Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(1): 1497-1502

Received: 01-11-2018
Accepted: 04-12-2018

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# Varietal screening for the management of major pests of soybean

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**Abstract**
An investigation on screening of Advanced Varietal lines against major pests (leaf miner (*Aproaerema modicella*, Deventer), leaf eating caterpillar (*Spodoptera litura*, Fabricius) and green semilooper (*Chrysodeixis acuta*)) of soybean was conducted at Research Farm, Department of Agricultural Entomology, College of Agriculture, Badnapur during *Kharif* season 2017 in Randomized Block Design (RBD) with 14 AVT lines and two replications in protected and unprotected set of conditions. The lowest infestations of leaf miner was recorded on line RVS 2007-6, KDS-1045 and check JS 97-52 while the highest infestation recorded on line DSB-28-3, RVS 2010-1 and MAUS-2. The lowest *S. litura* larvae recorded on line KDS-1045, KDS-980 and check MAUS-158 and JS 97-52 while the highest larvae observed on line DSB-28-3 and check JS-335.The lowest *C. acuta* larvae were recorded on line KDS-921, RVS 2007-6, KDS-1045 and check MAUS-158 while the highest *C. acuta* were observed on line AMS-MB-5-18, DS-3105 and check MAUS-2.
Under unprotected condition the highest grain yield was obtained in line DS-3105, AMS-MB-5-18, check MAUS-158 and JS-335 while the lowest yield were obtained in line KDS-1045.Under protected condition the highest yield were recorded in DS-3105, RSC-10-70 and check JS-335.

**Keywords:** Screening, soybean lines, yield

## Introduction
Soybean is a wonder crop of twentieth century. It is two dimensional crop as it contains about 40 percent high quality protein and 20-22 percent oil besides minerals and vitamins. It ranks first among the oilseeds in the world as well as in India. In India it is grown on 101.56 Lakh ha with the production of 83.50 Lakh metric tons and an average yield of 822 kg per ha. Soybean accounts more than is 34.48 lakh ha total area under cultivation with production of 29.0 Lakh metric tons and productivity 841 kg per ha in Maharashtra, (Anonymous, 2017) [1]. Average yield of Soybean is much lower than global average yield and major reason for this low yield is attack of insect pest. In Marathwada region of Maharashtra, about 19 different species of insect pests have been reported on soybean. The important ones are leaf miner (*Aproaerema modicella*, Deventer), stem fly (*Melanagromyza sojae*, Zehntner), girdle beetle (*Obereopsis brevis*, Gahan), leaf eating caterpillar (*Spodoptera litura*, Fabricius) and green semilooper (*Chrysodeixis acuta*) (Munde, 1982) [7]. These insect are causing appreciable loss to the crop therefore growing resistant varieties is the better option which can help to minimize the cost of pest management. Present investigation was undertaken to screen some of the promising soybean cultivar lines for their resistance against major pests of soybean.

## Material and Methods
The experiment was laid out in randomized block design (RBD) by using 14 lines *viz.*,AMS-MB-5-18, KDS-1045, KDS-980, DS-3105, MACS-1340, RVS 2007-6K-2017, RVS-2010-1, KDS-921, DSB-28-3, RSC 10-70 with MAUS-158 as resistant check (RC), susceptible check MAUS-2K-2017 (SC) and JS 97-52K-2017 National Check (NC) and JS-335 (NC) replicated two times in two sets i.e. protected and unprotected. This lines was sown on 17th July 2017 in two lines of three meter of each line with spacing 45×5cm. The crop management practices i.e. field preparation, weeding, fertilizer application, etc. were adopted as per the recommended practices.

**Method of Recording observation**

**Leaf miner**

Observation on number of infested leaflets with live larvae and total number of leaflets was recorded from five randomly selected plants in each variety and worked out in percent damage. The observations were recorded at 7, 14, 21, 28, 35, 42 days after germination**.**

$$\text{Percent damage by leaf miner} = \frac{\text{No. infested leaflets}}{\text{Total number of healthy leaflets}} \times 100$$

**Leaf eating caterpillar, Green semilooper**

Observation on larval population of leaf eating caterpillar and green semilooper, was taken at three spots of one meter row length. Larval count was made by shaking the plant gently over a white cloth placed between the rows. Average number of caterpillars per meter row length (mrl) was worked out at 15, 30, 45 and 60 days after germination.

