

Strategies for management of Pink boll worm *Pectinophora gossypiella* (Saunders) in cotton through different methods

ABSTRACT

The present study of experiment entitled on the strategies for management of pink boll worm *Pectinophora gossypiella* (Saunders) in cotton through different methods was conducted in farmers fields as a form of Frontline Demonstration (FLD). The experiment was conducted in 30 locations in Nalgonda and Yadadri bhuvangiri districts of Telangana during kharif 2018, 2019 and 2020 respectively. The results revealed that, due to the adoption of IPM practices in addition to good agricultural practices, the average kapas yield was high in IPM demonstration plots (1857.0 kg/ha) with 12.0% increase over the farmers' practice (1658 kg/ha) during three years of study.

The average gross returns of Rs.1,01,007/ha, net returns of Rs.52,027/ha, and Benefit-cost ratio of 2.05 was recorded as higher in the demonstration plot as compared to farmers practice Rs. 90,121/ha, Rs.37,430 and 1.69 respectively during the study period. The additional average net returns of Rs.14,597/ha and reduction in the cost of cultivation of Rs.1912/ha were saved per year.

Keywords: Cotton, economics, frontline demonstration, pink bollworm, yield.

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is one of the most important commercial fiber crops of India and plays a dominant role accounting for 30 % of the agricultural domestic product [1]. In India, cotton crop was cultivated in an area of 13.48 M. hectares with a production of 36.07 Million bales which accounts for 37% of world's area [2]. India is one of the largest producers as well as consumers of cotton in the world. In India approximately 62% of the cotton area is under rainfed ecosystem and only 38% of area is under irrigation. In the world, India is the only country which cultivates all the four species of cotton [3]. In India, there are nine major cotton growing states, which are grouped into three diverse agro-ecological zones, i.e., Northern zone comprising of Punjab, Haryana and Rajasthan, Central zone includes the States like Gujarat, Maharashtra and Madhya Pradesh and Southern zone comprising of States like Telangana, Andhra Pradesh and Karnataka [4].

Cotton crop is being swarmed by 1326 insect pest species on the planet, and in India, just 166 arthropod pest species were recorded. Yield losses due to insect pests ranged from 50-60% [5]. The major boll worm complex pests are listed in the below table 1.

Table.1: Major pests of boll worm complex in cotton crop.

S.No	Common name	Scientific name
01.	American bollworm	<i>Helicoverpa armigera</i> (Hübner)
02.	Tobacco caterpillar	<i>Spodoptera litura</i> (Fabricius)
03.	Spotted bollworm	<i>Earias vittella</i> (Boisduvel)
04.	Pink bollworm	<i>Pectinophora gossypiella</i> (Saunders)

Read adoption efficacy article After the introduction of Bt Cotton i.e Boll guard-I technology which consist of Cry1Ac protein in 2002 and Boll guard technology-II which consist of Cry1Ac and Cry2Ab protein in 2006 the incidence of bollworm complexes on the crop has drastically reduced. Both the production and productivity of cotton in India have improved significantly during the past few decades. In the recent past, Bt-cotton technology is unable to protect the cotton crop from pink bollworm due to the development of resistance against Cry1Ac and Cry2Ab toxins in India [6]. The pink bollworm developed resistance to Cry1Ac in 2009 and 2010 and survived on all Bt-cotton

hybrids in Karnataka, Andhra Pradesh[7]. It became a major and most destructive pest of cotton having national importance by causing severe yield losses[6]. The incidence of Pink Bollworm (PBW) was increasing in the recent past. In India, the productivity levels are very low compared to other countries like USA and China.

The pinkboll worm Larvae cause damage from the flowering to harvesting stage by feeding on anthers, pollens, flowers, green bolls, locules, lint, and seed. The damaged flowers are twisted in the form of a rose called as "rosette flowers". The larvae initially bore inside the green bolls with making minute hole, burrow into lint and then penetrate seeds. The affected bolls rot, shed prematurely. (Symptomatology may be in detail and in separate para with adequate pictures). While opening, immature fibers deteriorate the quality of lint.

