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Innovative Front Line Demonstrations to Enhance Cotton Income through Integrated Pest Management

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Abstract- Cotton (*Gossypium spp.*) is a major cash crop, being the world's leading natural fibre for the manufacture of textiles and edible oil. Cotton crop suffers more from insect pest attack. Farmers solely depend on calendar based pest management chemical strategies which not only increases cost of production but it is also non eco friendly. The integrated pest management strategy involving many components was demonstrated through innovative large scale contagious technology demonstration in 100 hectare cotton crop area in three consecutive years 2009-10, 20010-11 and 2011-12 during Kharif season in rain fed track of Belgaum district in Karnataka, India. The various production and protection parameters indicated that adoption of IPM strategies decrease the cost of production without affecting the yield. The IPM demonstration, insecticides sprays quantity reduction in Bt and non Bt cotton was 2.29 and 2.68 liters per hectare respectively as compared to the local check. Adoption of IPM technology increased the net income over the local check both in Bt cotton (Rs. 4285/ha) and non Bt (Rs. 6867 /ha) cotton hybrids.

Index Terms: **Cotton Hybrids, IPRM Strategies and IPM.**

I. INTRODUCTION

Cotton (Gossypium sp) white gold is a major commercial crop grown in India. Over 1000 species of insects and mites have been recorded on cotton (Hargreaves, 1984). Among these, 162 species of insects have been reported to attack cotton at various growth stages and 15 are considered as key pests (Puri, 1998). There are some studies that find that Bt cotton does not significantly increase yield and income and bollworms continue to grow (Hayee 2005), These studies identify a variety of factors for the failure of Bt cotton such as limited knowledge on how to use the technology, prevalence of a black market for un-improved Bt cotton varieties, and climatic variations and other disasters. Negating these findings are studies by Sheikh et al. (2008), Nazli (2009, 2010) and Ali and Abdulai (2010), who indicate that the overall outcome of adopting Bt cotton is positive for all farm categories, but in varying degrees. While the literature on the impacts of Bt cotton on small farmers is mixed, other worries remain about the long term impacts of Bt cotton. Two public bads that can occur are the loss of biodiversity and genetic pollution (Park et al.(2011). Biodiversity loss may occur as farmers start planting only Bt cotton on their farms. Study of Pray et al. (2002), report that a larger percent of non-Bt growing farmers (around 22 percent) identified various health problems related to pesticide use compared to farmers planting only Bt cotton (5-8 percent). Kousar and Qaim (2011) also argue that Bt cotton has led to a notable decline in acute pesticide poisoning cases among cotton growers in India.

The magnitude of pest problem forced cotton growers to depend heavily on insecticides, about 56 per cent of the insecticides produced was consumed by this crop alone. This has really caused ecological disaster and resistance of pests to pesticides. It awakened wide scale public concern about excess use of pesticides and led to the emergence of Integrated Pest Management (IPM) concept as an environmentally safe alternative to sole use of insecticides. Karnataka was one of the important cotton areas in India and covered an area of 6.05 lakh ha in 1998-99 (Anonymous 2007). This area in the state decreased year by year (3.62 lakh ha in 2002-03) owing to pest problem and more cost on protection measures. The yield levels also decreased from 244 kg lint per hectare in 1998-99 to 201 kg lint per hectare in 2005-06 (Anonymous 2007). Though IPM developed long back, the technological knowledge and adoption rate was low in the minds of cotton farmers. The improved technology package was found beneficially attractive, yet adoption levels for several components were low, hence emphasizing the need for better dissemination innovative large scale 100 hectare IPM front line demonstration was planned and implemented successively three consecutive years to diffuse and influence the practices of IPM technology on yield, cost of plant protection, quantity of pesticides consumption and frequency of pesticides sprays.

II. METHODOLOGY

Large scale integrated pest management demonstrations were conducted with medium staple cotton hybrids in a contagious area of 100 hectares during three consecutive years starting from 2009-10 in rain fed tracks of Belgaum district of Karnataka state during Kharif season. The 100 hectares in three years in three different locations o

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f the district involving 214 farmers in all the three years irrespective of their farm size and cotton crop area. The selection of taluk, village and farmers were made purposively looking the criteria of continuity of cotton crop in that area, cotton crop pest population, use of more number and dosage of synthetic pesticides and lack of IPM pa ckage of practices. Before conducting of demonstrations the actual existing field problems of cotton growing far mers and technological gaps in cotton production were identified with due care through extension methods like s urvey, group discussion, secondary data and gram Sabha. During the conduct of these resource inventory techni ques farmers were facilitated to express the constraints in the production of cotton crop over the years. Due care was taken to listen and consider the field experiences of progressive cotton growers, medium to big land holders and categories of farmers and gender.

The components of IPM demonstration in non Bt cotton were summer ploughing, sowing of insecticides treated seeds, sowing of eco-feast (Cowpea), boarder crop (Maize) and trap crop (Bhendi), stem smearing with Imidach loprid at 35 days of crop, monitoring of pest load through pheromone traps, trichogramma egg release, spray wit h HNPV, need based application of neem and need based sprays of chemical pesticides. In case of IPM demonst ration with Bt hybrids all the practices excluding the release of trichogramma egg card and HNPV. Data on yiel d gaps between potential yield and demonstration yield, extension gap, technology index, quantity of insecticide s used and reduction of plant protection were the parameters observed to analyze the impact of IPM in enhancin g the productivity in turn net income from cotton cultivation. The insect pest population level and stage of crop was considered to impose the IPM components. Traditional calendar based pest management practices were con sidered as local check for comparative study.