**Statistical analysis**

The data on lepidopteron pests were subjected to $\sqrt{(x + 0.5)}$ transformation before analysis. The percent damage by leaf miner was subjected to angular transformation. The data was statistically analyzed by standard analysis of variance methods suggested by Panse and Sukhatme (1967) [8]. The variance due to treatment were compared against variance due to error to test the null hypotheses by 'F' test of significance at p= 0.05.

**Results and Discussion**

The incidence of leaf miner, green semilooper and leaf eating caterpillar was recorded along with its extent damage on different AVT lines of soybean under natural field conditions in two sets i.e. protected and unprotected set. The results obtained in the present investigation are presented under following headings.

**Leaf miner infestation**

The percent infestation due to leaf miner was recorded 0.0 percent at 7 days after germination. The leaf miner infestation in different lines was recorded 2.5 to 6.0 percent at 14 days after germination. The line RVS 2007-6 was recorded significantly least incidence of leaf miner i.e. (2.5%) followed by KDS-1045 (3.0%), KDS-921 (3.7%) and DS-3105 (4.0%) were at par with each other and also at par with check JS 97-52 (2.6%), JS-335 (2.8%) and MAUS 158 (4.0%) recorded significantly less percent leaflet damage and significantly superior over the rest of lines. The infestation due to leaf miner was recorded 4.8 to 10.8 percent at 21 days after. The line RVS 2007-6 (4.8%) was recorded minimum incidence of leaf miner followed by KDS-1045 (5.7%), RSC-10-70 (5.8%), KDS-921 (6.1%), AMS-MB-5-18 (6.2%), MACS-1340 (6.2%), KDS-980 (6.9%) and DS-3105 (7.1%) were at par with each other and also at par with check MAUS 158 (5.0%) JS-335 (6.00%) and JS 97-52 (5.2%) which recorded significantly less percent leaflet damage and significantly superior over the rest of lines. The infestation due to leaf miner was recorded 6.9 to 14.3 percent at 28 DAG. The minimum incidence of leaf miner was observed in line KDS-1045 (6.9%) followed by RVS 2007-6 (8.3%), RSC-10-70 (8.9%), KDS-921 (9.5%), DS-3105 (10.3%) were at par with each other and also at par with check JS 97-52 (7.3%), MAUS 158 (8.0%) and JS-335 (8.9%) which recorded significantly less percent leaflet damage and significantly superior over the rest of lines. The infestation due to leaf miner was recorded 8.7 to 18.6 percent at 35 DAG. The line RVS 2007-6 was recorded significantly least incidence of leaf miner i.e. (9.6%) followed by KDS-1045 (9.9%), RSC-10-70 (10.9%) and KDS-921 (11.2%), DS-3105 (12.2%), AMS-MB-5-18 (13.5%) were at par with each other and also at par with check lines JS 97-52 (8.7%), MAUS 158 (11.2%) and JS-335(13.3%) which recorded significantly less leaflet damage as compare to rest of lines. The infestation due to leaf miner was recorded 11.5 to 21.5 percent at 42 DAG. The minimum incidence of leaf miner was recorded in line RVS 2007-6 (11.5%) followed by KDS-1045 (11.7%), KDS-921 (13.4%) RSC-10-70 (14.3%) and AMS-MB-5-18 (16.9%) were at par with each other and also at par with check JS 97-52 (12.7%), MAUS 158 (13.4%) JS-335 (15.3%) recorded significantly less leaflet damage and significantly superior over the rest of lines.

