Screening of soybean varieties against girdle beetle and other pests

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INTRODUCTION

Soybean is a wonder crop of twentieth century. It is an excellent source of protein and oil. It is a two dimensional crop as it contains about 40-42 per cent high quality protein and 20-22 per cent oil. It also contains 20-30 per cent carbohydrates. The protein quality of soybean is equivalent to that of meat, milk products and eggs. Hence, it is well established fact that soybean is cheap source of protein and edible oil. These characteristics have made soybean to fit well in sustainable agriculture. During the late sixties and early seventies, the soybean crop was considered to be comparatively safe crop as regards to insect pest attack. However, Gangrade (1976) reported over 99 insect species attacking soybean crop at Jabalpur, but now the situation has changed and as many as 275 insect species have been recorded attacking soybean crop in India. Researchers in many parts of India have confirmed that seed yield and seed quality are being adversely affected by major insect pests viz., girdle beetle, tobacco caterpillar, green semilooper, Helicoverpa armigera, jassids and white fly.

MATERIALS AND METHODS

Twelve advanced genotypes of soybean were screened against girdle beetle and other pests under randomized block design in which plot size was 1 m x 5 m, row to row spacing 30 cm, replicated three times. The crop was sown on 5th July 2010 to evaluate the incidence of girdle beetle and other pests during Kharif season. Screening of nine genotypes of soybean along with three check entries, was carried out in randomized block design with plot size of 1 m x 5 m, row to row spacing 30 cm, replicated three times The entries were sown on 4th July, 2010.

Observations recorded:

The observations were taken at ten days interval by counting the total numbers of plants and number of plants
infested by girdle beetle and other major pests from randomly selected one meter row lengths in each plot. The observations were initiated with first appearance of girdle beetle on the crop. The varieties screened are listed in Table A.

**Statistical analysis:**

The data on girdle beetle infested plants were converted into percentage infestation. The data so obtained were subjected to arc sine transformation for statistical analysis. Using the formula $X = \sin^{-1} P$, where, $X$ = transformed value and $P$ = percentage data. This transformed data were then analyzed by the method of analysis of variance as described by Gomez and Gomez (1984). The “F” test was used at 5 per cent level of significance. Critical difference (CD) values were analyzed at 5 per cent level of significance. The skeleton of analysis of variance and formula used for various estimations are given in Table B.

The following formulae were used for standard error, critical difference and co-efficient of variance estimations:

(a) $\text{S.E.} \pm = \sqrt{\frac{\text{EMS}}{R}}$

(b) $\text{C.D.} = \frac{\text{EMS}}{R} \times t_{11} \text{(D.F. at 5%)}$

(c) $\text{C.V.} (%) = \frac{\text{EMS}}{R} \times 100$

Where,

\begin{align*}
\text{R} & = \text{Number of Replications}, \\
\text{T} & = \text{Degrees of freedom}, \\
\text{S.S.} & = \text{Sum of square}, \\
\text{C.D.} & = \text{Critical difference}, \\
\text{C.V.} & = \text{Coefficient of variance}, \\
\text{M.S.S.} & = \text{Mean sum of square}, \\
\text{EMS} & = \text{Error mean square}, \\
\text{S.E.} \pm & = \text{Standard error of means}, \\
\text{GM} & = \text{General mean}, \\
\text{t} & = \text{error degree of freedom at 5% level of significance}
\end{align*}

**RESULTS AND DISCUSSION**

A trial was conducted during Kharif, 2010 to screen nine genotypes of soybean against girdle beetle and other major insect pests with three zonal checks. The genotypes were sown in Randomized Block Design with plot size $1\text{m} \times 5\text{m}$, row to row spacing $30\text{ cm}$, replicated three times. The trial was sown on 4th July 2010. Total number of plants and number of plants infested by girdle beetle, number of lepidopterous caterpillars per meter row length and mean population of sucking pests per plant were recorded at ten days interval.

Based on the data (Table 1) recorded for girdle beetle infestation, the number of girdle beetle damaged plants/meter row ranged from 1.70 to 3.70. Minimum incidence of girdle beetle (1.7 damaged plants/meter row) was observed on three genotypes viz., $F_5\text{P}_{21}$, $H_2\text{P}_2$, and $L_{129}$. It was followed $F_4\text{P}_{21}$ and $H_5\text{P}_{19}$ each with 2.3 damaged plants/meter row. Genotype $G_4\text{P}_{15}$ with 3.7 damaged plants/meter row was most damaged by girdle beetle as against 2.3 to 2.7 damaged plants per meter row in check varieties.

