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Study of yield losses and correlation between population of major sucking pests with weather in Bt cotton

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Abstract

The investigation was carried out on Study of yield losses and Correlation between population of major sucking pests with weather in Bt cotton during *Kharif* 2011-2012 at instructional farm, JAU, Junagadh. The data revealed that significantly higher seed cotton yield 2038.82 kg/ha was recorded from protected plots, while the yield of 1312.70 kg/ha was recorded from unprotected plots. The yield increased in protected plots over unprotected plots was 726.12 kg/ha. The result clearly indicated that by providing protection with effective pesticides against cotton sucking pests, 726.12 kg/ha yield loss can be saved. The infestation of aphid on cotton commenced during the 3rd week of September and reached at a peak during the 2nd week of December. Jassid population had highly significant positive correlation with maximum temperature, morning relative humidity and afternoon relative humidity, while non-significant negative correlation occurred with minimum temperature, rainy days. The incidence of thrips on cotton was found to be active from 2nd week of August to 4th week of January. The incidence of whitefly on cotton commenced during the 2nd week of August and reached at a peak level in 1st week of November. Mealy bug population had highly significant positive correlation with maximum temperature and non-significantly positive correlation with minimum temperature, morning relative humidity and afternoon relative humidity.

Keywords: BT cotton, yield losses, sucking pests, correlation study

Introduction

Cotton crop is known as “White gold” and is a premier commercial crop in India, which occupies only 5 percent of the arable land and supports 60 million people having direct bearing on the country’s economy. India is a unique among the cotton growing countries of the world in which four species of cotton *viz*, *Gossypium hirsutum*, *G. barbadense*, *G. arboreum* and *G. herbaceum* are grown commercially under diversified ecosystem. The major cotton growing states in India are Maharashtra, Gujarat, Andhra Pradesh, Madhya Pradesh, Punjab, Haryana, Karnataka, Rajasthan, Tamil Nadu and Orissa. In India, 160 species of insect pests have been reported to attack the cotton crop right from time of germination till the final harvesting of cotton (Agarwal, 1978) [1]. The total loss due to cotton pests (Jassid and bollworm complex) in north, central and south zone was estimated as 52.80, 46.53 and 47.56 percent, respectively (Basu *et al.*, 1990) [4]. Among the various insect pests listed above, aphid, whitefly, thrips, cotton leaf hopper or jassid and mealy bugs are the major sucking pests of cotton and limiting the profitable cultivation. Due to introduction and adoption of Bt hybrid cotton, the yield losses caused by bollworms become minimized.

Materials and Methods

Present investigation was carried out on estimation of yield losses in Bt cotton due to major sucking pests infesting cotton during *Kharif* 2011-2012 at instructional farm, JAU, Junagadh. With a view to estimate the losses caused by major sucking pest in the Bt cotton (Bt hybrid cotton KDCHH-441).

Unprotected (plot): The crop was kept free from insecticides and subjected to the natural occurrence of the sucking pests of cotton.

Protected (plot): The crop was protected against the major sucking insect pests damage through application of recommended insecticides. *viz*. Imidacloprid @ 0.01% and quinalphos @ 0.05% alternately at ten day interval.

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For this purpose, two strip each of 12 m x 20 m was prepared and from each strip fifteen quadrates of size 2.5 m x 1.5 m was selected randomly for the observations. The observations were recorded from each quadrate and the data was subjected to statistical analysis using CRD design.

Observations to be recorded: Yield of treated plot Kg/quadrat and Yield of untreated plot Kg/quadrat.

Yield and economics: The grain yield obtained from each net plot of insecticidal treatments was converted on hectare basis and subjected to statistical analysis. The percent increase in yield over control was calculated by using following formula:

$$\text{Yield increase over control} = \frac{T - C}{C} \times 100$$

Where, T = Yield of respective treatment (kg/ha)

C = Yield of control (kg/ha)

The percentage avoidable loss in yield due to sucking pests was calculated as per the formula given by (Khosla, 1977) [11].

$$\text{Percentage avoidable loss} = \frac{T - C}{C} \times 100$$

Where, T = Yield in the most effective treatment (kg/ha)

