FIELD EVALUATION OF FUNGICIDES, BOTANICALS AND BIOAGENTS AGAINST ANTHRACNOSE OF SOYBEAN

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ABSTRACT

Anthracnose/pod blight (Colletotrichum truncatum Schw) is one of the major diseases of soybean (Glycine max L.) during Kharif season. Present study conducted in the Marathwada region of the State of Maharashtra during Kharif, 2006 aimed to find out the efficacy of fungicides, bioagents and botanicals in the management of anthracnose / pod blight of soybean. Results indicated that all five fungicides, two botanicals and two bioagents evaluated significantly reduced the disease intensity and thereby enhanced the seed yield over unsprayed control. However, fungicide Carendazim (@ 0.1%) was found most effective and economical in controlling the disease, which recorded least mean foliage anthracnose (19.43%), mean defoliation (11.85%), mean pod blight (9.64%) with highest seed yield (2605 kg/ha) and most economical C:B ratio (1:13.55). This was followed by the fungicides Hexaconazole and Propiconazole. Both botanicals and bioagents tested were also found effective against the disease.

Key words : Anthracnose, Colletotrichum truncatum, Glycine max, Fungicides, Bio-agents.

Anthracnose/pod blight of soybean (Glycine max L.), incited by Colletotrichum truncatum (Schw.) Andrus and Moore, is a serious disease in almost all soybean growing areas of the world including India and thereby causing qualitative as well as quantitative losses to the tune of 30 to 70 per cent (Lenne, 1992; Backman et al., 1982; Chandrasekaran and Rajappan, 2002). Keeping in view, importance of the disease, present studies were undertaken during Kharif, 2006 and aimed at finding out the effective and economical integrated management strategy for anthracnose of soybean.

The field experiment was conducted at Department of Plant Pathology, College of Agriculture, Latur (Maharashtra), by sowing (10th July, 2006) anthracnose susceptible soybean Cv. JS-335 at 30 X 10 cm spacing and the crop was grown applying all recommended package of practices. Details of the experiment are as follows

Design : R.B.D.
Variety : JS-335
Replications : Three

Plot size : Net : 2.40 x 1.20 m
           Gross : 3.0 x 1.8 m

Treatments
T_1 – Carbendazim 50WP @ 0.1%
T_2 – Chlorothalonil 75WP @ 0.2%
T_3 – Difenconazole 25EC @ 0.1%
T_4 – Hexaconazole 5EC @ 0.1%
T_5 – Propiconazole 25EC@ 0.1%
T_6 – NSKE @ 5%
T_7 – Mehandi leaf extract @ 10%
T_8 – Trichoderma viride (100 % w/w) @ 0.5%
T_9 – Verticillium lecanii(100 % w/w) @ 0.5%
T_{10} – Control (unsprayed)

Three sprays of all the treatments were given at 15 days interval, starting first spraying at 30 DAS. Single plot / replication was maintained as unsprayed control. Ten plants / treatments / replication were randomly selected and tagged for recording observations. Observations on anthracnose disease intensity were recorded before and after each spraying and last observation was recorded at 15 days after last spraying.
was graded by applying 0-9 rating scale (Mayee and Datar, 1986) and per cent disease intensity (PDI) and per cent disease control (PDC) were worked out applying formulae:

\[
PDI = \frac{\text{Sum of numerical ratings}}{\text{No. of leaves examined/plant} \times \text{max disease rating}} \times 100
\]

\[
PDC = \frac{\text{PDI in untreated plot} - \text{PDI in treated plot}}{\text{PDI in untreated plot}} \times 100
\]

Observations on defoliation were recorded on tagged plants at 50, 65 and 80 DAS and observations on per cent pod blight (PPB) were recorded 15 days before harvesting of the crop. At harvest seed yield and test weight were recorded and yield data was presented on hectare basis. Economics (Cost : Benefit ratio) of all the treatments was also determined.

