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Sustainable Cotton Production

(Continued from Issue No.10 dated 6th June 2017)

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Pest Management

GUEST COLUMN

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1. Generally, sap-sucking insect pests such as aphids, leaf hoppers, thrips and whiteflies occur to a great extent during the vegetative phase. They extend into the reproductive phase of the crop, only if the variety is highly susceptible and if chemical application in the crop tilts in favour of their survival. Spotted bollworms and sometimes pink bollworms generally occur during the early flowering phase. American bollworms occur during September-October in Central and South India and rarely later. Pink bollworm starts from late October and reaches peak infestation during November to January. It is considered as a winter pest.

2. Long duration (180-240 days) cotton varieties have a long flowering phase of 60-80 days and a long fruiting window of 60-120 days which makes the crop vulnerable to insect pests for a longer phase of time that can extend over 3-4 months. Short durations crops have a shorter flowering window of 15-20 days and a shorter boll formation window of 50-60 days which makes it easier for pest management.

3. Integrated pest management methods must be used to avoid chemical pesticides, as far as possible.

4. Cultivation of 'sucking-pest resistant varieties' help in avoidance of 'early-season' chemical usage. Strictly avoid chemical insecticide sprays during the first two months of the crop. Ecosystems of the crop evolve in a healthy manner during the first 2-3 months of the crop. With 'sap-sucking pest resistant varieties' natural enemies of insect pests thrive and keep insect pests under control naturally as long as human interventions do not disrupt the balance. The natural enemy complex of insect pests comprises of predators, parasitoids and pathogens that are common to sap-sucking pests and bollworms. Insecticides strongly disrupt the naturally occurring parasitoids and predators of insect pests which build-up during the early vegetative phase of the crop

and help in managing insect pests all through the season. Avoidance of insecticides will help in conserving naturally occurring insects such as ladybird grubs and beetles, Chrysoperla grubs and adults, Syrphid flies, Geocoris grubs and bugs, Aenasius spp., Aphilinus grubs and wasps, mirid bugs and spiders can effectively control aphids, jassids (leaf hoppers), thrips, mirids, whiteflies and mealybugs.

5. Inter-cropping with legume crops such as cluster bean, cowpea or sorghum or soybean or black gram, encourages establishment of predators and parasitoids of sucking pests.

6. Nitrogenous fertilizers should be applied judiciously to the minimum to prevent the proliferation of sap-sucking pests. Limited usage of nitrogenous fertilizers plus full application of P+K before flowering helps in reduction of sucking-pest infestation.

7. Fields must be kept free of weeds at least for the first 2-3 months of the crop.

8. Mealy bug infested plants should be uprooted and destroyed.

9. Neem preparations and biological control options must be preferred during the first 3-4 months for effective pest management with least disruption in the naturally occurring biological control.

10. Pheromone traps, selective light traps, are efficient for pest monitoring and management.

11. Avoid insecticide sprays against minor lepidopteran insects such as the cotton leaf folder, Sylepta derogata and cotton semilooper, Anomis flava which cause negligible economic damage to cotton. These larvae serve as excellent hosts for parasitoids such as Trichogramma spp., Apanteles spp and Sysiropa formosa, that attack bollworms such as H. armigera and Pectinophora gossypiella.

12. Strictly avoid WHO Class-I (Extremely Harzardous category) insecticides such as Phosphamidon, Methyl parathion, Phorate, Monocrotophos, Dichlorvos, Carbofuran, Methomyl, Triazophos and Metasystox.

13. Synthetic Pyrethroids must be avoided during the first 4-5 months after sowing so as to prevent any resurgence of whiteflies and H. armigera.

14. Insecticide mixtures must be strictly avoided all through the crop phase to prevent whitefly and other pest outbreaks.

Pesticide Management:

Currently, a total of 65 pesticides are approved by the Central Insecticide Board (CIB) for use on cotton in India. These include six fungicides, nine herbicides, five biopesticides and 45 chemical insecticides. The CIB approved list includes several insecticides that are harmful to the environment and as listed by many global authorities such as the WHO (World Health Organization), IARC (International Agency for Research on Cancer) and US-EPA (United States Environmental Protection Agency) as chemicals that could possibly/probably cause cancer. This list should be reviewed in light of environmental hazards, human safety and ecological harm that these chemicals can have from their application in cotton fields.

Indian farmers continue to use insecticides, which are considered to be extremely hazardous to the environment and which have been severely regulated by the FAO (Food and Agricultural Organization), WHO and the UNEP (United Nations Environment Programme). In small scale cotton production systems, it is very common for farmers to use the cheapest of available insecticides for pest control. Many of the cheaper insecticides either belong to WHO Class 1 (extremely or highly hazardous) or are related to carcinogenicity to some extent. A total of 28 insecticides were severely restricted for manufacture, import and use by the Rotterdam Convention on Prior Informed Consent (PIC) on 24th February 2004, by 95 countries including India as a signatory. For example, Monocrotophos and Methyl parathion which are still part of the list of CIB (Central Insecticide Board) approved insecticides for cotton in India are also being recommended by the state agricultural universities in India. These are amongst the PIC group and have been phased out by several countries across the globe.