The results of present investigation are discussed in the light of findings of previous workers. Behera *et al*., (1990) [3] reported lowest leaflet damage by leaf miner in cultivar JS (SH) 90-9 and NRC 3. Similarly, less infestation was observed in cultivar viz., JS 80- 21, JS 335, NRC 37, NRC 39 and JS 7105 than rest of the cultivars. Salunke *et al*., (2002) [10] all cultivars varied in leaf damage from 29.0 to 52.0 percent and number of leaf miner (*A. modicella*) from 3.18 to 5.13 larvae/ plant. The highest incidence of leaf miner was recorded in MAUS-20 (5.13 larvae/ plant) and lowest leaf damage in NRC-37 (3.18 larvae/ plant)

**Table 1:** Leaf miner incidence on AVT liner

| Sr. No. | Variety | % Infestation | | | | | |
|---|---|---|---|---|---|---|---|
| | | 7DAG | 14DAG | 21DAG | 28DAG | 35DAG | 42DAG |
| 1 | AMS-MB-5-18 | 0.0 | 4.2 (11.83) | 6.2 (14.42) | 11.6 (19.91) | 13.5 (21.56) | 16.9 (24.27) |
| 2 | KDS-1045 | 0.0 | 3.0 (9.97) | 5.7 (13.810) | 6.9 (15.23) | 9.9 (18.34) | 11.7 (20.00) |
| 3 | KDS-980 | 0.0 | 4.3 (11.97) | 6.9 (15.23) | 13.9 (21.89) | 14.8 (22.63) | 18.5 (25.47) |
| 4 | DS-3105 | 0.0 | 4.0 (11.54) | 7.1 (15.45) | 10.3 (18.72) | 12.2 (20.44) | 18.3 (25.33) |
| 5 | MACS-1340 | 0.0 | 4.9 (12.79) | 6.2 (14.42) | 11.6 (19.91) | 18.0 (25.10) | 18.1 (25.18) |
| 6 | RVS 2007-6 | 0.0 | 2.5 (9.10) | 4.8 (12.66) | 8.3 (16.74) | 9.6 (18.05) | 11.5 (19.82) |
| 7 | RVS 2010-1 | 0.0 | 5.7 (13.81) | 9.5 (17.95) | 14.3 (22.22) | 17.1 (24.43) | 19.7 (26.35) |
| 8 | KDS-921 | 0.0 | 3.7 (11.09) | 6.1 (14.30) | 9.5 (17.95) | 11.2 (19.55) | 13.4 (21.47) |
| 9 | DSB-28-3 | 0.0 | 6.0 (14.18) | 10.2 (18.63) | 14.1 (22.06) | 18.6 (25.55) | 20.9 (27.20) |
| 10 | RSC-10-70 | 0.0 | 5.8 (13.94) | 5.8 (13.94) | 8.9 (17.36) | 10.9 (19.28) | 14.3 (22.22) |
| 11 | MAUS158 (RC) | 0.0 | 4.0 (11.54) | 5.0 (12.92) | 8.0 (16.43) | 11.2 (19.55) | 13.4 (21.47) |
| 12 | MAUS-2 (SC) | 0.0 | 5.7 (13.81) | 10.8 (19.19) | 12.1 (20.36) | 15.3 (23.03) | 21.5 (27.62) |
| 13 | JS 97-52 (NC) | 0.0 | 2.6 (9.28) | 5.2 (13.18) | 7.3 (15.68) | 8.7 (17.15) | 12.7 (20.88) |
| 14 | JS 335 (NC) | 0.0 | 2.8 (9.63) | 6.0 (14.18) | 8.9 (17.36) | 13.3 (21.39) | 15.3 (23.03) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | SE(m)± | | 0.89 | 1.03 | 1.37 | 1.69 | 1.53 |
| | CD 5% | | 2.60 | 2.99 | 3.99 | 4.90 | 4.46 |
| | C.V. | | 10.84 | 9.77 | 10.47 | 11.37 | 9.26 |

*Figures in parentheses are arc sine transformed values.