Results (Table 1) revealed that all the treatments significantly reduced intensity of foliage anthracnose, corresponding defoliation and pod blight and enhanced the seed yield and test weight over unsprayed control. Among the fungicides, Carbendazim (@ 0.1%) effectively controlled the disease and recorded least mean foliage anthracnose intensity (19.43%), mean defoliation (11.85%) and mean pod blight (9.64%) with highest seed yield (2605 kg/ha) and test weight (14.33 g). The second and third best fungicides found were Propiconazole (@ 0.1%) and Hexaconazole (@ 0.1%) with mean foliage anthracnose intensity of 21.44 and 23.22 per cent, mean defoliation of 12.35 and 12.72 per cent and mean pod blight of 10.80 and 16.63 per cent, with seed yield of 2505 kg/ha and 2406 kg/ha, respectively. Other test fungicides were also found effective against the disease. Highest increase in seed yield (30.95%) and test weight (17.44%) were recorded with fungicide Carbendazim. This was followed by the fungicides Propiconazole (28.18% and 15.50%) and Hexaconazole (25.82% and 12.37%).

Both botanicals (NSKE and Mehandi) and bioagents (T. viride and V. lecanii) were found comparatively less effective than the fungicides tested, but were significantly superior over unsprayed control in combating the foliage anthracnose, defoliation and pod blight and thereby increased the seed and test weight over unsprayed control.

Results (Table 2) of the economics / cost : benefit (C:B) ratio indicated that all the treatments were economical over unsprayed control in management of the disease with higher net returns and net gain per rupee invested. However the fungicide Carbendazim was found most economical with highest C:B ratio of 1:13.55. The second and

**Table 1.** Efficacy of fungicides, botanicals and bioagents against anthracnose/pod blight of Soybean.

<table>
<thead>
<tr>
<th>Treat.</th>
<th>Mean* (%)</th>
<th>Seed yield*</th>
<th>Test weight*</th>
<th>% increase over control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FA (PB) (DF)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T₁</td>
<td>19.43(25.60) 9.64(18.09) 11.85(19.96)</td>
<td>2605</td>
<td>14.33</td>
<td>30.95</td>
</tr>
<tr>
<td>T₂</td>
<td>27.15(31.36) 29.33(32.79) 13.67(21.60)</td>
<td>2154</td>
<td>13.00</td>
<td>16.48</td>
</tr>
<tr>
<td>T₃</td>
<td>24.51(29.66) 22.52(28.33) 13.10(21.10)</td>
<td>2248</td>
<td>13.16</td>
<td>19.97</td>
</tr>
<tr>
<td>T₄</td>
<td>23.22(29.39) 16.63(24.06) 12.72(20.76)</td>
<td>2406</td>
<td>13.50</td>
<td>25.22</td>
</tr>
<tr>
<td>T₅</td>
<td>21.44(27.26) 10.80(19.18) 12.35(20.44)</td>
<td>2505</td>
<td>14.00</td>
<td>28.18</td>
</tr>
<tr>
<td>T₆</td>
<td>25.76(30.47) 32.68(34.86) 15.08(22.80)</td>
<td>2048</td>
<td>13.00</td>
<td>12.15</td>
</tr>
<tr>
<td>T₇</td>
<td>25.30(30.16) 31.03(33.85) 14.38(22.23)</td>
<td>2130</td>
<td>13.00</td>
<td>15.53</td>
</tr>
<tr>
<td>T₈</td>
<td>25.91(30.58) 32.51(34.76) 14.94(22.69)</td>
<td>2034</td>
<td>12.50</td>
<td>11.55</td>
</tr>
<tr>
<td>T₉</td>
<td>26.53(30.95) 33.36(35.28) 14.61(22.43)</td>
<td>1979</td>
<td>12.16</td>
<td>9.09</td>
</tr>
<tr>
<td>T₁₀</td>
<td>31.94(34.38) 39.39(38.87) 41.85(39.91)</td>
<td>1799</td>
<td>11.83</td>
<td>–</td>
</tr>
</tbody>
</table>

S.E. ± 0.74 0.17 0.30 31.87 0.25 – –

C.D. 2.22 0.50 0.91 94.70 0.75 – –

(P=0.05)

* - Average of three replications, FA - Foliage Anthracnose, PB - Pod Blight, DF - Defoliation, Figures in parenthesis are angular transformed values
third best fungicides found economical were Hexaconazole and Propiconazole with C:B ratio of 1:8.22 and 1:4.22, respectively.

