



## ESTIMATION OF LOSSES IN SOYBEAN DUE TO INSECT PESTS

R. K. KALYAN<sup>1</sup>, O. P. AMETA<sup>2</sup>, G. S. AMETA<sup>1</sup>, B. S. RANA<sup>2</sup> AND H. K. JAIN<sup>3</sup>

<sup>1</sup>Agricultural Research Station-Banswara, <sup>2</sup>Department of Entomology, <sup>3</sup>Department of Statistics, Rajasthan College of Agriculture, Udaipur

### ABSTRACT

Field experiments were conducted at the Agricultural Research Station-Banswara (Rajasthan) during *kharif*-2012 and 2013 to work out the losses in soybean caused by insect pests. The soybean variety JS-335 was sown in 26 plots of 3 × 4 m, having 6 rows. One set of plots was kept protected from insect infestation by regular application of recommended insecticides (protected) and the other set was exposed to natural infestation (unprotected). Infestation by insect pests in soybean significantly affect the plant height causing 8.58 and 11.68 per cent loss, 12.23 and 24.31 per cent loss to number of pods/ plant, 11.06 and 14.86 per cent reduction in seeds/pod, 7.28 and 8.00 per cent loss in weight of 100 seeds, during 2012 and 2013, respectively. The mean yield data recorded from protected and unprotected plots of soybean indicated that insect pests caused 23.79 and 37.16 per cent loss in seed yield, equivalent to a loss of 5.65 and 9.71 q/ha during 2012 and 2013, respectively.

**Key Words :** Insect pests, losses and soybean.

### INTRODUCTION

Soybean is the major oilseed crop in India known as miracle crop of the 20<sup>th</sup> century. It is low cost source of protein and contains 20 per cent oil, 40 per cent protein, 26.5 per cent carbohydrate and 5.5 per cent mineral nutrients and vitamins (thiamine and riboflavin). Because of its high nutritional value, it is also known as the "nutritional powerhouse" and "King of the beans". Soybean is the prime source of vegetable oil and protein in the world. In India, soybean cultivation has increased manifold as compared to any other oilseed crop and stands next only to groundnut. Soybean is grown over an area of 10.88 million ha with a production of 10.43 million tonnes and productivity of 959 kg per ha, which is much below the average productivity in the world (2670 kg per ha) (Anonymous, 2015). Madhya Pradesh state contributes more than 50 per cent in total area and production of soybean and is called as 'Soya State'. Madhya Pradesh, Maharashtra and Rajasthan together contribute about 93.0 per cent to total area and 92.5 per cent production of soybean in the country (Anonymous, 2013). The low productivity of soybean both at national and state levels is attributed to abiotic and biotic stresses like drought, weeds, insect pests and diseases. Among these, insect pests often pose a serious threat to soybean production by increasing cost of cultivation and impairing quality of produce in many ways. In the present investigation the effect of insect pests on yield and various yield attributing characters *viz.*, plant height, number of pods/plant, grain yield/plant, weight of 100 seeds and grain yield/ plot were analyzed.

### MATERIAL AND METHODS

A field experiment was conducted at Agricultural Research Station-Borwat Farm, Banswara (Rajasthan) during *kharif*-2012 and 2013. Soybean variety JS-335 was sown in well prepared field during the first week of July, 2012 and 2013 with row to row and plant to plant spacing of 40 × 10 cm, respectively. The estimation of losses due to insect pests of soybean was worked out using paired plot design as suggested by Le Clerg (1971). There were 26 plots of 3 m × 4 m, (12m<sup>2</sup>) having 6 rows. One set of plots was kept protected from insect infestation by regular application of recommended insecticides (protected) and the other set was exposed to natural infestation (unprotected). All recommended agronomic practices were followed as per the package of practice for Zone IV (b) to raise a good crop except insecticidal sprays. Ten plants were selected randomly and uprooted at the harvest time from each plot in protected and unprotected sets. Actual amount of qualitative and quantitative losses inflicted by the insect pests and their effect on various yield attributing characters of the crop *viz.*, plant height, pods/plant, seeds/pod, 100 seed weight (g), seed yield/plant (g), seed yield/plot (Kg) and seed yield/ha (Kg) were recorded separately.