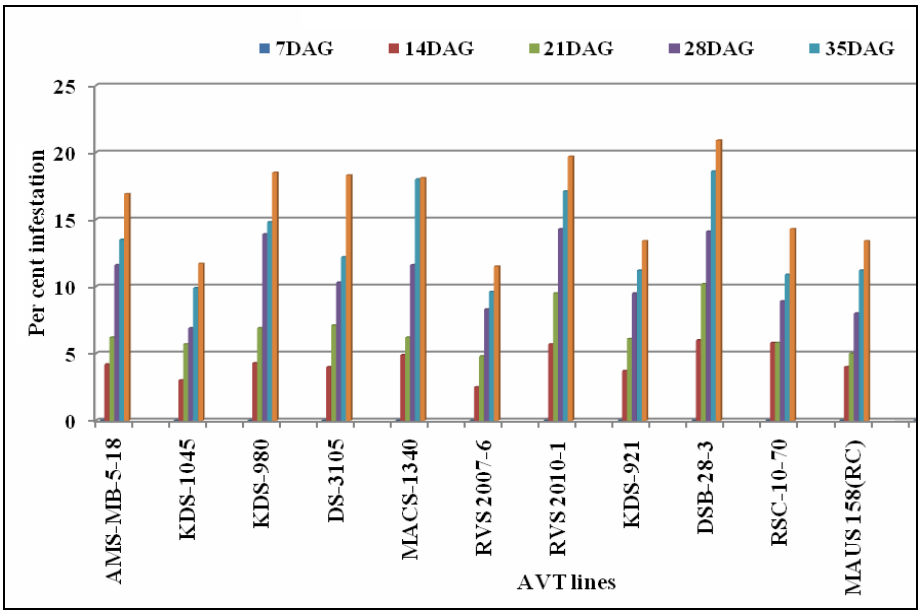


**Fig 1:** Leaf miner incidence on AVT lines

**Leaf eating caterpillar infestation**

The incidence of *Spodoptera* larvae was recorded from 0.5 to 2.3 larvae/mrl at 15DAG. The line KDS-980 (0.8 larvae/mrl) recorded minimum incidence of *Spodoptera* followed by RSC-10-70 (1.0 larvae/mrl) and RVS 2007-6 (1.2 larvae/mrl) were at par with each other and also at par with check JS 97-52 (0.5 larvae/mrl) and MAUS 158 (0.7 larvae/mrl) which recorded less incidence and significantly superior over rest of lines. The incidence of *Spodoptera* larvae was recorded from 2.5 to 6 larvae/mrl at 30 DAG. The line KDS-1045 (2.8 larvae/mrl) recorded less incidence followed by KDS-921 (3.2 larvae/mrl), RVS 2007-6 (3.5 larvae/mrl) and KDS-980 (3.5 larvae/mrl) and at par with check MAUS 158 (2.5 larvae/mrl) and JS 97-52 (2.8 larvae/mrl) were significantly superior over the rest of lines. The incidence of *Spodoptera* larvae was recorded from 3.5 to 8.3 larvae/mrl at 45 DAG. The minimum incidence of *Spodoptera* registered with the line RVS 2007-6 (4.2 larvae/mrl) followed by KDS-980 (4.3 larvae/mrl), KDS-1045 (4.5 larvae/mrl) RSC-10-1 (5.0 larvae/mrl) and DS-3105 (5.3 larvae/mrl) were at par with each other and also at par with check MAUS 158 (3.5 larvae/mrl) and JS 97-52 (4.5 larvae/mrl) which recorded less incidence and significantly superior over rest of lines. The incidence of Spodoptera larvae was recorded from 3.5 to 6.8 larvae/mrl at 60 DAG. The line KDS-1045 (3.5 larvae/mrl) recorded less incidence followed by RVS 2007-6 (4.2 larvae/mrl) KDS-921 (4.2 larvae/mrl) and KDS-980 (4.7 larvae/mrl), MACS-1340 (5.0 larvae/mrl), AMS-MB-5-18 (5.5 larvae/mrl), RSC-10-70 (5.5 larvae/mrl) and at par with check JS 97-52 (5.0 larvae/mrl) and MAUS 158 (5.2 larvae/mrl) and significantly superior over the rest of lines.

The present findings were also in conformity with the report of Salunke *et al*. (1999) [9], who reported that out of 14 soybean cultivars, highest incidence of defoliators was recorded in MAUS-2 and lowest leaf damage was recorded in cultivar NRC-37. Ashish *et al*., (2003) [2] reported that the variety JS 71-05 and NRC 33 were highly resistant and NRC 18 and NRC 7 were resistant to tobacco caterpillar.