C = Yield in the respective treatment (kg/ha)

Results and Discussion

Yield losses: The data on yield losses in Bt cotton due to sucking pests revealed that 26.21 percent damage was recorded in unprotected crop (untreated plots). While in protected crop (treated plots) only 7.29 percent damage was recorded due to the sucking pests. Significantly higher cotton yield 2038.82 kg/ha was recorded from protected plots, while the yield of 1312.70 kg/ha was recorded from unprotected plots. The yield increased in protected plots over unprotected plots was 726.12 kg/ha. This showed 55.31 percent yield increased over control and 35.61 percent avoidable loss. The result clearly indicated that by providing protection with effective pesticides against cotton sucking pests, 726.12 kg/ha yield loss can be saved. Total avoidable yield loss could be worked out as 35.61 percent (Table 1).

Table 1: Yield losses in Bt cotton crop due to sucking pests during

Treatment	Damage (%)	Cotton yield Kg/ha	Yield loss Kg/ha	Avoidable yield loss (%)	Yield increased over control (%)
Untreated (unprotected)	32.37 (26.21)	1312.70	726.12	—	—
Treated (Protected)	9.68 (7.29)	2038.82	—	35.61	55.31
S.Em±	1.67	45.57			
C.D	4.91	131.99			
C.V %	10.71	11.57			

Correlation studies between aphid population and weather parameters

Study on effect of various weather parameters on the fluctuation of aphid population was carried out on cotton and indicated that aphid population had exhibited significantly positive correlation with minimum temperature (r= 0.4514). It was positive correlation with morning relative humidity (r= 0.5796), evening relative humidity (r= 0.4717). Whereas, it was negative correlation with maximum temperature (r= -0.2871), and rainy days (r= -1.0000). Correlation co-efficients between aphid population and bright sunshine hours (r= -0.4713) and rainfall (r= -0.3136) were negative.

Araujo and Sales (1985) [3] revealed that the populations of aphids were not affected much by the minimum and maximum temperature, relative humidity, velocity of wind and rain on cotton crop. Chattopadhyay *et al.* (1996) [6] stated that the cloudiness weather played an important role in the development of aphid on cotton during the first generation. A drop in mean temperature to below 25 °C could cause a sharp increase in the aphid population. Patel *et al.* (1997) [8] reported that there was no significant relationship between the population of *A. gossypii* and any weather parameters on cotton. Hence, the present findings are more or less in confirmation with the results of the earlier worker.

Correlation studies between jassid population and weather parameters

Study on effect of various weather parameters on the fluctuation of jassid population on cotton was conducted and revealed that jassid population had exhibited highly significantly positive correlation with maximum temperature (r= 0.8447), morning relative humidity (r= 0.7123), evening

relative humidity (r= 0.3710). Whereas, it was non-significantly negative between pest population and minimum temperature (r= -0.8802), rainfall (r= -0.5339), rainy days (r= -0.5827) and bright sunshine hours (r= -0.7953).

Patel *et al.* (1997) [8] reported significant relationship between jassid population level and maximum temperature (r = 0.76) as well as hours of bright sunshine (r = 0.82) on okra. Singh *et al.* (2002) [9] reported that population of cowpea jassid positively correlated with maximum temperature and negatively correlated with relative humidity and minimum temperature. Hence, the present findings are more or less corroborating with the results of the earlier workers.

Correlation studies between thrips population and weather parameters

Correlation coefficients between thrips population and weather parameters were calculated and data revealed that the thrips population had exhibited significantly positive correlations with maximum temperature (r= 0.5679) and minimum temperature (r= 0.3583). It was non-significantly positive between pest population and morning relative humidity (r= 0.7136) and evening relative humidity (r= 0.5041). While, it was non-significantly negative with rainfall (r= -0.4982) and rainy days (r= -0.5803) and bright sunshine hours (r= -0.8072).

Significant positive correlation was observed between thrips population and weather parameters *viz*; minimum temperature, RH at morning and evening and rainy days on cotton (Anonymous, 2004-05) [2]. Hence, the present observations are in confirmation with the results of the earlier workers.