Mean loss in seed yield (%) was calculated by comparing the yield obtained from protected and unprotected plots using the following formula:

$$\text{Mean loss in yield (\%)} = \frac{X_1 - X_2}{X_1} \times 100$$

Where,

$X_1$  = Yield of protected plots

$X_2$  = Yield of unprotected plots

$$\text{Standard deviation (sd)} = \sqrt{\frac{\text{sum of square of the deviation from the mean difference}}{\text{Number of paired plots} - 1}}$$

$$\text{Standard error of mean (SE)} = \frac{\text{Standard deviation (sd)}}{\sqrt{\text{Number of paired plots (n)}}}$$

$$t \text{ calculated} = \frac{\bar{X}_1 - \bar{X}_2}{\text{se}}$$

Where,

$\bar{X}_1$  = Average yield in treated plot (Protected)

$\bar{X}_2$  = Average yield in untreated plot (Unprotected)

Se = standard error of mean difference

## RESULTS AND DISCUSSION

Infestation of insect pests in soybean significantly affect the plant height, number of pods/ plant, seeds/plant, weight of 100 seeds and seed yield/ plant.

### Effect of insect pest infestation on yield attributing characters:

**Effects on plant height.** The data presented in Tables 1 & 2 reveal that plant growth was adversely affected. In protected plots the height of plants had a mean of 59.49 cm in comparison to the mean height of 54.41 cm in unprotected plots during the year 2012. The plant height in the year 2013 in protected plots had a mean of 63.15

The yield data and yield attributing characters of plant will also subjected to statistical analysis and significance was tested using 't' test as under:

cm as against the mean of 55.73 cm in unprotected plots. The insect pest infestation caused 8.58 and 11.68 per cent reduction in plant/height during 2012 & 2013, respectively.

**Effect on pods and seeds:** The data presented in Tables 1 & 2 reveal that the insect pest infestation caused significant effect on number of pods/plant and number of seeds/pod during both the years. The number of pods/plant in protected plots had a mean of 50.46 pods/plant in comparison to a mean of 44.15 pods/plant in unprotected plots during the year 2012. Similarly, during the year 2013, the mean number of pods/plant in protected and unprotected plots was 55.13 and 41.69, respectively. A significant difference in number of seeds/pod was and also observed in protected and unprotected plots. During the year 2012, number of seeds/pod in protected plots had a mean of 3.03 while in unprotected plots it was 2.69. Similarly during 2013, the number of seeds/pod in protected and unprotected plots had a mean of 3.10 and 2.64 respectively (Tables 1 & 2).

**Table 1. Mean effect of insect pest complex on various yield attributing characters in soybean during *kharif*-2012**

S.No.	Plant Characters	Protected	Unprotected	Difference	Loss (% reduction)	"t" at 5%	
						Tabulated	Calculated
1.	Plant height (cm)	59.49	54.41	5.08	8.58	1.179	13.61
2.	No. of pods/plant	50.46	44.15	6.31	12.33	2.179	7.74
3.	No. of seeds/pod	3.03	2.69	0.34	11.06	2.179	9.66
4.	100 seed weight (g)	12.23	11.34	0.89	7.28	2.179	7.77
5.	Seed yield/plant (g)	18.67	14.15	4.53	23.79	2.179	10.56
6.	Seed yield/plot (kg $ha^{-1}$ )	2801	2122	679	23.79	2.179	10.31
7.	Yield (kg $ha^{-1}$ )	2333	1768	565	23.79	2.179	10.56