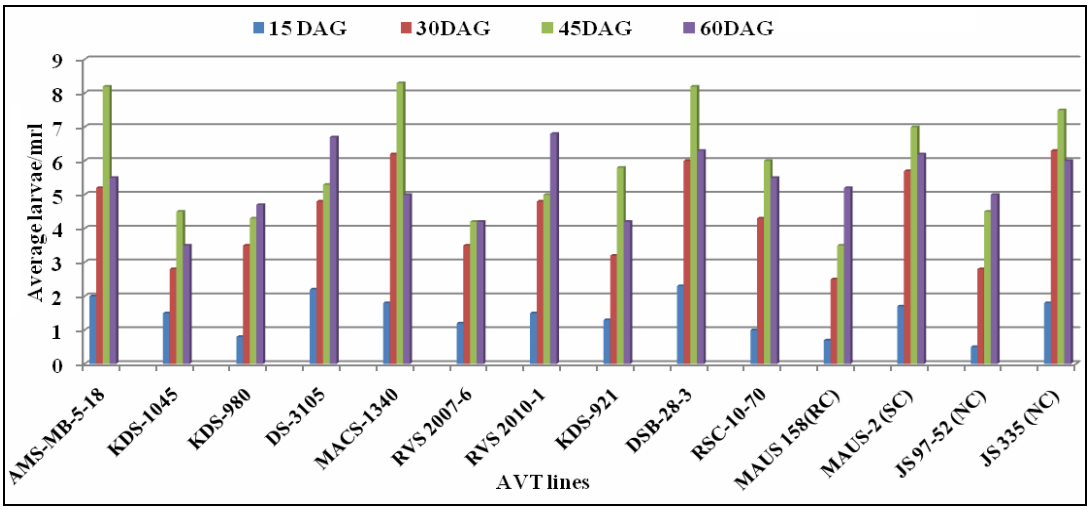


**Fig 2:** Incidence of *Spodoptera litura* on AVT lines of soybean

**Table 2:** Incidence of *S. litura* on AVT lines of soybean

| Sr. No. | Variety | Average larvae/mrl | | | |
|---|---|---|---|---|---|
| | | 15 DAG | 30DAG | 45DAG | 60DAG |
| 1 | AMS-MB-5-18 | 2.0 (1.58) | 5.2 (2.39) | 8.2 (2.94) | 5.5 (2..45) |
| 2 | KDS-1045 | 1.5 (1.41) | 2.8 (1.82) | 4.5 (2.24) | 3.5 (2.00) |
| 3 | KDS-980 | 0.8 (1.15) | 3.5 (2.00) | 4.3 (2.20) | 4.7 (2.27) |
| 4 | DS-3105 | 2.2 (1.63) | 4.8 (2.30) | 5.3 (2.41) | 6.7 (2.68) |
| 5 | MACS-1340 | 1.8 (1.53) | 6.2 (2.59) | 8.3 (2.97) | 5.0 (2.35) |
| 6 | RVS 2007-6 | 1.2 (1.29) | 3.5 (2.00) | 4.2 (2.16) | 4.2 (2.16) |
| 7 | RVS 2010-1 | 1.5 (1.41) | 4.8 (2.30) | 5.0 (2.35) | 6.8 (2.71) |
| 8 | KDS-921 | 1.3 (1.35) | 3.2 (1.92) | 5.8 (2.52) | 4.2 (2.16) |
| 9 | DSB-28-3 | 2.3 (1.68) | 6 (2.55) | 8.2 (2.94) | 6.3 (2.61) |
| 10 | RSC-10-70 | 1.0 (1.22) | 4.3 (2.19) | 6.0 (2.55) | 5.5 (2.45) |
| 11 | MAUS 158(RC) | 0.7 (1.08) | 2.5 (1.73) | 3.5 (2.00) | 5.2 (2.38) |
| 12 | MAUS-2 (SC) | 1.7 (1.47) | 5.7 (2.49) | 7.0 (2.74) | 6.2 (2.58) |
| 13 | JS 97-52 (NC) | 0.5 (1.00) | 2.8 (1.82) | 4.5 (2.24) | 5.0 (2.34) |
| 14 | JS 335 (NC) | 1.8(1.53) | 6.3 (2.61) | 7.5 (2.83) | 6.0 (2.55) |
| | SE(m)± | 0.10 | 0.15 | 0.16 | 0.17 |
| | CD 5% | 0.30 | 0.45 | 0.48 | 0.51 |
| | C.V. | 10.78 | 10.14 | 9.38 | 10.58 |

*figures in parentheses are √x+0.5 transformed values.