On an overall the infestation of pinkboll worm ranges from 40-95% in Bt-cotton [8]. The range of incidence of infestation of this pest varies with different growth stages viz. during early flowering stage 3.09 to 29.26% and late infestation was 36-90%, green boll and locule damage was upto 13.58% in Telangana, Maharashtra, Andhra Pradesh and Gujarath [9]. The reduction in seed cotton yield was 61.9% and 59.2% bolls were normal in opening nature through pink bollworm and infestation ranged from 20-40% [10]

The pink bollworm incidence was high due to cultivation of long-duration hybrids, continuous hosts throughout the year, long term storage of raw cotton at ginning mills. Further, non-adoption of refugia, less expression of *Bt*-toxin in squares, flowers, and developing seeds in young bolls, extension of crop upto April-May and early sowings of seed production plots of cotton in May are favourable for the pink bollworm survival. [6] [11] [12]

The management of pink bollworm with conventional insecticides is very difficult; and is not a viable solution in long term. Insect resistance was developed due to repeated sprayings and no single method would be completely satisfactory to manage this pest. Integration of different pest management practices like Cultural, Mechanical, Physical, Biological and Chemical control the pest below Economic Threshold Level (ETL). Hence, the present study was undertaken to assess the efficacy of IPM module in the field conditions against pink bollworm in cotton in Nalgonda and Yadadri Bhuvanagiri districts of Telangana.

MATERIALS AND METHODS

Frontline demonstrations were conducted to assess the strategies for management of pinkboll worm through different methods in cotton in farmer's fields conducted by the (District Agricultural Advisory and Transfer of Technology) DAATT Centre during *kharif* 2018, 2019 and 2020. The farmers were sensitized on the relevance of these technologies by organizing pre-Kharif awareness programmes, focused group discussions, conducting method demonstrations, and training programmes. Based on the response for sensitization programme from farmers, a total 30 demonstrations were organized in two districts i.e. Nalgonda and Yadadri Bhuvanagiri with 10 locations in each season every year. The total experimental area with 0.4 Ha. for each location in that 0.2 Ha. selected as a demonstration plot and all IPM practices were imposed and 0.2 Ha. of remaining field of was treated as check. (Table.2)

The improved Integrated Pest Management practices comprised of incorporation of cotton crop stubbles in the field by tractor drawn cotton shredder, deep summer ploughings to eliminate pupa and larval diapauses stages, adoption of community sowing in village, installation of pheromone traps at 45 days after sowing @ 10/ha to monitor the pest, removal and destruction of rosette flowers from 45 - 70 days after sowing, spraying of Azadirachtin 0.15% EC @ 5 ml/l with sandovit @ 1 ml/l at 40-45 days of the crop, spraying of Emamectin benzoate 5% SG @ 0.5 g/l, Chlorantraniliprole 18.5 EC @ 0.3 ml/land spinosad 45% SC @ 0.375 ml/l alternatively at an interval of 7 - 10 days depending on pest load, terminate the crop between 180-200 days, erection of bird perches 10/acre. Whereas, farmer's practice include spraying of Acephate @ 1.5 g/l at 20 day after sowing. Spraying of synthetic pyrethroids like lambda-cyhalothrin @ 1 ml/l, cypermethrin @ 1.25 ml/l, Chlorantraniliprole + lambda-cyhalothrin @ 0.4 ml/l alternatively at an interval of 7-10 days depending on the pest load from 45 days after flowering to end of the crop.

The FLD was conducted to study the potential yield reduction factors that are mainly due to the pests and yield difference between the farmer's practice and demonstration. A random crop cutting experiment was conducted and the yield data of farmer's practice and demonstration trial was recorded. The qualitative data was converted into quantitative form and expressed in terms of per cent increase in yield. Other data parameters like cost of cultivation, gross returns, net returns,

and benefit-cost ratio were recorded.

