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## Effect of seed dressing on germination and root rot of soybean

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### Abstract

Field trial were conducted at three locations to find out the effect of different chemical seed dresser and bio-agent on seed germination, root rot incidence and yield of soybean and results revealed that in comparison with bio-agent (*Pseudomonas fluorescens* and *Trichoderma viride*) seed dressing with Carboxin 37.5% + Thiram 37.5% (combi product) @ 2g/kg seed recorded maximum seed germination (92.96%), least per cent incidence of root rot (1.01, 2.79 and 6.22%) at 15, 30 and 45 days after germination respectively. Significantly superior yield (1224 kg/ha) recorded in seed dressing with Carboxin 37.5% + Thiram 37.5% (combi product) which is at par with seed dressing with Carbendazim 25% + mancozeb 50% WS (combi product) @ 2g/kg seed. Higher yield ascribed due to increased seed germination, minimum root rot incidence.

**Keywords:** Soybean, seed dresser, germination, root rot

### Introduction

Soybean (*Glycine max* (L.) Merrill) is a significant species of legume inhabitant to East Asia. The estimated national production of soybean during 2015 was 8.57 million ton with the national productivity of 8.57 kg/ha in India. Madhya Pradesh, Maharashtra and Rajasthan continue to be the leading states with 5.61, 3.59 and 1.02 million ha under soybean and contribution of about 85% towards total production of the crop in the country (Anonymous, 2016) [1].

Researchers in many parts of India and abroad have long-established that seed germination and seed yield are being adversely affected by major soil born fungi in soybean crop. Amongst the soil born pathogen disease, root rot of soybean caused by *Rhizoctonia bataticola* (pycnidial stage *Macrophomina phaseolina*) and Collar rot (*Sclerotium rolfsii*) is severe disease in Maharashtra and other states of India resulting in huge losses on account of pre and post emergence damping off and root rot in well grown plants which cause substantial loss to yield (Chavan and Gupta, 2005). Control of the disease is more efficient when integrated measures are adopted involving cultural practices, treatment of seeds with bio-agent, good sanitary and chemical control with recommended fungicides. Being seed and soil borne and poly-phagous pathogen it is difficult to manage in field. Use of seed dressing fungicides and bio-agents helps to resolve this problem. Hence, present investigation undertaken to management of root rot of soybean with some seed dresser fungicides and biological control agents.

### Materials and methods

Multi-location experiment was laid out in Randomized Block Design with three replications at the farm of Regional Research Center, Amravati, Agriculture Research Station, Yavatmal and Fruit Research Station, Katol in Vidarbha region of Maharashtra during *Kharif*- 2015-16 under natural field condition. The variety JS-335 was used for the experiment. The plot size of 5 x 3.6 m (08 lines of 5 meter length) was used with spacing of 45 x 5 cm. Seed dressing prior to half an hour of sowing was done by treating the seeds with different fungicides separately and bio-agent as per treatments (Table 1). Per cent germination after 7 days of sowing (DAS) and root rot disease incidence recorded at 15, 30 and 45 days after germination (DAG). Per cent disease incidence was calculated by using the formula given below-

$$\text{Per cent disease incidence} = \frac{\text{No. of infected plant}}{\text{Total no. of plant observed}}$$

## Results and discussion

Significant seed treatment effects on germination (Table 1) were observed in all three locations. The pooled result revealed that significant differences in seed germination compared to control treatments. Maximum seed germination (92.96%) recorded in treatments T3: Carboxin 37.5%+Thiram 37.5% (combi product) @ 2g/kg seed and which is at par with treatments T2: Seed dressing with Carbendazim 25%+mancozeb 50% WS (combi product) @ 2g/kg seed (90.44%) with increasing germination over control by 18.01 and 14.81% respectively. Second preeminent treatment was seed dressing with Carbendazim 50% WP+Thiram 75% WP @ 1:2 g/kg seed registered 88.93% seed germination with rising 12.88% germination over control. Bio-agent *Pseudomonas fluorescens* and *Trichoderma viride* also recorded higher germination (83.96 and 83.37% respectively) in comparison to control treatment (78.78%). Variation in seed germination observed in tested treatments may be attributed by different chemical component in fungicides and growth regulatory substances present in bio-agent. Seed dressing with chemical fungicides and bio-agent guard the seed from infection by seed and soil borne pathogens this enables the seed to germinate and establish as healthy seedlings (Anitha *et al.*, 2015) [2]. Seed dressing with Carboxin 37.5%+Thiram 37.5% seed and Carbendazim 25% + mancozeb 50% WS registered higher germination in comparison to other treatments. These results are in corroboration with the findings of Prasanth and Patil (2007) [7] and Anitha *et al.* (2015) [2].

