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## Assessment of crop losses due to tomato fruit borer, *Helicoverpa armigera* in tomato

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### Abstract

Present study was undertaken to estimate yield losses due to tomato fruit borer in tomato crop at farm of Agricultural Research station, Swami Keshwanand Rajasthan Agricultural University, Bikaner, during the *rabi* season, 2013-14. In unprotected plots, the average height of plants, number of leaves and average weight of fruits per plant recorded were 43.78 cm, 50.13 and 45.69 gm, respectively. While these values in protected plots being 59.88 cm, 61.10 and 54.32 gm, respectively. On the basis of difference obtained in net yield in protected and unprotected plots the avoidable quantitative loss was 31.53 per cent on winter sown tomato crop.

**Keywords:** *H. armigera*, tomato, yield losses, protected and unprotected condition

### 1. Introduction

Among various vegetables, tomato is most popular and extensively consumed vegetable crops in the world [1]. Various factors have been attributed for low yield of tomato like poor quality seeds, incidence of pests and adverse climate. Among all the known factors, insect pests are of prime importance which affects not only its yield but also spoil the quality [2]. The tomato fruit borer, *Helicoverpa armigera* (Hubner) is a key pest as it attacks the cashable part of the plant *i.e.* fruits and makes them unfit for human consumption causing considerable crop loss leading up to 55 per cent [3]. It has been estimated that the crops worth Rs.1000 crore are lost annually by this pest [4]. The present study was undertaken to estimate yield losses due to tomato fruit borer, *Helicoverpa armigera* in tomato crop.

### 2. Materials and Methods

The present experiment was laid out in a Paired plot design with 14 replications. Each plot size was 3.6×2.0 m<sup>2</sup>. The seed of tomato (Variety "RS-2") were sown in raised nursery beds in last week of October. The seedlings were transplanted in the experimental plots after they attained a height of 15 cm with 8-10 leaves in the last week of November keeping row to row 60 cm and plant to plant distance 40 cm.

One set of plot referred, here as protected was provided complete protection by spraying with acephate 75 SP and quinalphos 25 EC alternatively at weekly interval. In another set of plots (unprotected plots) no insecticide was sprayed on the crop and was exposed to natural infestation. The infestation & fruit yield of treated and untreated plots was recorded at each picking.

To know the avoidable losses due to *H. armigera*, 10 plants were selected from each replication in both protected and unprotected set of plots and observation pertaining to various plant characters related to the plant yield *viz.*, height of plants, number of leaves, and weight of fruits was subjected to 't' test and significance was tested.

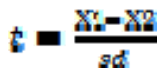
#### 2.1 Statistical analysis

Finally loss in yield due to fruit borer was calculated by following formula [5].

$$s = \sqrt{\frac{\text{Sum of square of the deviation of difference}}{\text{Number of paired plots} - 1}}$$

$$sd = \frac{s}{\sqrt{n}}$$

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Where,

$X_1$  = yield in protected plots

$X_2$  = yield in unprotected plots

### 3. Results

The present study results revealed that “RS-2” variety of tomato suffered by fruit borer, which adversely affected the growth and yield of tomato crop. Actual amount of quantitative avoidable loss inflicted by this naturally occurring pest population together with their effect on various plant characters viz., height of plant, number of leaves, weight of fruit were recorded (Table 1).

#### 3.1 Height of plants

It was evident from Table 1 that in tomato crop, a significant reduction in height per plant between protected and unprotected plots was noticed. The height of plants in protected plots ranged from 45.85 to 67.84 cm with a mean of 59.88 cm in comparison to range of 36.75 to 53.00 cm with a mean of 43.78 cm in unprotected plots.

#### 3.2 Number of leaves

It was revealed from Table 1 that in tomato crop, a significant reduction in number of leaves per plant between protected and unprotected plots was noticed. In protected plots the number of leaves per plant ranged from 56.01 to 69.00 with a mean of 61.10 in comparison to range of 44.09 to 56.70 with a mean of 50.13 in unprotected plots.

#### 3.3 Weight of fruits

A significant difference was observed in weight of fruits, thereby showing a reduction in weight of marketed fruits per plant. The average weight of fruits in protected plots ranged from 44.48 to 60.63 gm with a mean of 54.32 gm in comparison to range of 41.06 to 52.26 gm with a mean of 45.69 gm in unprotected plots (Table 1).

