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Estimation of boll damage by pink bollworm *Pectinophora gossypiella* in cotton under different sowing dates

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Abstract

The present investigation was carried out at the research farm of Cotton Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during *khariif* 2016-17. Four different cotton cultivars were used to estimate pink bollworm damage with three different sowing periods in factorial randomized block design. The results revealed that among the different cotton cultivars, minimum green boll damage (35.00%) due to pink bollworm was recorded on *arboreum* hybrid (Suvarna) whereas maximum (48.88%) was recorded in Non Bt *hirsutum* hybrid (DCH-32). Maximum pink bollworm infestation (18.92%) in loculi at harvest was observed in early sowing of Non Bt *hirsutum* hybrid whereas minimum loculi damage (13.69%) was recorded in timely sown *arboreum* variety. Maximum seed cotton yield (11.08 q/ha) was recorded in Bt BG II hybrid (RCH-2) whereas the minimum (6.43 q/ha) was recorded in *arboreum* variety (AKA-7). Maximum pink bollworm infestation at harvest was observed in early sown (5th June) non Bt *hirsutum* hybrid (DCH-32), whereas minimum infestation was recorded in timely sown (25th June) of *arboreum* variety (AKA-7).

Keywords: *Pectinophora gossypiella*, Bt cotton, sowing dates, boll damage, Loculi damage

1. Introduction

Cotton (*Gossypium hirsutum* L.) is most important commercial crop known as “King of natural fiber” and world over commonly referred as “White Gold”. Cotton belongs to family Malvaceae and genus *Gossypium*. As a leading commercial crop, it is grown worldwide and playing a key role in economic as well as social affairs of the world. Cotton is grown chiefly for its fibre which is used in the manufacture of cloth for the mankind. It is also used for several other purposes like, making threads, for mixing in other fibers and extraction of oil from the cotton seed. Its wide spread use is largely due to the ease with which its fiber are spun into yarns. It is the oldest among the commercial crops of the world. India accounts for about 32 percent of the global cotton area and contributes to 21 percent of the global cotton produce. Cotton contributes about 65 percent of the total raw material needs of textile industry in India. The area of cotton in India is 118.81 lakh hectares whereas production is 352 lakh bales and productivity is 504 kg/ha^[1]. Cotton and textile exports account for nearly one-third of total foreign exchange earnings of India. Cotton provides employment and sustenance to a population of nearly 42 million people, who are involved directly or indirectly in cotton production, processing, textiles and related activities^[2].

The pink bollworm *Pectinophora gossypiella* (Saunders) is the most important cotton pest in the world;^[3,4] reported greatest loss (20-40%) in cotton seed yield. It is distributed in all most all cotton growing states of the country and has caused millions of the rupees of damage. It is oligophagous pest, feeds on cotton, okra, and allied plants. It has been a major pest of cotton produced in the southwestern United States for many years. The pink bollworm is back with a vengeance. This insect was a serious concern for cotton in India about 30 years ago. There were very few reports of any major damage by pink bollworm to cotton since 1982 in the country. But all that has changed now. Pink bollworm is the most destructive pest of cotton in later stages of the crop growth. It causes locule damage of 37.5 percent and 13.58 percent on non-Bt and Bt cotton, respectively, at 160 days of planting resulting into heavy loss in cotton production^[5]. During 2014, severe damage to bolls by pink bollworm and yield-losses were observed in Bt-cotton in many regions of Gujarat and some parts of AP, Telangana and Maharashtra. More concerning is the fact that the worm is happily chewing up Bollgard-II-Bt-

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cotton which contains two genes (cry1Ac+cry2Ab) that were supposed to be highly effective in controlling the pest [6].

2. Materials and Methods

Field experiment was laid out with Factorial Randomized Block Design (FRBD). The plot size was 2.4 × 6 m. with different spacing's 90 × 45, 60 × 30, 60 × 15 and 60 × 45 cm for BG II hybrid (RCH-2), non Bt *hirsutum* hybrid (DCH-32), *arboreum* variety (AKA-7), *arboreum* hybrid (Suvarna) respectively. Sowing was done on 5 June (Early sowing), 25 June (Timely sowing) and 15 July (Late sowing) during 2016. Before sowing, cotton seed was treated with imidacloprid 70 WS @ 10 gm/kg.