Significant differences in per cent mortality in treatments at respective period observed (Table 2 and 3). Root rot severity in control was significantly greater than that of the seed dressing treatment at both the locations. Least per cent mortality (1.01, 2.79, and 6.22%) due to root rot registered in treatment T3: Carboxin 37.5%+Thiram 37.5% (combi product) @ 2g/kg seed during the 15, 30 and 45 DAG followed by treatment T5: Seed dressing with Carbendazim 50% WP+Thiram 75% WP @ 1:2 g/kg seed recorded 2.80, 5.42 and 9.06% root rot at respective observation. Among the bio-agent, *T. viride* @ 6 g/kg seed (powder based) recorded

minimum (5.81, 8.33 and 13.22%) root rot incidence at 15, 30 and 45 DAG. Result of the present studies in controlling root rot mortality caused by *Rhizoctonia bataticola* and *Sclerotium rolfsii* in soybean corroborates the finding of Bradley (2008) [4] and Mishra *et al.* (2012) [8] who reported that seed dressing with combi product superior over other individual product and bio-agents. The results of present studies are also similar to earlier reports of Dhutraj and Dey (2014) [5] who reported significant reduction in the incidence of collar rot and root rot of soybean due to seed treatment with combination of Carboxin 37.5% + Thiram 37.5% (combi product). Ansari and Agnihotri (2002) [3] too reported that the *T. viride* and *P. fluorescens* were effective in controlling the collar rot incidence, increased per cent seed germination and reduced pre and post emergence mortality caused by *S. rolfsii* in soybean and groundnut respectively.

The given treatments significantly affected the grain yield as compared with control treatment (Table 3). Significantly higher grain yield of soybean registered in treatment T3: Carboxin 37.5% + Thiram 37.5% (combi product) @ 2g/kg seed (1202 kg/ha) over rest of the treatments. Second best treatment was (T2) Seed dressing with Carbendazim 25% + Mancozeb 50% WS (combi product) @ 2g/kg (1026 kg/ha) followed by (T5) Seed dressing with Carbendazim 50% WP + Thiram 75% WP @ (1:2) 3 g/kg seed (1013 kg/ha) and (T1) Seed dressing with Carbendazim 50% WP @ 2g/kg (931 kg/ha) and which is at par with each other. Least yield was recorded in control (640 kg/ha). The results showed that seed treatment with fungicides and bio-agents showed positive effects in reducing root rot that may lead to more seed germination and ultimately more crop yield. These findings corroborate with the results of Griffin (1990) [6]; Bradley (2008) [4] and Mishra *et al.* (2012) [8] who reported that fungicide treatments showed higher yield than non-treated plants.

The results of the present investigation indicated that seed dressing with fungicides and bio-agent showed significant effect in enhancing germination, reducing root rot incidence and increasing yield.