RESULTS AND DISCUSSION

The results of the frontline demonstration on strategies for management of pinkboll worm in cotton through different methods were presented (Table 2). Pooled mean yield was recorded in demonstration plot was 18.57 q/ha which is significantly superior over the farmer's practice plot 16.58/ha i.e 12.0% increase in demonstration plot. The year wise cotton yields were 16.20 q/ha, 22.48 q/ha, and 17.04 q/ha in demonstration plot respectively, whereas in farmer's practice it was 14.85 q/ha, 19.54 q/ha, and 15.34 q/ha respectively. These results clearly indicated that adoption of IPM practices like installation of Pheromone traps from 4/acre for mass trapping, collection and destruction of rosette flowers, erection of bird perches, spraying of azadiractin 1500 ppm@ 5 ml/lit and spray of Emamectin benzoate @0.5 g/l have significant impact over the farmer's practice. whereas, the yields were low in farmer's practice due to non-adoption of IPM practices. The findings are inline with Shankar *et al.*, 2022 [13]

The economic indicators, i.e gross returns, net returns, B:C ratio of frontline demonstration were illustrated in Table 2. The data clearly envisages that gross returns, net returns, and BC ratio were substantially higher in the demonstration plots than farmer's practice during all the years of the study. The average gross returns from demonstration practice were Rs.101007/ha compared to Rs.90121/ha. The net returns from demonstration practice were Rs. 52,027/ha compared to Rs.37430/ha in farmers practice the results are tune with Shankar *et al.*, 2022 [13]. The average cost of cultivation was low of Rs. 50,779 in demonstration plot and it was of Rs. 52691 in farmer's practice during the study period.

The Benefit cost ratio of frontline demonstration was illustrated in table 2. The benefit cost ratio of demonstration plot and farmers practice were recorded as 1.81, 2.23 and 2.21, 1.47, and 1.81 and 1.80 during kharif 2018, kharif 2019 and kharif 2020 respectively. The cumulative effect of technological interventions over three years revealed an average benefit cost ratio of 2.05 in demonstration plots compared to 1.69 in farmers practice. The results are in tune with the findings of Narendar *et al.*, (2021) [14]. who observed additional net returns and increase in B:C ratio among FLD farmers.

The incidence and damage of pink bollworm was minimum in demonstrations plots due to adoption of Integrated Pest Management technologies viz., identification of pest and damage symptoms at the field level, regular monitoring of pest through field visits, suggestions given by DAATT Centre scientists from time to time. Application of IPM components and strong linkages with farmers and scientists to understand the role of a pest monitoring, the concept of ETL and need-based application of pesticides was benefitted the farmers. The incidence was high in farmers' practice due to non-adoption of IPM practices and lack of awareness on new technologies. Similar results were reported by Kolhe *et al.* (2017) [15] who observed that pink bollworm incidence was low in demonstration plots.

CONCLUSION

The present demonstration conducted by the DAATT Centre scientist indicates that the extension activities carried out in the field has enhanced the skill and knowledge of the farmer. This resulted the demonstration plot with high yields, high gross returns, net returns, Benefit cost ratio, low cost of cultivation.

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Table.2: Yield and economics of cotton between farmers practice and demo practice during kharif 2018-2020.

S. No	Year	Area (Acres)	District wise and year wise number of demonstrations		Yield q/ha			Gross returns Rs./ha		Cost of cultivation Rs./ha		Net returns Rs./ha		B:C ratio	
			Nalgonda	Yadadri bhuvanagiri	Farmer practice	Demo	% Increase	Farmer practice	Demo	Farmer practice	Demo	Farmer practice	Demo	Farmer practice	Demo
1.	2018-19	10	05	05	14.85	16.20	9.09	77220	84240	52500	46500	24720	37740	1.47	1.81
2.	2019-20	10	05	05	19.54	22.48	15.04	106471	122505	57500	55000	48971	67505	1.81	2.23
3.	2020-21	10	05	05	15.34	17.04	11.08	86671	96276	48073	50836	38598	50836	1.80	2.12
4.	Average	10	05	05	16.58	18.57	12.00	90121	101007	52691	50779	37430	52027	1.69	2.05