Periodical observations were undertaken to record the incidence of bollworms prior to application of treatment sprays for *Helicoverpa armigera* & *Earias vittella*. As soon as the level of infestation reached to 5 percent, the treatment spray of Spinosad was initiated for the management of *Helicoverpa armigera* and *Earias vittella*. Pheromone traps (Helilure and Vitilure) @ 1 trap per replication were installed for management of *H. armigera* and *E. vittella*. The observations of green bolls damaged due to pink bollworm, randomly 20 matured green bolls were plucked from each plot at 120, 140 and 160 days after emergence. These green bolls were dissected and were observed for pink bollworm damage. Observation on open boll damage and loculi damage were also undertaken. All open bolls randomly selected from five plants from each net plot were assessed at the end of third pickings for pink bollworm damage. From this data the percent open boll damage and loculi damage at harvest was worked out. Thus, the data generated were statistically analyzed by using Factorial Randomized Block Design.

3. Results and Discussion

3.1 Green boll damage due to pink bollworm in cotton

The data presented in table 1 indicated that the maximum pink bollworm infestation in green bolls was recorded in early sowing regime i.e. 47.50 percent and minimum was recorded late regime i.e. 35.42 percent at 120 DAS. Pink bollworm infestation was observed in the range of 45.42 to 47.50 percent, 38.33 to 44.17 percent and 35.42 to 39.17 percent in early, timely and late sowing regime, respectively. However, cumulative data on infestation of pink bollworm (percent green boll) during the season indicated that significant differences among the D₁ (early sowing), D₂ (timely sowing) and D₃ (late sowing). The infestation of pink bollworm in early sowing was significantly higher than timely and late sowing which were at par with each other. The data revealed that minimum boll damage was recorded in *arboreum* hybrid whereas maximum in non Bt *hirsutum* hybrid (DCH-32) followed by Bt Hybrid (RCH-2) and *arboreum* variety (AKA-7). From the cumulative data, it was observed that *arboreum* hybrid (Suvarna) was recorded significantly lower boll damage (36.11%) than non Bt *hirsutum* hybrid (DCH-32), Bt Hybrid (RCH-2) and *arboreum* variety (AKA-7) which were at par with each other.

In the early sown crop (June 10th), the incidence of pink bollworm was 32.28 percent and the incidence was more severe (above 50%) from December onwards. Further higher infestation of pink bollworm population was noticed in non-Bt cotton (DCH-32) during January to February months [7]. The pink bollworm damage was lower in green bolls during initial boll formation period and later increased to peak levels in the month of January and February on non-Bt cotton [8]. Lower green boll damage in Bt (1.7%) and non-Bt cotton (10.5%), respectively, by pink bollworm was observed however, during peak boll development period (up to December) 13.7 percent and 40.6 percent green boll damage was registered in Bt and non-Bt cotton, respectively [9]. Presents results are in close conformity with the above findings.

3.2 Open boll and locule damage due to pink bollworm in cotton at harvest

The data presented in table 2 indicated that the maximum pink bollworm infestation in open bolls found to 40.62 percent was recorded in early sowing regime and minimum was recorded in late sown regime i.e. 34.30 percent. Maximum percent boll damage due to pink bollworm was recorded in Non-Bt *hirsutum* hybrid (DCH-32) was 41.06 percent. and data revealed that minimum boll damage was recorded in *arboreum* hybrid (Suvarna) was 34.74 percent. The maximum loculi damage at harvest was 17.75 percent recorded in the early sowing regime and minimum was recorded in late sown regime i.e. 13.84 percent. Maximum percent locule damage of pink bollworm was recorded in Non-Bt *hirsutum* hybrid (DCH-32) i.e. 18.92 percent. The data revealed that minimum loculi damage 13.69 percent was recorded in *arboreum* hybrid (Suvarna) and it was at par with Non-Bt *hirsutum* hybrid (DCH-32) and *arboreum* variety.