**Table 1:** Effect of seed dressing on germination of soybean

| S.N | Treatments   | Germination %     |                   |                   | Pooled Mean (%germination) | Increase germination over control |
|-----|--|-------------------|-------------------|-------------------|----------------------------|-----------------------------------|
|     |  | AMT               | YTL               | KTL               |                            |                                   |
| 1   | Seed dressing with Carbendazim 50% WP @ 2g/kg                                    | 85.67<br>(67.85)* | 86.67<br>(68.77)* | 86.22<br>(68.21)* | 86.19<br>(68.18)*          | 9.40                              |
| 2   | Seed dressing with Carbendazim 25% + mancozeb 50%WS (combi product) @ 2g/kg seed | 91.67<br>(74.32)  | 89.00<br>(70.83)  | 90.67<br>(72.24)  | 90.44<br>(72.02)           | 14.81                             |
| 3   | Seed dressing with Carboxin 37.5% + Thiram 37.5% (combi product) @ 2g/kg seed    | 94.33<br>(76.55)  | 91.00<br>(72.70)  | 93.55<br>(75.43)  | 92.96<br>(74.69)           | 18.01                             |
| 4   | Seed dressing with Captan 75% WS @ 2 g/kg seed                                   | 86.00<br>(68.16)  | 84.67<br>(66.99)  | 85.89<br>(68.00)  | 84.96<br>(67.20)           | 7.85                              |
| 5   | Seed dressing with Carbendazim 50% WP + Thiram 75% WP @ 1:2 g/kg seed            | 89.67<br>(71.42)  | 87.33<br>(69.28)  | 89.78<br>(71.44)  | 88.93<br>(70.58)           | 12.88                             |
| 6   | Seed dressing with <i>Pseudomonas fluorescens</i> @ 5 g/kg seed (powder based)   | 83.67<br>(66.27)  | 83.00<br>(65.69)  | 83.56<br>(66.09)  | 83.96<br>(66.40)           | 6.58                              |
| 7   | Seed dressing with <i>Trichoderma viride</i> @ 6 g/kg seed (powder based)        | 82.33<br>(65.17)  | 85.33<br>(67.57)  | 82.44<br>(65.27)  | 83.37<br>(65.95)           | 5.83                              |
| 8   | Control  | 79.00<br>(62.74)  | 80.33<br>(63.69)  | 77.00<br>(61.41)  | 78.78<br>(62.58)           |                                   |
|     | SE m (±)   | 2.14              | 1.60              | 1.27              | 0.99                       |                                   |
|     | CD (P=0.05)  | 6.51              | 4.86              | 3.86              | 2.82                       |                                   |

\* Figure in parentheses are arc sine transformed value, AMT-Amravati, YTL-Yavatmal and KTL-Katol

**Table 2:** Effect of seed dressing on per cent root of soybean at 15 and 30 DAS.

| SN | Treatments  | Root rot ( % mortality) 15 DAS |                 |                 | Pooled Mean 15 DAS | Root rot ( % mortality) 30 DAS |                 |                 | Pooled Mean 30 DAS |
|----|---|--------------------------------|-----------------|-----------------|--------------------|--------------------------------|-----------------|-----------------|--------------------|
|    |   | AMT                            | YTL             | KTL             |                    | AMT                            | YTL             | KTL             |                    |
| 1  | Seed dressing with Carbendazim 50% WP @ 2g/kg                                     | 5.40<br>(2.32)#                | 3.03<br>(1.74)# | 3.87<br>(1.97)# | 4.10<br>(2.01)#    | 9.27<br>(3.03)#                | 6.40<br>(2.53)# | 7.07<br>(2.65)# | 7.58<br>(2.74)#    |
| 2  | Seed dressing with Carbendazim 25% + mancozeb 50% WS (combi product) @ 2g/kg seed | 4.00<br>(1.99)                 | 2.00<br>(1.41)  | 2.13<br>(1.46)  | 2.71<br>(1.62)     | 8.67<br>(2.94)                 | 5.23<br>(2.28)  | 4.57<br>(2.12)  | 6.16<br>(2.45)     |
| 3  | Seed dressing with Carboxin 37.5% + Thiram 37.5% (combi product) @ 2g/kg seed     | 1.67<br>(1.28)                 | 0.87<br>(0.91)  | 0.50<br>(0.71)  | 1.01<br>(0.96)     | 3.67<br>(1.88)                 | 2.83<br>(1.68)  | 1.87<br>(1.35)  | 2.79<br>(1.64)     |
| 4  | Seed dressing with Captan 75% WS @ 2 g/kg seed                                    | 6.00<br>(2.44)                 | 4.40<br>(2.09)  | 3.10<br>(1.76)  | 4.50<br>(2.10)     | 11.00<br>(3.31)                | 7.10<br>(2.66)  | 6.27<br>(2.50)  | 8.12<br>(2.83)     |
| 5  | Seed dressing with Carbendazim 50% WP + Thiram 75% WP @ 1:2 g/kg seed             | 4.00<br>(1.99)                 | 2.40<br>(1.54)  | 2.00<br>(1.41)  | 2.80<br>(1.65)     | 8.00<br>(2.82)                 | 4.80<br>(2.19)  | 3.47<br>(1.86)  | 5.42<br>(2.29)     |
| 6  | Seed dressing with <i>Pseudomonas fluorescens</i> @ 5 g/kg seed (powder based)    | 7.67<br>(2.76)                 | 4.97<br>(2.22)  | 4.93<br>(2.22)  | 5.86<br>(2.40)     | 11.00<br>(3.31)                | 6.70<br>(2.59)  | 7.30<br>(2.70)  | 8.60<br>(2.90)     |
| 7  | Seed dressing with <i>Trichoderma viride</i> @ 5 g/kg seed (powder based)         | 8.33<br>(2.89)                 | 4.03<br>(2.01)  | 5.07<br>(2.25)  | 5.81<br>(2.38)     | 11.67<br>(3.41)                | 6.57<br>(2.56)  | 7.57<br>(2.74)  | 8.33<br>(2.86)     |
| 8  | Control   | 10.67<br>(3.26)                | 9.33<br>(3.05)  | 8.40<br>(2.90)  | 9.47<br>(3.07)     | 16.33<br>(4.04)                | 13.63<br>(3.69) | 12.17<br>(3.49) | 14.04<br>(3.74)    |
|    | SE (m) ±  | 0.12                           | 0.08            | 0.08            | 0.06               | 0.14                           | 0.10            | 0.13            | 0.07               |
|    | CD (P=0.05)   | 0.36                           | 0.26            | 0.26            | 0.17               | 0.44                           | 0.31            | 0.40            | 0.20               |