Insecticides recommended for cotton and food crops, by several Indian Agricultural Universities fall in the category of WHO Class 1a (extremely hazardous category; Methyl Parathion & Phorate) and WHO-Class 1b (highly hazardous; Monocrotophos, Dichlorvos, Carbofuran, Methomyl, Triazophos and Metasystox). Interestingly, Diclorvos was never approved for use in cotton, but is being recommended by the agricultural universities in India.

The Annual Cancer Report 2015 published by the US-EPA lists the following commonly used pesticides under category-C (Possible human carcinogens): Acephate, Alpha-cypermethrin, Bifenthrin, Carbendazim, Cypermethrin, Dimethoate, Fipronil, Pendimethalin and

Pyrithiobac sodium. Thiodicarb, Metiram and glyphosate are categorised under 'probable human carcinogens'. Three pesticides, Permethrin, thiacloprid and Carbaryl are categorized as 'likely to be carcinogenic to human beings' and pesticides such as Buprofezin, Flonicamid and Fenoxaprop ethyl are under the category of 'suggestive evidence of carcinogenic potential'. Thus at least 18 pesticides out of the 65 chemicals approved for use as pesticides in cotton are related to human cancer and at least 7 out of the 65 chemicals belong to WHO Class-1 category of extremely or highly hazardous, top the environment.

About 50% of insecticide usage on cotton across the world is done with knap sack sprayers, mainly in developing countries, wherein these insecticides pose a acute hazard to farm workers. The problem becomes aggravated due to the lack of protective clothing and mechanical equipment where people will come in direct contact with chemicals. Toxicity is characterised by nausea, diarrhea, blurred vision, and, in severe cases, respiratory depression, convulsions and death.

There is an imminent need to restrict and regulate harmful insecticides in the country. The use of bio-pesticides and biological control needs to be properly deployed in pest management to ensure least use of chemical pesticides for pest management. As mentioned earlier, short duration cotton varieties can help in achieving this goal.

Crop Management Policies

Proper management of chemicals is important to achieve the goal intended, without any detrimental side-effects to ecology, environment and populace. Chemical intensive agriculture can lead to unsustainable ecologies in agriculture. Realising these threats to sustainability, from the 1990s, there were conscious efforts to change the cotton production strategy, using the ecosystem management approach. The strategic changes were enabled through the development and adoption of Integrated Pest Management (IPM), Integrated Nutrient Management (INM), Organic cotton, transgenic Bt-cotton, reduced tillage, drip and other micro-irrigation systems, Insecticide Resistance Management (IRM) technologies. In the context of sustainability, these technologies can be viewed as major shifts from an input oriented to an ecosystem based approach for managing the cotton production system in a sustainable manner. Efforts on quantification of sustainability of these systems in a scientific manner have been few and often incomplete due to lack of comprehension about the specific indicators and scale to measure sustainability.

Yet there is a general consensus that compared to conventional system, organic cotton production restored ecosystem services (improved soil structure and water infiltration, promoted crop residue and farm waste recycling, increased carbon sequestration, improved nutrient recycling and enhanced the activity of predators, parasites and pollinators) to such an extent that the use of permitted/approved external inputs also declined. Some studies indicate that compared to conventionally managed farms, adoption of organic cotton production system has resulted in an increase in cropping diversity (Strout's index), soil biodiversity and the spectrum/activity of natural enemies of cotton pests. The soils of organic cotton farms in semi-arid tropics, also had a higher soil organic carbon and improved labile carbon pool, had lower soil inorganic carbon and were less degraded (lower soil pH and exchangeable Na). Similarly, adoption of IRM strategies, in the project adopted areas of 32 districts across 11 states, economically benefitted 3.3 lakh cotton farmers and reduced pesticide usage in the cotton ecosystem by 45% compared to the non-IRM counterparts. From the above discussion it is evident that, sustainability analyses in cotton production systems have largely been restricted to economic and environmental dimensions using few indicators. If these analyses have to be made holistic, all the relevant economic and environmental indicators, along with social, trade and political dimensions need to be addressed.

Recently, the expert panel of ICAC on Social, Environmental and Economic Performance (SEEP) of Cotton Production enlisted 68 core, measurable indicators (along with uniform units) for evaluation, monitoring and comparison of sustainability of cotton production. These indicators encompass Environmental (pest and pesticide management, water management, soil management, biodiversity and land use, climate change), Economic (viability and poverty reduction, risk management and Social (labour, worker health and safety, equity and gender, farmer organisations) dimensions of sustainability of cotton production.

To put the cotton production system back onto a sustainable path, we need short duration, early maturing varieties (will impart higher water and nutrient use efficiency and avert risk due to climatic uncertainties) tolerant to pest and diseases (to reduce pesticide consumption and restore pest-natural enemy balance) along with a good crop husbandry with minimum use of external inputs and minimise production costs.

Courtesy : Cotton India 2016-17

(The views expressed in this column are of the author and not that of Cotton Association of India)