Bt hybrids had significantly lower locule damage (9.5 to 12.3%) over non-Bt hybrids where it ranged between 17.83 to 25.4 percent [10]. Bt hybrid had less boll and locule damage (%) as compared to their non-Bt counter parts [11]. Bt hybrids had significantly lesser loculi damage than their counterparts providing the overall efficiency of Bt cotton hybrids against bollworms [12]. RCH-368 Bt recorded lowest boll damage of 4.25 percent while non- Bt recorded maximum damage of 35.96 percent [13]. The results of the present study are similar to the above findings.

3.3 Yield of seed cotton (Quintal per hectare)

The data recorded at the time of harvesting indicated that the yield of seed cotton under different sowing dates was significantly higher (9.74 q/ha) in timely sowing than early sowing (7.86 q/ha) and late sowing (7.90 q/ha). The highest yield (11.08 q /ha) was noted in Bt hybrid (RCH-2) followed by non Bt hybrid (DCH-32) (8.5 q/ha), *arboreum* hybrid (7.98 q/ha) and the lowest yield was recorded in *arboreum* variety i.e. 6.43 qt/ha, respectively (Table 3). Bt cotton hybrids was significantly higher than non Bt hybrids in any environment without insecticide sprays [14]. The results of the present study are similar to the above finding.

Table 1: Percent green boll damage due to pink bollworm at boll development stage

Treatment	120 DAS	140 DAS	160 DAS	Cumulative Mean
I Factor. A- Sowing dates				
D1-Early Sowing (5 June)	47.50 (43.57)	46.25 (42.85)	45.42 (42.93)	46.39 (42.93)
D2-Timely Sowing (25 June)	38.33 (38.25)	38.75 (38.50)	44.17 (39.48)	40.42 (39.47)
D3-Late Sowing (15 July)	35.42 (36.52)	37.08 (37.51)	39.17 (37.60)	37.22 (37.60)
'F' Test	Sig	Sig	Sig	Sig
SE (m±)	1.42	1.24	1.37	1.34
C.D. (P=0.05)	4.17	3.64	4.02	3.94
II Factor B- Different Cotton Varieties				
V1-Bt Hybrid (RCH-2)	41.67 (40.20)	42.22 (40.53)	43.33 (22.34)	42.41 (40.63)
V2-Non Bt Hybrid (DCH-32)	46.67 (43.09)	46.67 (43.09)	48.88 (23.81)	47.40 (43.51)
V3- <i>arboreum</i> Var. (AKA-7)	38.33 (38.25)	37.78 (37.93)	41.66 (21.88)	39.25 (38.80)
V4- <i>arboreum</i> Hy. (Suvarna)	35.00 (36.27)	35.56 (36.60)	37.77 (20.78)	36.11 (36.94)
'F' Test	Sig	Sig	Sig	Sig
SE (m±)	1.64	1.43	1.58	1.55
C.D. (P=0.05)	4.81	4.2	4.64	4.55
III Interaction (A×B)				
D ₁ V ₁	50.00 (45.00)	51.67 (45.96)	48.33 (44.04)	50.00(45.00)
D ₁ V ₂	55.00 (47.87)	53.33 (46.91)	51.66 (45.96)	53.88 (47.23)
D ₁ V ₃	45.00 (42.13)	40.00 (39.23)	41.66 (40.20)	42.22 (40.53)
D ₁ V ₄	40.00 (39.23)	38.33 (38.25)	40.00 (39.23)	39.44 (38.91)
D ₂ V ₁	40.00 (39.23)	40.00 (39.23)	45.00 (42.13)	41.66 (40.20)
D ₂ V ₂	45.00 (42.13)	45.00 (42.13)	50.00 (45.00)	46.66 (43.09)
D ₂ V ₃	35.00 (36.27)	35.00 (36.27)	43.33 (41.17)	37.77 (37.93)
D ₂ V ₄	33.33 (35.26)	35.00 (36.27)	38.33 (38.25)	35.55 (36.60)
D ₃ V ₁	35.00 (36.27)	35.00 (36.27)	36.66 (37.27)	35.55 (36.60)
D ₃ V ₂	40.00 (39.23)	41.67 (40.20)	45.00 (42.13)	42.22(40.53)
D ₃ V ₃	35.00 (36.27)	38.33 (38.25)	40.00(39.23)	37.77 (37.93)
D ₃ V ₄	31.67 (34.24)	33.33 (35.26)	35.00 (36.27)	33.33 (35.26)
SE (m±)	2.84	2.48	2.74	2.69
C.D. (P=0.05)	NS	NS	NS	NS
C.V. %	12.18	11.6	11.06	11.61

DAS-Days After Sowing, Figures in the parentheses indicate Arc sine transformation (green boll damage).