**Table A: List of soybean varieties for screening against girdle beetle**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Treatment no.</th>
<th>Varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>$V_1$</td>
<td>$F_1\text{P}_{21}$</td>
</tr>
<tr>
<td>2.</td>
<td>$V_2$</td>
<td>$F_4\text{P}_{20}$</td>
</tr>
<tr>
<td>3.</td>
<td>$V_3$</td>
<td>$F_5\text{P}_{21}$</td>
</tr>
<tr>
<td>4.</td>
<td>$V_4$</td>
<td>$F_5\text{P}<em>2\text{S}</em>{02}-2$ sel.3</td>
</tr>
<tr>
<td>5.</td>
<td>$V_5$</td>
<td>$G_5\text{P}_{15}$</td>
</tr>
<tr>
<td>6.</td>
<td>$V_6$</td>
<td>$H_2\text{P}_5$</td>
</tr>
<tr>
<td>7.</td>
<td>$V_7$</td>
<td>$H_5\text{P}_1$</td>
</tr>
<tr>
<td>8.</td>
<td>$V_8$</td>
<td>$H_5\text{P}_{19}$</td>
</tr>
<tr>
<td>9.</td>
<td>$V_9$</td>
<td>$L_{129}$</td>
</tr>
<tr>
<td>10.</td>
<td>$V_{10}$</td>
<td>Check 1* Bragg</td>
</tr>
<tr>
<td>11.</td>
<td>$V_{11}$</td>
<td>$V_{11}$ - Check 2* RKS-18</td>
</tr>
<tr>
<td>12.</td>
<td>$V_{12}$</td>
<td>$V_{12}$ - Check 3* JS-97-52</td>
</tr>
</tbody>
</table>

**Table B: The skeleton of the analysis of variance**

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>DF</th>
<th>SS</th>
<th>MSS</th>
<th>$F_{cal}$</th>
<th>$F_{tab}$</th>
<th>S.E.±</th>
<th>C.D. 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replication (R)</td>
<td>$(R-1)=2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment (T)</td>
<td>$(T-1)=11$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>$(R-1)(T-1)=22$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$RT-1=35$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The same genotypes were screened for resistance against major caterpillar pests, tobacco caterpillar (Spodoptera litura) and semiolooper (Chrysodecxis acuta). Among the different genotypes, L129 with 1.9 larvae per meter row was least preferred by Spodoptera litura. It was followed by F5 02-2 sel-03 and H5 P19 with 2.3 and 2.4 larvae per meter row, respectively. Genotype G P15 with 3.4 larvae/meter row was most attacked by tobacco caterpillar, among the test entries. Genotype F5 02-2 sel-03 with 1.0 larvae per meter row was least attacked by green semiolooper (C. acuta). It was followed by H P5, H P20, H P2 with 1.3, 1.6 and 1.6 larvae per meter row, respectively. Genotype F P21 with 2.2 larvae per meter row was most attacked by the semiolooper. It was followed by L129, H5 P19 and P4 P21 with 1.9, 1.8 and 1.8 larvae per meter row, respectively, as against 1.9 to 2.0 larvae per meter row in check varieties.

Based on total lepidopterous larval infestation, genotype F P21 with 5.3 larvae per meter row was most attacked as against 4.9 to 5.2 larvae per meter row in check entries. Genotype L129 with 3.1 larvae per meter row was least preferred by the lepidopterous pests and it was followed by F5 02-2 sel-3 with 3.3 larvae per meter row.

Among the sucking pests, the incidence of whitefly was comparatively higher than that of jassids. The incidence of whiteflies ranged from 2.1 whiteflies per plant on H P2 and L129 to 2.6 whiteflies per plant on genotype G P15 as against 2.5 and 2.7 whiteflies per plant in check entries. Similarly, the jassid incidence ranged from 0.7 to 1.2 jassids per plant on the test entries.

Genotype L129 with least jassid infestation (0.7 per plant) was least preferred by the jassids, whereas, F P20 with 1.2 jassids per plant was most attacked as against 1.1 to 1.3 jassids per plant on the check entries.

Based on overall pest incidence, genotype L129 with least number of girdle beetle damaged plants per meter row (1.7), least number of lepidopterous caterpillars per meter row (3.1) and least number of whitefly (2.1) and jassids (0.7) per plant was least preferred by these insect pests.

The grain yield among different test genotypes ranged from 35.5 to 28.9 q/ha as against 24.4 to 37.8 q/ha yield in check entries. The highest yield of 35.5 q/ha was recorded with genotypes F P21 and F 02-2 Sel-03 as against 31.1 q/ha yield in L129, the most resistant genotype against all the insects. The Directorate of Soybean Research reported that out of 54 genotypes of soybean evaluated against major pests, JS-97-52 had 2.22 girdle beetle damaged plants at Kota and 2.24 and 2.81 girdle beetle damaged plants per meter row in variety JS-97-52 and Bragg at Amravati (DSR, 2006; DSR, 2007). This is almost similar to the present finding with 2.3 and 2.7 girdle beetle infested plants per meter row in JS-97-52 and Bragg, respectively.
REFERENCES


DSR (2005). Annual Report of All India Coordinated Research Project on soybean, NRC for soybean, Khandwa Road, Indore (M.P.) INDIA.

DSR (2006). Annual Report of All India Coordinated Research Project on soybean, NRC for soybean, Khandwa Road, Indore (M.P.) INDIA.

DSR (2007). Annual Report of All India Coordinated Research Project on soybean, NRC for soybean, Khandwa Road, Indore (M.P.) INDIA.


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