**Table 2. Mean effect of insect pest complex on various yield attributing characters in soybean during *kharif*-2013**

S.No.	Plant Characters	Protected	Unprotected	Difference	Loss (% reduction)	"t" at 5%	
						Tabulated	Calculated
1.	Plant height (cm)	63.15	55.73	7.42	11.68	2.179	12.17
2.	No. of pods/plant	55.13	41.69	13.44	24.38	2.179	22.03
3.	No. of seeds/pod	3.10	2.64	0.46	14.86	2.179	14.82
4.	100 seed weight (g)	12.28	11.29	0.98	8.02	2.	9.16
5.	Seed yield/plant (g)	20.86	13.08	7.78	37.15	2.179	24.31
6.	Seed yield/plot (kg $ha^{-1}$ )	3128	1962	1166	37.15	2.179	24.31
7.	Yield (kg $ha^{-1}$ )	2606	1636	970	37.15	2.179	25.38

**Effect on weight of 100 seed:** The data presented in tables reveal that the weight of 100 soybean seeds was higher in protected plots than the weight of 100 seeds of soybean under unprotected plots during both the years. During the year 2012, in protected plots the 100 seed weight had a mean of 12.23g as against 11.34g in unprotected plots. During 2013 the weight of 100 seed in unprotected plots had a mean of 11.29g. The weight of 100 seed in protected plots had a mean of 12.28g ( Table 4). The insect pest infestation caused 7.28 and 8.0 percent reduction in weight of 100 seeds during 2012 and 2013, respectively.

**Effect on seed yield:** Insect pest infestation on seed yield was clearly manifested and had significant effect on seed yield/plants. During the year 2012, seed yield/plant in protected plots had a mean of 18.67g as against 14.15g in unprotected plots. During 2013, the seed yield in protected plots had a mean of 20.86g in comparison to 13.08g in unprotected plots (Tables 1 & 2).

The data presented in Tables 1 & 2 reveal that there was significant difference in the seed yield/plot. During the year 2012, the mean seed yield in protected plots was 2.78 kg as against 2.11 kg/plot in unprotected plots. Similarly, during the year 2013, the mean seed yield/plot in protected plots was 3.14 kg as against 1.96 kg in unprotected plots.

The yield data recorded from protected and unprotected plots of soybean was converted to kg/ha, analysed and is depicted. The seed yield ranged from 1989 to 2683 kg/ha with mean of 2333 kg/ha in protected plots in comparison to 1624 to 1915 kg/ha with mean of 1768 kg/ha in unprotected plots. Similarly, during 2013 the seed yield mean of 2606 kg/ha was recorded in protected plots as against mean of 1635 kg/ha in unprotected plots. The mean yield data recorded from protected and unprotected plots of soybean indicated that insect pests caused 23.79 and 37.16 per cent loss in seed yield which is equivalent to a loss of 5.65 and 9.71 q/ha during 2012 and 2013, respectively.

Variation in per cent loss in grain yield of soybean, reported by different workers may be attributed to change in agro-climatic conditions. The present findings are in close conformity with the findings of Singh and Singh (1991) who reported from 7.29 to 45.35 per cent losses by insect pests. Venkatesan and Kundu (1994a) observed the loss of pod weight of 5.16 to 7.09 g or grain yield losses of 2.75-3.81 g per plant resulted into 24.84 to 33.96 per cent loss. Kundu *et al* (1995) reported yield losses from 18.60 to 40.10 per cent in soybean. Bajpai *et al* (2004) reported 20.65 to 34.98 per cent avoidable losses due to insect pests in variety JS-335. Gupta *et al* (1997) studies the losses in soybean yield due to the insect pest and estimated 24.0 % losses in crop. Upadhyay *et al* (1999) estimated the maximum reduction (39.06 %) in seed yield in JS-335. Jain and Sharma

(2011) reported 5.42 and 21.40 percent infestation in protected and unprotected condition in soybean variety JS-335 due to girdle beetle. Abudulai *et al* (2012) reported the yield loss range between 25.8 and 42.8% in untreated plots. Ahirwar *et al* (2014) report 30.8 % avoidable losses due to insect pests.

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