Table 2: Percent boll and locule damage due to pink bollworm at harvest.

Treatment	% Boll Damage	% Locule Damage
I Factor A Sowing dates		
D1-Early Sowing (5 June)	40.62 (39.59)	17.75 (4.21)
D2-Timely Sowing (25 June)	38.09 (38.11)	15.03 (3.88)
D3-Late Sowing (15 July)	34.30 (35.85)	13.84 (3.72)
'F' test	Sig	Sig
SE (m±)	0.93	0.43
C.D. (P=0.05)	2.72	1.25
II Factor B- Different Cotton Varieties		
V1-Bt Hybrid (RCH-2)	37.97 (38.04)	14.86 (3.86)
V2-Non Bt <i>Hirsutum</i> (DCH-32)	41.06 (39.85)	18.92 (4.35)
V3- <i>arboreum</i> Var. (AKA-7)	36.92 (37.41)	14.68 (3.83)
V4- <i>arboreum</i> Hy. (Suvarna)	34.74 (36.11)	13.69 (3.70)
'F' test	Sig	Sig
SE (m±)	1.07	0.49
C.D. (P=0.05)	3.15	1.44
III Interaction (A×B)		
D ₁ V ₁	41.57 (40.15)	15.82 (3.98)
D ₁ V ₂	43.38 (41.19)	22.10 (4.70)
D ₁ V ₃	40.19 (39.34)	18.34 (4.28)
D ₁ V ₄	37.35 (37.67)	14.74 (3.84)
D ₂ V ₁	38.71 (38.47)	14.61 (3.82)
D ₂ V ₂	41.00 (39.81)	19.23 (4.38)
D ₂ V ₃	37.45 (37.73)	12.69 (3.56)
D ₂ V ₄	35.22 (36.41)	13.59 (3.69)
D ₃ V ₁	33.63 (35.45)	14.16 (3.76)
D ₃ V ₂	38.79 (38.52)	15.44 (3.93)
D ₃ V ₃	33.11 (35.13)	13.01 (3.61)
D ₃ V ₄	31.65 (34.23)	12.74 (3.57)
'F' test	Non Sig	Sig
SE (m±)	1.85	0.85
C.D. (P=0.05)	00	2.49
C.V. %	8.54	9.48

Figures in the parentheses indicates \sqrt{X} transformation (locule damage), DAS-Days After Sowing, Figures in the parentheses indicate Arc sine transformation (boll damage).

Table 3: Yield of seed cotton (q/ha)

Treatment			
I Factor. A- Sowing dates		III Interaction (A×B)	
D1-Early Sowing (5 June)	786.62	D ₁ V ₁	1035.96
D2-Timely Sowing (25June)	974.63	D ₁ V ₂	803.75
D3-Late Sowing (15 July)	790.33	D ₁ V ₃	604.52
SE (m±)	18.93	D ₁ V ₄	702.23
C.D. (P=0.05)	55.51	D ₂ V ₁	1288.05
II Factor B- Different Cotton Cultivars		D ₂ V ₂	559.84
V1-Bt Hybrid (RCH-2)	1108.62	D ₂ V ₃	705.56
V2-Non Bt(DCH-32)	850.63	D ₂ V ₄	887.08
V3- <i>arboreum</i> Var. (AKA-7)	643.92	D ₃ V ₁	1001.84
V4- <i>arboreum</i> Hy. (Suvarna)	798.93	D ₃ V ₂	730.30
SE (m±)	21.86	D ₃ V ₃	621.70
C.D. (P=0.05)	64.10	D ₃ V ₄	807.49
		SE (m±)	37.85
		C.D. (P=0.05)	111.02
		C.V	7.71

