

Strategies for management of Pink bollworm through Integrated Pest Management

ABSTRACT

The present study of the frontline demonstration on the Efficacy of Integrated Pest Management (IPM) practices against pink bollworm was carried out to assess the damage incidence caused by the pink bollworm *Pectinophora gossypiella* (Saunders) and its effective management strategies conducted in 30 farmer fields of Nalgonda and Yadadri Bhuvanagiri districts of Telangana during kharif 2018, 2019 and 2020 respectively (Split into two or three simple sentences). The results revealed that, due to the adoption of IPM practices along with addition to good agricultural practices, the average kapas yield was high in IPM demonstration plots (1857.0 kg/ha) with a percent increase of 12.0% increase over the farmers' practice (1658 kg/ha) during three years of study.

The mean percent of rosette flowers, green boll damage, and the number of larvae per 50 flowers was 11.93%, 9.05%, and 17.87 respectively recorded in the demonstration plot which is significantly lower than the check plots i.e., 15.93%, 13.20%, 21.90 respectively. Pheromone trap catches were recorded at 28.67 in the demonstration plot. 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 three years of 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.

(Please split and reframe into simple sentences in the second para)

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 (Reference). 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 (name the species) of cotton (Reference). 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 [2].

Cotton crop is being infested by 1326 insect pest species in the world, and in India, only 166 arthropod pest species were recorded. Yield losses due to insect pests ranged from 50-60% (Puri et al., 1999) (Please follow uniform pattern in mentioning the references); and due to arthropod pests ranged from 20-60% (Please reframe the sentence). The major pests of bollworms in cotton are American bollworm, *Helicoverpa armigera* (Hübner), Tobacco caterpillar, *Spodoptera litura* (Fabricius) spotted bollworm, *Earias vittella* (Boisduval), *E. insulana* (Fab.) and pink bollworm, *Pectinophora gossypiella* (Saunders) (Present this sentence in tabular form).

After the introduction of Bt Cotton (BG-1, cry1Ac – describe /what is this gene) in 2002 and (BG-II, cry1Ac, and cry2Ab - describe /what this gene) 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 (Please follow uniform pattern in describing the gene name) toxins in India [3]. The pink bollworm developed resistance to Cry1Ac in 2009 and 2010 and survived on all Bt-cotton hybrids in Karnataka, Andhra Pradesh [4]. It became a major and most destructive pest of cotton having national importance by causing severe yield losses [3]. 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 pink boll worm Larva caused 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. The infestation ranged between 40 - 95% in *Bt*-cotton [5], early flower infestation was 3.09 - 29.26% and late infestation was 36 - 90% in Telangana, Maharashtra, Andhra Pradesh and Gujarat [6]. Green boll damage, locule damage 13.58% in *Bt*-cotton (**Please reframe into a meaningful sentence**). The reduction in seed cotton yield was 61.9% and 59.2% bolls were normal in opening nature through pink boll worm infestation ranged from 20-40% [7] and where as it is 20 - 90% (**Please reframe the sentence**).

The pink boll worm 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 up to April-May and early sowings of seed production plots of cotton in May are favourable for the pink boll worm survival (**Please provide adequate references and this details may be provided in tabular form**).

The management of pink boll worm with conventional insecticides is very difficult; and is not a viable solution in long term to control this pest. Insect resistance was developed due to repeated sprayings and no single method would be completely satisfactory to manage this pest and integrated pest management practices will (i.e., cultural, mechanical, physical, biological and chemical) control the pest below ETL (**Please reframe into simple sentences**). Hence, the present study was undertaken to assess the efficacy of IPM module in the field conditions against pink boll worm in cotton in Nalgonda and Yadadri Bhuvanagiri districts of Telangana.

