 2013.

**REFERENCES**