**Incidence of *Chrysodeixis acuta* on AVT lines of soybean**

The incidence of *C. acuta* larvae was recorded from 0.5 to 2.3 larvae/mrl at 15 DAG. The minimum incidence of *C. acuta* was observed in check line JS 97-52 (0.3 l arvae/mrl) followed by MAUS 158 (0.5 larvae/mrl) and were significantly superior over rest of the lines. The incidence of *C. acuta* larvae was recorded from 2.5 to 6 larvae/mrl at 30 DAG. The line RSC-10-70 (3.0 larvae/mrl) recorded least incidence of *C. acuta* followed by KDS- 921 (3.2 larvae/mrl), KDS-980 (3.7 larvae/mrl), KDS-1045 (4.3larvae/mrl) and RVS 2007-6 (4.5 larvae/mrl) were at par with each other and also at par with check MAUS 158 (3.0 larvae/mrl) and JS 97-52 (3.3 larvae/mrl) which recorded less incidence and significantly superior over rest of lines. The incidence of green semilooper larvae was recorded from 3.5 to 8.3 larvae/mrl at 45DAG.The minimum incidence of *C. acuta* was observed in line KDS-921 (4.5 larvae/mrl) which was significantly superior over rest of lines followed by KDS-980 (5.3 larvae/mrl), RVS 2007-6 (5.7 larvae/mrl), KDS-1045 (5.7 larvae/mrl) and DSB-28-3 (7.0 larvae/mrl) were at par with each other and also at par with check JS 97-52 (4.7 larvae/mrl), MAUS 158 (5.5 larvae/mrl) and JS-335 (7.2 larvae/mrl). The incidence of green semilooper larvae was recorded from 4.2 to 9.2 larvae/mrl. The population of green semilooper was reduced at 60 DAG in all lines except DS-3105 (9.0 larvae/mrl) and MACS-1340 (9.2 larvae/mrl) were at par with each other and significantly inferior over rest of lines which recorded higher incidence of green semilooper.

The present findings were in conformity with the report of Dubey *et al*. (1998) [4] Screened 44 lines of soybean against *Chrysodeixis acuta* (Lepidoptera: Noctuidae) Out of these, one line highly resistant (MACS- 392) two were resistant, NRC 20, JS 71-5), 20 lines were moderately resistant, 19 lines were low resistant and two lines were susceptible to *C. acuta*. Salunke *et al*. (2002) [10], who reported that out of 14 soybean cultivars, highest incidence of defoliators was recorded in MAUS-2 and lowest leaf damage was in cultivar NRC-37.

**Table 3:** Incidence of *Chrysodeixis acuta* on AVT lines of soybean

| Sr. No. | Variety | Average larvae/mrl | | | |
|---|---|---|---|---|---|
| | | 15 DAG | 30DAG | 45DAG | 60DAG |
| 1 | AMS-MB-5-18 | 1.8 (1.52) | 6.8 (2.71) | 7.5 (2.83) | 7.2 (2.77) |
| 2 | KDS-1045 | 1.5 (1.41) | 4.3 (2.20) | 5.7 (2.49) | 5.2 (2.39) |
| 3 | KDS-980 | 1.0 (1.22) | 3.7 (2.04) | 5.3 (2.41) | 6.2 (2.59) |
| 4 | DS-3105 | 2.3 (1.67) | 5.5 (2.45) | 8.8 (3.05) | 9.0 (3.08) |
| 5 | MACS-1340 | 1.7 (1.48) | 4.8 (2.31) | 8.3 (2.97) | 9.2 (3.11) |
| 6 | RVS 2007-6 | 1.3 (1.34) | 4.5 (2.24) | 5.7 (2.49) | 4.2 (2.17) |
| 7 | RVS 2010-1 | 1.7 (1.48) | 5.2 (2.38) | 7.3 (2.79) | 7.2 (2.77) |
| 8 | KDS-921 | 1.3 (1.34) | 3.2 (1.91) | 4.5 (2.24) | 5.5 (2.45) |
| 9 | DSB-28-3 | 2.5 (1.73) | 6.3 (2.61) | 7 (2.74) | 6.5 (2.65) |
| 10 | RSC-10-70 | 1.0 (1.22) | 3.0 (1.87) | 8.7 (3.03) | 5.7 (2.49) |
| 11 | MAUS 158(RC) | 0.5 (1.00) | 3.0 (1.87) | 5.5 (2.45) | 4.8 (2.30) |
| 12 | MAUS-2 (SC) | 1.8 (1.52) | 5.7 (2.48) | 7.3 (2.79) | 6.5 (2.65) |
| 13 | JS 97-52 (NC) | 0.3 (0.89) | 3.3 (1.96) | 4.7 (2.28) | 4.3 (2.19) |
| 14 | JS 335 (NC) | 1.8 (1.52) | 5.3 (2.41) | 7.2 (2.77) | 5.8 (2.51) |
| | SE(m)± | 0.11 | 0.14 | 0.18 | 0.21 |
| | CD 5% | 0.31 | 0.41 | 0.54 | 0.63 |
| | C.V | 11.31 | 9.08 | 10.00 | 12.02 |