4. Conclusions

Minimum pink bollworm infestation was recorded on *arboreum* hybrid (Suvarna) followed by *arboreum* variety (AKA-7) and Bt BG II hybrid (RCH-2), whereas a maximum was recorded in non Bt *hirsutum* hybrid (DCH-32). Maximum pink bollworm infestation in loculi at harvest was observed in early sown non Bt *hirsutum* hybrid (DCH-32), whereas minimum infestation was recorded in timely sown of *arboreum* variety (AKA-7). 37.97, 41.06, 36.92 and 34.74 percent boll damage and 14.86, 18.92, 14.68 and 13.69 percent loculi damage were recorded in Bt hybrid (RCH-2), non Bt *hirsutum* hybrid (DCH-32), *arboreum* variety (AKA-7), *arboreum* hybrid (Suvarna), respectively due to pink bollworm infestation.

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6. Reference

- Anonymous. Cotton advisory board (CAB), 2016.
- Kranthi KR. CICR- Vision 2030. Central Institute for Cotton Research, Nagpur. http://www.cicr.org.in/pdf/cicr_vision_2030.pdf, 2011.
- Green MB, Lyon DJ de B. (Eds). Pest management in cotton. Society of Chemical Industry/Ellis Horwood Limited, Chichester. 1989, 259. (ISBN0 7458 0452 7)
- Amin AA, Gergis MF. Integrated management strategies for control of cotton key pests in middle Egypt. *Agron. Res.* 2006; 4:121-128.
- Naik VC, Jothi Dhara B, Dabhade PL, Kranthi S. Pink bollworm (Saunders) infestation on Bt and non-Bt hybrids in India in 2011-2012, *Cotton Research Journal.* 2014; 6(1):37-40.
- Kranthi KR. Pink bollworm strikes Bt cotton. *Cotton Statistics News.* 2015; 35:1-6.
- Patil SB. Studies on the management of cotton pink bollworm *Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelichiidae). Ph. D. thesis, University of Agricultural Sciences, Dharwad, 2003.
- Suresh R. Seasonal activity and management of cotton pink bollworm *Platyedra gossypiella* (Saunders) (Lepidoptera: Gelechiidae) M.Sc. (Agri.) Thesis,

University of Agricultural Science, Dharwad, 2001.

- Henneberry TJ, Jech LF. Seasonal pink bollworm, *Pectinophora gossypiella* (Saunders), infestations of transgenic and non-transgenic cottons. *Southwestern Entomol.* 2000; 25(4):273-286.
- Sharma OP, Lavekar RC, Pande AK, Rathod KS, Jafir AA, Murthy KS *et al.* Validation and adoption of biointensive Ashta cotton IPM module at Sonkhed and Dongargaon villages in Southern Maharashtra. *Ann. Pl. Prot. Sci.* 2001; 12:425-475.
- Patil BV, Bhemmanna M, Hanchinal SG, Kengegouda N. Performance and economics of Bt cotton cultivars in irrigated ecosystem. Inproceedings of International symposium on Sustainable cotton production- Aglobal Vision 23-25 November 2004, UAS Dharwad, India. 2004, 139-142.
- Vennila S, Biradar VK, Gadpayle JG, Panchbhai PR, Ramteke MS, Deole SA *et al.* Field evaluation of Bt transgenic cotton hybrids against sucking pests and bollworms. *Indian J. Pl. Prot.* 2004; 32:1-10.
- Bhemanna M, Patil BV, Biradar DP, Sharanabasappa, Hosamani AC. Screening of Bt Cotton Hybrids Against Bollworms. *Indian J. Entomol.* 2010; 72(1):48-52.
- Wu K, Guo Y, Lu N, Greenplate JJ, Deaton R. Efficacy of transgenic cotton containing Cry 1Ac gene from Bt against *Helicoverpa armigera* (Lepidoptera: Noctuidae) in North China. *Journal of Economic Entomology.* 2003; 96(4):1322-1328.