Technological gap, extension gap and the technological index were calculated using the following standard form ula (Samui, et. Al 2000).
Technology gap = Potential yield – Demonstration yield
Extension gap = Demonstration yield – Farmers / Local check yield
Technology index = [(Potential yield – Demonstration yield) / Potential yield] x 100

III. RESULTS AND DISCUSSION

The data presented in the table 1 revealed that the yield difference between potential, demonstration and local ch eck attributed for the fact that the cotton was grown in the rain fed situations during Kharif season. The study re vealed that there was no much difference in the yield of Bt and non Bt hybrids both in the demonstration and loc al check. The per cent increase in the yield of Bt and non Bt was 4.89 and 8.96 respectively. These results indica te that the IPM technology had no impact irrespective of Bt and non Bt hybrids yields.

The technology gap in the yield of Bt and non Bt was 16.81 q/ha and 13.68 q/ha respectively. The probable reas on for this gap may be due to the soil type. Generally as seen in the demonstration field's non Bt cotton hybrid was cultivated in medium red and red sandy soils, where as Bt cotton hybrid was cultivated in medium to deep b lack soils. The extension gap was 0.96 q/ha and 1.78 q/ha in Bt and non Bt cotton hybrids respectively. The data shows that there was no much extension gap in the yield levels; however some more efforts are yet to be interve ned to convince the advantages and effectiveness of IPM technologies. The knowledge up gradation on eco frien dly farmer friendly and cost effective technologies, time of proper use of IPM inputs and accessibility of IPM in puts at times of need may definitely create positive impact on the enhanced yields of cotton irrespective of Bt an d non Bt hybrids and also influence in the reduction of cotton pest load. The IPM technologies demonstrated eve ntually lead the farmers to discontinue the old practices with adoption of demonstrated practices.

The technology index showed the feasibility of the evolved technology at farmer's fields. The lower the value of technology index the more shall be the feasibility of the technology. The technology index of Bt and non Bt hyb rids was 42.08 per cent and 39.09 per cent respectively. Considering these data it seems that the technology is 6 0 per cent feasible. However, in view of the ecological safety and net economic benefits (Table 2) the technolog y is much feasible as IPM technology includes ecologically safer pest management practices.

The additional income due to increased yield and saving on plant protection chemical in Bt cotton was Rupees 2 544/- and Rupees 1741/- per hectare respectively. (Table 2 & 3), where as in non Bt hybrids it was Rupees 4717 /- and Rupees 2150/- respectively. These data showed that the adoption of IPM technology increased the net inc ome over the local check both in Bt cotton (Rs.4285 per hectare) and non Bt cotton (Rs. 6867 per hectare) hybri ds. The data on number of sprays in Bt and non Bt showed reduction in number, hence it can be concluded that I

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PM technology reduces chemical load on cotton production system.

IV. CONCLUSION

Farmers around the world both large and smallholders benefit from this technology through increased productivi ty, convenience and time savings. The vast majority of farmers using Bt cotton globally are smallholder farmers. The economic, environmental, and social benefits derived from adoption of this important tool have very positi ve implications for the farmers, their surrounding communities and the future of agriculture. (Purcell, J.P.,& Perl ak, F.J., 2004) It was concluded that if the profitability status of Bt cotton cultivation in the area could be enhanc ed, the sustainability status of Bt cotton could be increased (Nithy et al. 2009).

In cotton production system, IPM technology was found as imperative for common pest problems. The adoption of IPM technology increased the net income. There is need to adopt multipronged strategy that involves enhanc ing income of cotton farmers through effective management of insect pest with the adoption of IPM technology. Hence, the technology may be popularized to mitigate the extension gap.

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APPENDIX

Table 1. Productivity, Yield Gap and Technology Index of IPM Demonstration

Type of Cotton	Average Yield (Kg/ha)			Per Cent Increase in Yield	Technology Gap	Extension Gap	Technology Index
	Potential	Demonstration	Local Check				
Bt Cotton Hybrid	40.00	23.17	22.21	4.89	16.81	0.96	42.08
Non Bt Cotton Hybrid	35.00	21.32	19.54	8.96	13.68	1.78	39.09

Table 2. Economics of IPM Demonstration

Type of Cotton	Increased Yield (Extn Gap Over Local Check) (qtl/ha)	Average Price of Cotton (Rs./qtl)	Additional Income Due to Increased Yield (Rs./ha)	Amount Saved in plant Protection Chemical Over Local Check (Rs./ha)	Net Income Gained (Rs./ha)
Bt Cotton Hybrid	0.96	2650	2544	1741	4285
Non Bt Cotton Hybrid	1.78	2450	4717	2150	6867

Table 3. Cost of Plant Protection in Cotton IPM Demonstration

Type of Cotton	Cost of Plant Protection (Rs./ha)		Per Cent reduction in Cost of Plant Protection	Economic Extension Gap
	Demonstration	Local Check		
Bt Cotton Hybrid	2575	4316	40.67	-1741
Non Bt Cotton Hybrid	4104	6254	34.37	-2150

Negative digits of economic extension gap can be read as saving on plant protection chemicals.

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Table 4. Number of Sprays to Cotton IPM Demonstration

Type of Cotton	Number of Sprays		Per Cent reduction in Sprays	Extension Gap
	Demonstration	Local Check		
Bt Cotton Hybrid	4.08	6.02	31.85	-1.93
Non Bt Cotton Hybrid	5.90	7.78	24.29	-1.89

Negative digits of extension gap can be read as reduction in number of plant protection chemical sprayed in one hectare area.