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

Introduction:

Changes in pest scenario have become more common in recent times in the rapidly changing cropping systems and environment. Cotton scenario in India is now dominated by Bt cotton. While some pests have been impacted negatively (eg. *Helicoverpa* bollworm because of Bt cotton), hither to unknown minor pests are emerging as major pests (eg. mealy bug). Pest succession is an anticipated phenomenon. Agro-ecosystems need to be monitored continuously to understand the ecological processes that are in operation. One major event is likely to trigger multiple effects. In the context of pest scenario this has been witnessed very clearly in the case of Bt cotton replacing conventional cotton. Much of the knowledge on pest situation needs to be revisited in the changing times in a holistic manner and pest management has to be tuned accordingly. Integrated Pest Management is a system that emphasizes on appropriate decision-making and depends heavily on accurate and timely information for field implementation by practitioners. It needs continuous refinement and validation before implementation. Monitoring for bollworm resistance would facilitate in formulation of IPMjIRM strategies for slowing (~j6wnresistance development. The insect pests that are not targeted by Bt but cause damage need to be quantified firstly to know the estimates of loss followed by the establishment of economic threshold levels for their curative management using insecticides on Bt cotton. Since the Bt protein especially Cry lAc does not offer protection against *Spodoptera litura,* determination of ETLfor the pest was felt. The use of insecticides for management of non target pests again needs to consider biosafety attributes such that there happens compatible interventions in the cotton ecosystem that would allow natural operating biological forces to exercise their regulation in the given environmental conditions. Hence the frame work of the project towards applied pest management on Bt cotton formulated with the following objectives was executed during 2007-08, and the summary of results are furnished hereunder highlighting the major outcomes across centers.

Objectives:

1. Development of economic threshold levels on Bt cotton against insect pests with focus on Thrips, *Spodoptera litura and Helicoverpa armigera* on Bt cotton
2. Resistance monitoring to understand sucking pest and bollworms resistance to new chemistries
3. Software to assess eco-toxicity for insecticides to ensure ecofriendly window placement
4. Influence of biotic and abiotic factors on Cry lAc expression
5. Integration of all ecofriendly strategies and validation of IPM package on Bt cotton

Salient findings:

Development of Economic Threshold Level (ETL)for *Spodoptera Mura* on Bt cotton indicated that, ETLranged from 3.27 to 12.75 larvae/plant at different centers. ETLfor *Helicoverpa armigera* on Bt cotton revealed that, no fruiting bodies damage was recorded after release of larvae at 90 and 105 days of sowing and its effect on yield parameters and cotton yield

was found negligible.

Larvae released after 120 days of sowing resulted in zero to 3.24 % damage with ETL lowest of 0.72 larva/plant (TNAU Coimbatore) to 4.53 larvae/ plant (PDKV, Akola, 90 DAS).

In the present investigation variation in expression of Cry1Ac protein of first and second generation Bt cotton genotypes at different days of growth have been studied through ELISA quantification method. Cry protein expression derived between 65-160 DAS revealed that expression levels were lowest in the boll rind, ovary and square bud after 120 days onwards. Cry protein was 0.324 (J.lg/g fresh weight) in leaves of MRC 6301 and 0.151 (J.lg/g fresh weight) in MRC 7301 after 120 days at CICR, Nagpur. Similarly at Raichur it ranged from 0.38 to 0.59 (J.lg/g fresh weight) after 130 days in different hybrids.

Study on integration of all eco-friendly strategies and validation of IPM packages was conducted with specific IPM module for Bt cotton and compared with recommended package of practices (chemical protection) on Bt cotton. In general pests incidence was low in the IPM plots compared to RPP in most of the locations. Study clearly indicated the superiority of IPM module on Bt cotton by recording lower pest damage and higher seed cotton yield with maximum net profit.. Seed cotton yield ranged between 19.61 q/ha in MAU Parabhani to 37.05 q/ha in NAU, Surat. Net return ranged between Rs 26088 in Lam Guntur to Rs 70967 in UAS, Raichur.

Conservation of natural enemies

ETL for *Harmigera*