#### 3.4 Losses in yield

Table 2 indicated that in tomato crop a significant reduction in yield of tomato fruits between protected and unprotected plots was recorded. In protected plots the yield of tomato ranged from 195.25 to 250.11 q ha<sup>-1</sup> with a mean of 221.83 in comparison to range of 133.69 to 171.25 with a mean of 151.88 in unprotected plots. Reduction of 31.53 per cent was computed in unprotected plots as compared to protected plots

**Table 1:** Plant height, number of leaves and weight of fruits in protected and unprotected plots of tomato

Paired plot No.	Plant height (cm)		Number of leaves		Weight of fruit (gm)	
	Protected plots	Unprotected plots	Protected plots	Unprotected plots	Protected plots	Unprotected plots
1	52.80	45.93	59.01	49.49	50.43	44.34
2	64.54	45.58	59.01	53.11	44.48	41.54
3	67.84	43.81	63.99	51.30	54.97	52.26
4	59.40	36.75	56.01	44.09	60.63	41.06
5	62.34	53.00	69.00	56.70	60.07	49.94
6	59.40	45.23	60.99	47.71	49.58	47.60
7	58.30	40.28	62.01	49.49	54.12	45.26
8	55.74	42.75	60.99	49.49	56.10	44.80
9	58.30	39.93	59.01	50.41	56.95	42.46
10	60.14	44.52	60.99	49.49	55.82	47.60
11	53.05	41.71	66.33	55.22	49.96	47.11
12	45.85	40.15	58.65	50.98	48.09	43.33
13	60.62	49.45	62.61	50.68	51.64	47.57
14	56.93	49.39	64.35	51.17	49.17	44.17
Average	59.88	43.78	61.10	50.13	54.32	45.69
T Cal		9.07		18.50		5.37
T Tab		2.16		2.16		2.16
Significant at 5% level of significance.						

**Table 2:** Yield from protected and unprotected plots of tomato and losses caused by *H. armigera*

Paired plot No.	Yield in q ha <sup>-1</sup>		Difference (X <sub>1</sub> -X <sub>2</sub> )	Deviation from the mean of difference (d)	Square of the deviation from the mean of difference (d <sup>2</sup> )	Value of T at 5%		Per cent reduction in unprotected plots
	Protected X <sub>1</sub>	Unprotected X <sub>2</sub>				Calculated	Tabulated	
1	250.11	171.25	78.86	8.92	79.527			
2	195.25	133.69	61.56	8.38	70.217	42.93	2.16	31.53
3	225.65	154.50	71.15	1.21	1.453			
4	235.52	161.26	74.26	4.32	18.642			
5	200.21	137.08	63.13	6.82	46.453			
6	198.65	136.02	62.63	7.31	53.400			
7	245.75	168.27	77.48	7.54	56.898			
8	215.26	147.39	67.87	2.07	4.287			
9	223.85	153.27	70.58	0.64	0.407			
10	241.33	165.24	76.09	6.15	37.816			
11	206.65	141.49	65.16	4.79	22.897			
12	239.16	163.75	75.41	5.47	29.869			
13	229.84	157.37	72.47	2.53	6.384			
14	198.34	135.80	62.54	7.41	54.838			
Sum	3105.57	2126.38	979.19	0.00	483.089			
Mean	221.83	151.88	69.94					

#### 4. Discussion

The data recorded in the present investigation revealed that insect pest adversely affected the height of plants, number of leaves, weight of fruits and net yield as there was significantly difference in protected and unprotected plots.

The findings of present investigations are conformity with those of Bhardwaj *et al.* [6] in safflowers, Ameta and Bhardwaj [7] in pigeonpea, Meena [8] in coriander, Paliwal [9] in sorghum, Suryawansi *et al.* [10] in okra, Purohit and Ameta [11] in cotton and Meena [12] in okra, all the earlier workers have reported that insect pest infestation caused adverse effect on growth and yield attributing characters of a plant.

The results are also in agreement with the work of Kumar *et al.* [13] who reported that 18.50 to 32.64 per cent yield losses could be avoided as results of sprays of insecticides. However, Aheer *et al.* [14] reported 72.19 to 77.79 per cent yield losses does not support the present findings.

#### 5. Conclusion

The experiment on assessment of losses due to fruit borer by taking into the consideration of yield and yield attributing characters i.e. height of plants, number of leaves and weight of fruits was carried out and it was found that pest infestation adversely affect the yield attributing characters causing 31.53 per cent quantitative losses.

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