All the test fungicides found effective and economical against anthracnose / pod blight of soybean in present study were also reported effective against *C. truncatum* by several workers (Chaudhary, 1977; Singh et al., 1981; Shukla and Singh, 1993; Ghawde et al., 1996 and Chandrasekaran et al., 2000) and against *Collectotrichum* sp. causing anthracnose in other crops and vegetables (Bairwa et al., 2002; Gorawar et al., 2005; Joshi and Tripathi, 2002). Botanicals *A. indica* (Neem) *Ocimum sauctum* (Tulsi), *Lawsonia innerucis* (Mehandi), *Parthenium hysterophorus* (Parthenium) were reported fungitoxic against *Colletotrichum* sp. by many workers (Chandrasekaran et al., 2000; Bairwa et al. 2002). Fungal antagonists *Trichoderma* sp and *Verticillium lecanii* were also reported effective against anthracnose (Barrows et al., 1995; Ingle et al., 2002; Devis et al., 2003; Gupta et al., 2005 and Kaur et al., 2006).

Thus, fungicides viz., Carbendazim (@ 0.1%), Hexaconazole (@ 0.1%) and Propiconazole (@ 0.1%); found effective and economical in the management of anthracnose / pod blight of soybean and antagonists *Trichoderma viride* and *Verticillium lecanii* and botanicals Neem and Mehandi found fungitoxic / fungistatic against *C. truncatum* in present study could further be exploited commercially on large scale for the management of soybean anthracnose / pod blight.

### REFERENCES


### Table 2. Economics of fungicides, botanicals and bioagents for the management of anthracnose in soybean.

<table>
<thead>
<tr>
<th>Treat.</th>
<th>Yield* (Kg/ha)</th>
<th>Gross income**</th>
<th>Additional income/ha</th>
<th>Cost of spraying</th>
<th>Net profit</th>
<th>C:B ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>2605</td>
<td>33865</td>
<td>10478</td>
<td>579.98</td>
<td>729.98</td>
<td>1:13.55</td>
</tr>
<tr>
<td>T₂</td>
<td>2154</td>
<td>28002</td>
<td>4615</td>
<td>1987.65</td>
<td>2137.65</td>
<td>1:1.15</td>
</tr>
<tr>
<td>T₃</td>
<td>2248</td>
<td>29224</td>
<td>5837</td>
<td>3405.84</td>
<td>3555.84</td>
<td>1:0.64</td>
</tr>
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<td>T₄</td>
<td>2406</td>
<td>31278</td>
<td>7891</td>
<td>705.84</td>
<td>855.84</td>
<td>1:8.22</td>
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<td>T₅</td>
<td>2505</td>
<td>32565</td>
<td>9178</td>
<td>1542.50</td>
<td>1692.50</td>
<td>1:4.42</td>
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<tr>
<td>T₆</td>
<td>2048</td>
<td>26624</td>
<td>3237</td>
<td>1234.56</td>
<td>1384.56</td>
<td>1:1.33</td>
</tr>
<tr>
<td>T₇</td>
<td>2130</td>
<td>27690</td>
<td>4303</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>T₈</td>
<td>2034</td>
<td>26442</td>
<td>3055</td>
<td>1086.41</td>
<td>1236.41</td>
<td>1:1.47</td>
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<tr>
<td>T₉</td>
<td>1979</td>
<td>25727</td>
<td>2340</td>
<td>1382.64</td>
<td>1532.64</td>
<td>1:1.52</td>
</tr>
<tr>
<td>T₁₀</td>
<td>1799</td>
<td>23387</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

* - Mean of three replication, ** - Selling rates of soybean @ Rs. 1300/ qt., *** - As per the market costs of fungicides. Figures in parenthesis are angular transformed values.