Correlation studies between whitefly population and weather parameters

Correlation coefficients between whitefly population and weather parameters were also worked out and the results are presented that whitefly population had exhibited highly significantly positive correlation with maximum temperature ($r= 0.8071$). It was non-significantly positive with minimum temperature ($r= 0.3582$), morning relative humidity ($r= 0.7108$) and evening relative humidity ($r= 0.5007$) and non-significantly negative with rainfall ($r= -0.4900$) and rainy days ($r= -0.5743$) and mean bright sunshine hours ($r= -0.8001$).

Negative correlation between whitefly population and relative humidity was reported by Bhardwaj and Kushwaha (1984)^[5] on tomato crop and Singh *et al.* (1985)^[10] on cotton crop. Singh *et al.* (2002)^[9] reported that maximum and minimum temperatures were positively correlated with whitefly on cowpea. Hence, the present observations are in confirmation with the results of the earlier workers.

Correlation studies between mealy bug population and weather parameters

Correlation coefficients between whitefly population and weather parameters were also worked out and the results are revealed that whitefly population had exhibited highly significantly positive correlation with maximum temperature ($r= 0.8578$). It was non-significantly positive with minimum temperature ($r= 0.3595$), morning relative humidity ($r= 0.7197$) and afternoon relative humidity ($r= 0.5020$) and non-significantly negative with rainfall ($r= -0.4950$) and rainy days ($r= -0.5693$) and mean bright sunshine hours ($r= -0.8137$).

Hanchinal *et al.* (2010)^[7] evaluated that the mealybug infestation started appearing in the month of September and gradually increased as crop growth advanced. The population was 0.50/10 cm apical shoot in the 38th meteorological week and progressively increased throughout the season. Population reached to 115.42/10 cm apical shoot in the 3rd week of January and thereafter increased suddenly to reach 180.42/10 cm apical shoot in the 7th meteorological week. Later on, infestation of mealybug declined gradually and reached to 146.64/10 cm apical shoot in the 14th meteorological week.

Table 2: Correlation co-efficients between population of major sucking pests of cotton and weather parameters

Sr. No.	Name of sucking pests	Weather parameters									
		Temperature (°C)			Relative humidity (%)			Wind speed (Km/Hr)	Mean bright sunshine hours	Rainfall (mm)	Rainy days
		Max.	Min.	Ave.	Morn.	Even.	Ave.				
1	Aphid	-0.2871	0.4514	0.8604	0.5796	0.4717	0.9621	0.2617	-0.4713	-0.3136	-1
2	Jassid	0.8447**	-0.8802	0.5342	0.7123	0.3710	0.9768	0.6245	-0.7953	-0.5339	-0.5827
3	Thrips	0.5679	0.3583	0.7187	0.7136	0.5041	0.9750	0.5699	-0.8072	-0.4982	-0.5803
4	Whitefly	0.8071	0.3582	0.7131	0.7108	0.5007	0.9767	0.5609	-0.8001	-0.4900	-0.5743
5	Mealybug	0.8578	0.3595	0.7106	0.7197	0.5020	0.9790	0.5469	-0.8137	-0.4950	-0.5693

*Significant at 0.05 level Aphid (n=20) ($r=0.444$), Jassid (n=21) ($r=0.433$), Thrips, Whitefly and mealybug (n=25) ($r=0.396$).

**Significant at 0.01 level Aphid (n=20) ($r=0.561$), Jassid (n=21) ($r=0.549$), Thrips, Whitefly and mealybug (n=25) ($r=0.505$).

Conclusion

The investigation was carried out on Study of yield losses and Correlation between population of major sucking pests with weather in Bt cotton during *Kharif* 2011-2012 at instructional farm, JAU, Junagadh. The yield increased in protected plots over unprotected plots was 726.12 kg/ha. The result clearly indicated that by providing protection with effective pesticides against cotton sucking pests, 726.12 kg/ha yield loss can be saved. The infestation of aphid on cotton commenced during the 3rd week of September and reached at a peak during the 2nd week of December. The incidence of thrips on cotton was found to be active from 2nd week of August to 4th week of January. Mealy bug population had highly significant positive correlation with maximum temperature and non-significantly positive correlation with minimum temperature, morning relative humidity and afternoon relative humidity.

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