Figure in parentheses are square root transformed values, AMT-Amrvati, YTL-Yavatmal and KTL-Katol

**Table 3:** Effect of seed dressing on per cent root of soybean at 45 and 70 DAS.

| SN | Treatments  | Root rot ( % mortality)45 DAS |                 |                  | Pooled Mean 45 DAS | Yield (kg/ha) |        |        | Pooled Mean (kg/ha) |
|----|---|-------------------------------|-----------------|------------------|--------------------|---------------|--------|--------|---------------------|
|    |   | AMT                           | YTL             | KTL              |                    | AMT           | YTL    | KTL    |                     |
| 1  | Seed dressing with Carbendazim 50% WP @ 2g/kg                                     | 12.47<br>(3.53)#              | 9.10<br>(3.01)# | 11.77<br>(3.42)# | 11.11<br>(3.32)#   | 987           | 913    | 893    | 931                 |
| 2  | Seed dressing with Carbendazim 25% + mancozeb 50% WS (combi product) @ 2g/kg seed | 10.67<br>(3.26)               | 8.90<br>(2.95)  | 8.20<br>(2.85)   | 9.26<br>(3.02)     | 1031          | 1013   | 1033   | 1026                |
| 3  | Seed dressing with Carboxin 37.5% + Thiram 37.5% (combi product) @ 2g/kg seed     | 6.67<br>(2.57)                | 6.90<br>(2.61)  | 5.10<br>(2.24)   | 6.22<br>(2.48)     | 1202          | 1159   | 1311   | 1224                |
| 4  | Seed dressing with Captan 75% WS @ 2 g/kg seed                                    | 16.33<br>(4.04)               | 13.57<br>(3.68) | 9.90<br>(3.14)   | 13.27<br>(3.62)    | 887           | 856    | 944    | 896                 |
| 5  | Seed dressing with Carbendazim 50% WP + Thiram 75% WP @ 1:2 g/kg seed             | 11.07<br>(3.32)               | 10.20<br>(3.17) | 5.90<br>(2.39)   | 9.06<br>(2.96)     | 1013          | 981    | 1044   | 1013                |
| 6  | Seed dressing with <i>Pseudomonas fluorescens</i> @ 5 g/kg seed (powder based)    | 14.33<br>(3.78)               | 13.93<br>(3.72) | 13.20<br>(3.63)  | 13.82<br>(3.69)    | 943           | 880    | 789    | 870                 |
| 7  | Seed dressing with <i>Trichoderma viride</i> @ 5 g/kg seed (powder based)         | 15.00<br>(3.87)               | 11.30<br>(3.33) | 13.37<br>(3.66)  | 13.22<br>(3.62)    | 930           | 893    | 667    | 830                 |
| 8  | Control   | 21.00<br>(4.58)               | 21.47<br>(4.63) | 18.90<br>(4.33)  | 20.16<br>(4.47)    | 678           | 700    | 543    | 640                 |
|    | SE (m) ±  | 0.13                          | 0.22            | 0.19             | 0.11               | 49.03         | 40.45  | 50.76  | 42.10               |
|    | CD (P=0.05)   | 0.40                          | 0.68            | 0.59             | 0.30               | 148.73        | 122.72 | 154.00 | 119.82              |

#figure in parentheses are square root transformed values

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