TMC MM 3.2: Development and validation of IPM/ IRM strategies for Bt cotton under different ecosystems

INTRODUCTION

After introduction of Bt the cotton bollworm problem was solved upto an extent, but the severity of sucking pest was on the rise. Besides this, new insect pests that were hitherto uncommon on cotton were also becoming important at different locations e.g. mirid bug at Dharwad, stem weevil and mealy bug at Coimbatore. Since sucking pests were attaining importance as serious pests, the chances of their developing resistance to new chemistries increased, hence, monitoring for resistance against new chemistries was found necessary. It was also necessary to study the influence of the biotic and abiotic factors on gene expression (Cry1Ac) under different ecosystems. It was important to monitor for resistance development in the pink bollworm.

OBJECTIVES

- Development and validation of IPMIIRM strategies for Bt and conventional cotton under different ecosystems .
- Development of Economic Threshold Level (ETL) for *Helicoverpa armigera* (Hubner) .
- Influence of biotic (pests and diseases) and abiotic factors on Cry1 Ac expression in Bt cotton .
- Resistance monitoring to understand sucking pest and bollworms resistance to new chemistries .
- Software to assess eco-toxicity for insecticides to ensure eco-friendly window placement - CICR, Nagpur

SALIENT FINDINGS

The results obtained through different experiments are narrated below.

Integration of all eco-friendly Strategies and Validation of IPM Packages

The zone wise results of sucking pests, bollworms and natural enemies are depicted through Fig. 3.2.1 to 3.2.3

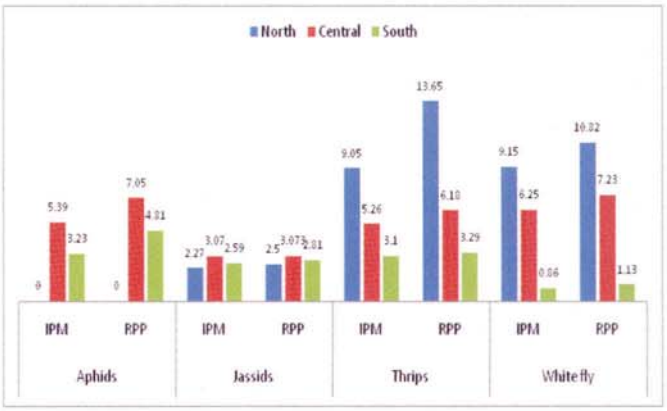


Fig. 3.2.1 : Average population of sucking pest in IPM and RPP plots in Bt cotton during 2009-10 .

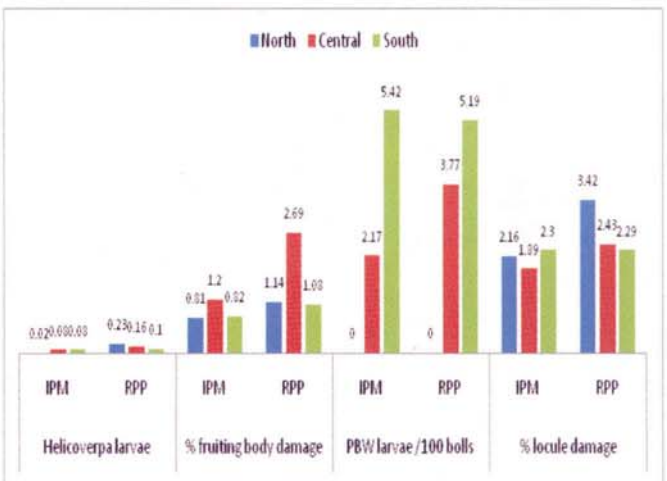
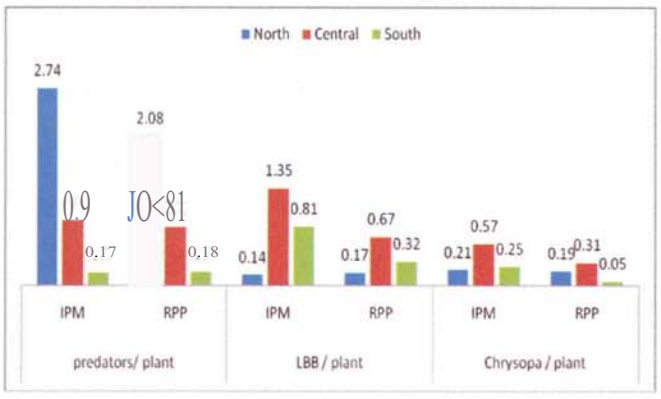


Fig. 3.2.2 : Average bollworm incidence in IPM and RPP plots in Bt cotton during 2009-10.

Table 3.2.1 : Yield and Economics of **IPM & RPP** plots in **Bt** cotton during 2009-10

Sr. No.	Nameof Centre	Seedcotton yield (q/ha) IPM	Costof plant Protection RPP	Net profit (Rs/ha) IPM	RPP	CBR IPM	RPP	IPM	RPP
A)	NorthZone	22.27	20.67	1816	2670	56923	51183	1:4.21	1:2,74
B)	CentralZone	22.77	18.18	3786	4507	59554	46700	1:5.67	1:3.75
C)	SouthZone	28.19	27.17	2898	4516	70797	64968	1:4.73	1:3.71
	OverallMean	24.41	22.01	2833	3897	62424	54283	1:4.87	1:3,73

Fig 3.2.3: Average population of natural enemies in **IPM & RPP** plots in Stcotton during 2009-10.