*figures in parentheses are √x+0.5 transformed values.

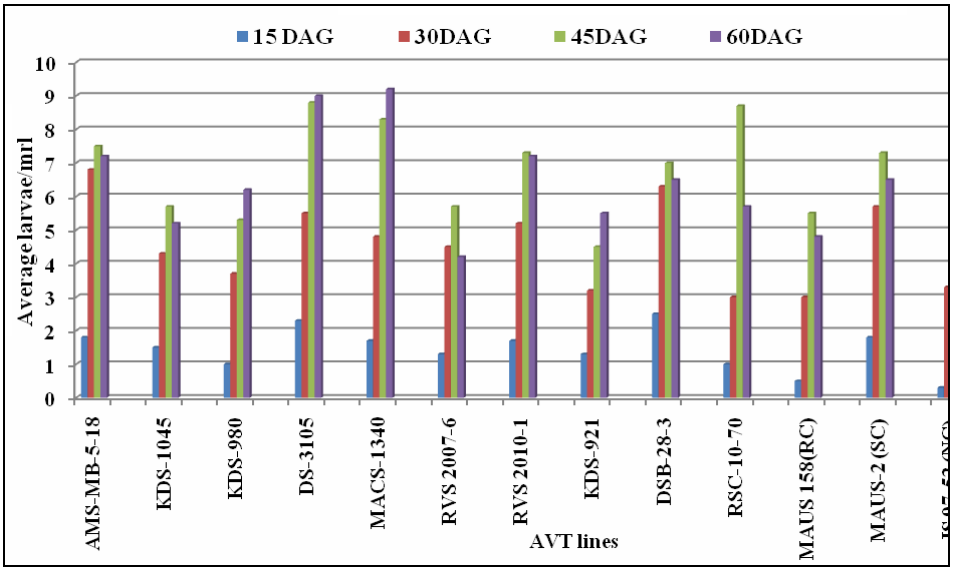


**Fig 3:** Incidence of *Chrysodeixis acuta* on AVT lines of soybean

**Yield of different AVT lines**

**Under unprotected condition**

The data indicates that the line DS-3105 (2439kg/ha) with the highest yield under unprotected conditions. Among the entries line AMS-MB-5-18 (2387 kg/ha) recorded significantly higher yield in unprotected condition followed by MACS-1340 (2300 kg/ha), KDS-921(2222 kg/ha) and at par with check line JS-335 (2326 kg/ha), MAUS-158 (2309 kg/ha) and MAUS-2 (2170 kg/ha).

The line KDS-1045(1406 kg/ha) recorded significantly lowest yield under unprotected condition followed by DSB-28-3 (1510 kg/ha), RVS 2010-1 (1571 kg/ha), KDS-980 (1623 kg/ha), RVS 2007-6 (1857 kg/ha), check JS 97-52 (1866 kg/ha) and RSC-10-70 (2101 kg/ha).