MATERIALS AND METHODS

Frontline demonstrations were conducted to assess the efficacy of Integrated Pest Management practices against pink boll worm in cotton in farmer's fields 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, training programmes and sending timely messages through AKPS, and WhatsApp groups (**Please mention the standard references**). Based on the response for sensitization programme from farmers total 30 demonstrations were organized in two districts i.e. Nalgonda and Yadadri Bhuvanagiri with 10 locations in each season every year. Each demonstration was laid out in 0.4 ha selected as a demonstration plot and all IPM practices were imposed and an adjacent field of 0.4 ha was treated as a check (**Please mention the total number of demonstration plots in a tabular form with respect to the districts**).

The improved Integrated Pest Management practices comprised of incorporation of cotton crop stubble in the field by tractor drawn cotton shredder, deep summer ploughing to eliminate pupa and larval diapause 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/l and 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 includes spraying of Acephate @ 1.5 g/l, synthetic pyrethroids like lambda-cyhalothrin @ 1 ml/l, cypermethrin @ 1.25 ml/l, Chlorantraniliprole + lambda-cyhalothrin @ 0.4 ml/l from flowering stage to end of the crop.

(**Please mention the schedules of these practices**)

Data were recorded on percentage of rosette flowers, green boll damage, Number of larvae per 50 flowers, pheromone trap catches per week. At the end of crop, seed cotton yield and economic parameters were computed (**Please give the duration or the period or time of data collection**).

The FLD was conducted to study the potential yield reduction factors that are mainly due to

the pests and yield difference between the farmers 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 efficacy of IPM in cotton (Table 1). Pooled mean yield was recorded in demonstration plot recorded 18.57 q/ha which is significantly superior over the farmer's practice plot which was 16.58/ha, which is 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 recorded in demonstration plot respectively, where as in farmer's practice it was recorded 14.85 q/ha, 19.54 q/ha, and 15.34 q/ha during kharif 2018, 2019 and 2020 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 of water. 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 [8]

The economics indicators, i.e gross returns, net returns, B:C ratio of frontline demonstration were illustrated in Table 1. 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 demonstration. 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 [8]. 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 1. The benefit cost ratio of demonstration plot and farmers practice were recorded as 1.81, 2.23 and 2.21 and 1.47, 1.81 and 1.80 during kharif 18, kharif 19 and kharif 20 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) [9]. who observed additional net returns and increase in B:C ratio among FLD farmers.

The incidence of pink bollworm was minimum in demonstration plots due to adoption of Integrated Pest Management technologies viz., creating awareness on the 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 pest monitoring, the concept of ETL and need-based application of pesticides. 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) [10] who observed that pink bollworm incidence was low in demonstration plots.

(Please reframe the result portion into a meaningful simple sentences)..

CONCLUSION

The present demonstration conducted during kharif 2018, 2019 and 2020 by the DAATT Centre scientist indicated that with the result of extension activities carried out in the field condition, the demonstration plot recorded high yields, high gross returns, net returns, Benefit cost ratio, low cost of cultivation. The incidence of pink boll worm in rosette flowers, green boll damage and number of larvae per 50 percent flowers were low in demonstration practice compared to farmers practice.

(Please reframe into simple sentences)..

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Table.1: Yield and economics of cotton between farmers practice and demo practice during kharif 2018-2020.

S. No	Year	Area (Acre s)	Yield q/ha			Gross returns Rs./ha		Cost of cultivation Rs./ha		Net returns Rs./ha		B:C	
			Farmer practice	Demo	% Increase	Farmer practice	Demo	Farmer practice	Demo	Farmer practice	Demo	Farm er practice	Demo
1.	2018-19	10	14.85	16.20	9.09	77220	84240	52500	46500	24720	37740	1.47	1.81
2.	2019-20	10	19.54	22.48	15.04	106471	122505	57500	55000	48971	67505	1.81	2.23
3.	2020-21	10	15.34	17.04	11.08	86671	96276	48073	50836	38598	50836	1.80	2.12
4.	Average	30	16.58	18.57	12.00	90121	101007	52691	50779	37430	52027	1.69	2.05

(Please provide uniform area details)