The IPM / IRM technology reduced the aphid, jassids, thrips, whitefly and bollworm populations than RPP, more over, the natural enemy population was also found to have increased in IPM/ IRM than RPP.

Similarly, the technology increased the net profit of Rs. 62,424/ha as compared to RPP (Rs. 54,283/ha) by achieving more cost benefit ratio in IPM/ IRM (1:4.87) than RPP (1:3.73)(table 3.2.1).

The IPM / IRM technology reduced pest population, increased natural enemies and the technology was environmentally safe and economically favorable.

Development of Economic Threshold Level (ETL) for *Helicoverpa armigera* (Hubner).

ETL's obtained for *H. armigera* in different locations is shown in table 3.2.2.

Table 3.2.2 : Economic Threshold level of *Helicovarpa armigera* on **Bt** cotton.

Name of centre	ETLlarvae/ plant
North zone	
Faridkot	22.28
Sirsa	3.85
Central zone	
Parbhani	1.12
Surat	2.03
South zone	
Raichur	1.28
Nandyal	1,45
Dharwad	0.76
Coimbatore	0.62

Influence of biotic (pests and diseases) and abiotic factors on *Cry 1Ac* expression in **Bt** cotton.

The results on influence of biotic and abiotic factors on Cry1 Ac expression in 8t cotton indicated that early stage of crop growth (100 DAS) Cry protein content was high in different plant parts which decreased at later stages of crop growth (160 DAS). Among the different parts of the plants, leaves recorded the highest content of Cry protein followed by squares and boll rind. The concentration of Cry1Ac protein increased with increase in the fertilizer dose. The expression level of Cry protein was observed to be on higher side in irrigated ecosystem compared to rainfed ecosystem.

Resistance monitoring to understand sucking pest and bollworms resistance to new chemistries.

Insecticide resistance was monitored for sucking pest resistance using jassid nymphs as test insects to conventional insecticides like monocrotophos and acephate and to neonicotinoids, imidachloprid and thiomethoxam. This study was carried across 5 labs following a common protocol with the same batch of insecticides at the same doses. The trial at Nagpur alone comprised of 12,000 insects per insecticide tested each time and bioassays were carried out more than once during the season. The toxicity to acephate ranged from LC50 0.0001 % (in Rajkot) to 0.011 % (in Indore) while for

monocrotophos it ranged from 0.0002% (in Junagarh) to 0.0113 % (Surendranagar). The toxicity to thiomethoxam ranged from 0.0002% (Junagarh) to 0.5% (Indore) while for imidachloprid it ranged from 0.00002% (Bhatinda) to 0.109% (Wardha). The resistance was 110 fold for acephate, 54 fold for monocrotophos, 2500 fold for thiomethoxam and 5450 fold for imidachlorprid. Resistance to neonocotinoids was the highest in central India, including Gujarat and Madhya Pradesh. While at CICR Sirsa, Jassid population from North India has still not acquired any resistance to commonly applied insecticides except dimehoate.

Rasi genotypes, both BG and BGII were the only genotypes very susceptible to leaf reddening at 85 DAS. Rasi 2 non Bt was free from leaf reddening. Sucking pests have recently been implicated in leaf reddening. However all the three Rasi genotypes harbored jassids at 3-4 nymphs/plant at the time of occurrence of leaf reddening.

SPECIFIC TECHNOLOGIES / RECOMMENDATIONS

Use of neonicotinoid sprays must be discontinued in central India on bt cotton.

Developed and validated IPM technology for Bt cotton.

EFFORTS MADE TO POPULARIZE THE TECHNOLOGY / RECOMMENDATION DEVELOPED

Efforts were made to popularize the technology amongst farmers through different extension activities conducted at different centers as below.

MAU, Parbhani

Organized 14 farmer's rallies, 25 field visits, 9 demonstrations, 9 exhibitions, 6 training programmes, 25 radio talks and 14 TV talks. Developed one illuminator and 7 digital charts for extension purpose

NAU, Surat

IPM technology was popularized among the farmers. During Farmer's day, Khedut Shibir, Krishi Mahotsav emphasis was given for successful transfer of IPM technology. During 2009-10, conducted 5 Kedut shibir, 3 on campus trainings , 5 field problems diagnosis and advice and one radio talk

UAS, Raichur

Demonstration was conducted in farmer's field to popularize the above recommendations in UKP and TBP project areas.

UAS, Dharwad

Demonstration of Bt IPM module were conducted both in main campus as well as ARS. The demonstrations were visited by thousands of farmers during mega Krishimela held in September. Under frontline demonstration Bt IPM technology was demonstrated at farmers field on an area of 50 ha involving around 50 farmers. The critical components viz okra seeds, pheromone traps, selective chemicals for sucking pest control, neem based insecticides were supplied to farmers. The performance of IPM technology was compared with farmers practice. At the end of the season, field day was organized involving University dignitaries and cotton scientists. IPM technology in Bt cotton was popularized through popular articles published in local magazines (Krishi sampada, Annadata etc.) and also through multicolored folders covering the details of IPM components and pests complex, their symptoms of damage. Popularization efforts were made through local TV channels viz DD-I, Annadata, Chandana channels by giving talks in IPM programme in Bt cotton. Training to field functionaries and extension workers on IPM were organized by Agricultural departments, government and non government agencies under mini mission III programme. During training, IPM technology was explained to farmers, trainers and extension workers.