**Under protected condition**

Two sprays of triazophos were conducted to protect the crop from insect pests. The data are presented in and graphically represented in indicates that the line DS-3105 (3550 kg/ha) gives highest yield under protected condition.

Among the entries RSC-10-70 (3472 kg/ha) noticed higher yield under protected set of conditions followed by MACS-1340 (3446 kg/ha), AMS-MB-5-18 (3325 kg/ha) and three checks, JS-335 (3481 kg/ha), MAUS-2 (3377kg/ha) and JS 97-52 (3377 kg/ha).

The line KDS-980 (2309 kg/ha) recorded significantly lowest grain yield under protected condition followed by DSB-28-3 (2361 kg/ha), KDS-1045 (2422 kg/ha), KDS-921 (2630 kg/ha), RVS 2007-6 (2812 kg/ha) and check line MAUS 158 (3021 kg/ha).

The results of present investigation are discussed in the light of findings of previous workers.

Harish (2009) reported that the lines JS-335, DSb1, PK 1029, JS (SH) 93-05 were rated as susceptible and high yielding *i.e.* tolerant to insect pest complex.

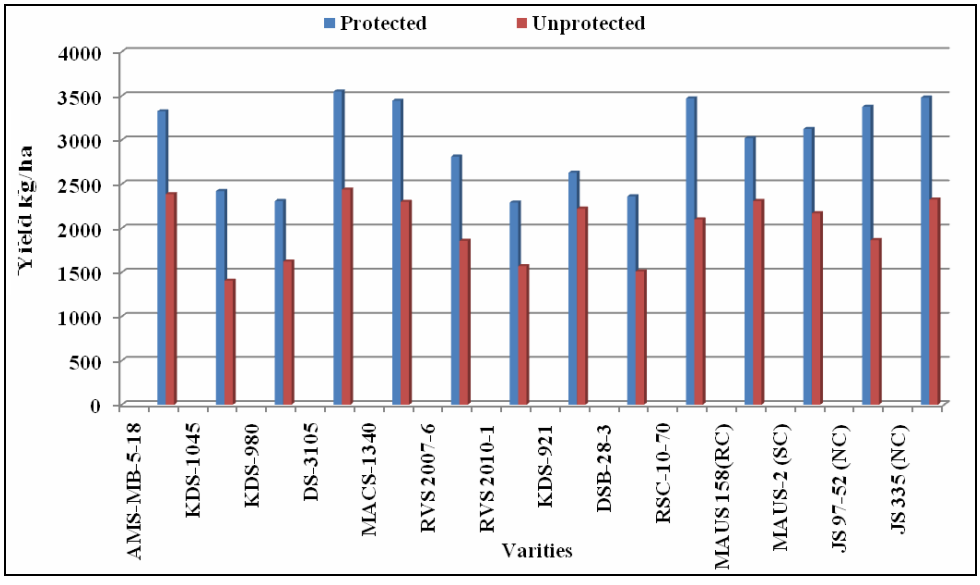


**Fig 4:** Yield of different AVT lines

**Table 4:** Yield of different AVT lines

| Sr. No. | AVT Lines | Yield (kg/ha) | |
|---|---|---|---|
| | | Protected | Unprotected |
| 1 | AMS-MB-5-18 | 3325 | 2387 |
| 2 | KDS-1045 | 2422 | 1406 |
| 3 | KDS-980 | 2309 | 1623 |
| 4 | DS-3105 | 3550 | 2439 |
| 5 | MACS-1340 | 3446 | 2300 |
| 6 | RVS 2007-6 | 2812 | 1858 |
| 7 | RVS 2010-1 | 2292 | 1571 |
| 8 | KDS-921 | 2630 | 2222 |
| 9 | DSB-28-3 | 2361 | 1510 |
| 10 | RSC-10-70 | 3472 | 2101 |
| 11 | MAUS 158(RC) | 3021 | 2309 |
| 12 | MAUS-2 (SC) | 315 | 2170 |
| 13 | JS 97-52 (NC) | 3377 | 1866 |
| 14 | JS 335 (NC) | 3481 | 2326 |
| | SE(m)± | 0.27 | 0.28 |
| | CD 5% | 0.80 | .82 |
| | C.V. | 7.02 | 8.73 |

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