

Bio-Intensive Management Strategies for Cotton Pests

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Cotton is popularly known as white gold and it is grown across India for its commercial value. The crop provides economic livelihoods to many in rural areas, ensuring food security and generation of income. However, the crop is subjected to both biotic and abiotic factors. About 1326 insect species have been reported on cotton world-wide and in India as many as 162 insect pests are reported to cause considerable damage, leading to complete failure of crops, if not managed timely, so farmers resorted to insecticides as an insurance against crop loss. Among insect pests, sucking pest complex (leaf hopper *Amrasca biguttula biguttula*, Whitefly *Bemisia tabaci*, thrips, *Thrips tabaci* and Aphids *Aphis gossypii*) and boll worm complex (American bollworm, *Helicoverpa armigera*, spotted bollworm, *Earias vittella* and pink bollworm, *Pectinophora gossypiella*) are major threat to cotton production.

Management of insect pests in cotton has been the most challenging aspect of applied entomology. Application of insecticides causing undesirable ecological and economic consequences for cotton growers. However, cotton is one of the crops has been subjected to maximum pesticide exposure among other crops grown in India. Further, intense application of insecticides resulted in insect resistance to insecticides, pesticide residues, and resurgence of minor pests and caused immense problems to cultivators. Insecticide Resistance Management strategies have strengthened pest management systems by identifying appropriate insecticides so as to delay resistance, ensure effective control of target pests, and conserve naturally occurring biological control for enhanced sustainability of ecosystems. With the recent introduction of Bt-cotton, novel eco-friendly pesticides and IRM strategies coupled with the trends in technology dissemination through area-wide farmer participatory approaches and Farmer

field schools, IPM programmes all over the world have become successful and sustainable.

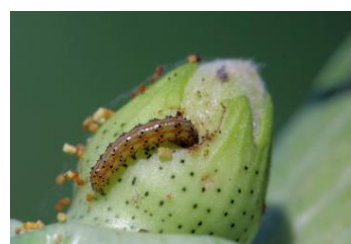
There are multiple strategies have been proposed for management of insect pests in cotton including cultivation of high level transgene expression cotton, cultivation of multi-lines containing different insect resistance genes, cultivation of susceptible plants for insect refuge along with main crop, cultivation of plants that express multiple novel insecticidal proteins, such as the Vip (vegetative insecticidal proteins) to impart a wider spectrum of pest control, use of bio-rational approaches such as pheromones, biocontrol agents, plant derived products and others.



Sucking pest damage



American bollworm



Spotted bollworm



Pink bollworm

Fig.1. Pest complex and their damage on cotton

Integrated management strategies

- Crop rotation is crucial to avoid survival of insect pests during off season.
- Cultivation of resistant varieties to counter the incidence of pest attack.
- Growing intercrops such as soybean green gram/black gram, cowpea and others increases the effectiveness of natural enemies.

- Seed treatment with recommended insecticides and fungicides to be followed.
- Judicious application of organic and chemical fertilizers.
- Use of sticky traps like yellow sticky traps for whitefly and leaf hoppers; whereas, blue colour traps for thrips.
- Use of pheromones - Sex pheromone can be employed against bollworm complex for mass trapping and mating disruption (25 traps/acre).
- Use of biocontrol agents - parasitoids such as *Trichogramma bactrae*, *Bracon sp* and predators such as coccinellids and syrphids can reduce the level of pest infestation.
- Bird perches should be arranged @ 10 per acre for encouraging bird predation on bollworm larvae.
- Use of plant derived products such as Neem, Pongamia and other suspension.

Apart from this, the specific window-based management strategies are necessary, which are discussed hereunder

Window 1: 0-60 DAS: Initial infestation of sucking pests - No foliar spray upto 60 DAS

- Cultivation of sucking pest tolerant varieties / hybrids
- Use dual gene cotton hybrids such as Bollgard II (Cry I Ac + Cry 2 Ab)
- Raising densely planted border rows of maize / sorghum / pearl millet / pigeonpea

- Mechanical control of *Parthenium* and *Abutilon* weeds to avoid buildup of initial mealybug inoculum.
- Neem oil sprays @ 1.0 l/acre + detergent powder @ 1.0 g or sandovit @ 0.5 ml or Teepol 0.5 ml/lt. for the control of whitefly.

Window 2: 60-90 DAS: Initial boll worm infestation. Mostly eggs and young larvae: Biological and bio-pesticide window

- Hand picking of *Helicoverpa* and *Spodoptera* larvae, and egg masses of *Spodoptera*.
- Installation of yellow sticky traps @ 10.0 / acre for monitoring of the whitefly.
- Application of 5% NSKE for bollworm and whitefly infestation.
- No spray against minor lepidopteran pests.
- Follow Integrated Nutrient Management practices including foliar spray of nutrients to reduce leaf reddening.

Window 3: 90-120 DAS: Boll worm infestation

- Use of Biocontrol agents such as parasitoids (*Trichogramma bactrae* and *Bracon sp.*).
- Entomo-pathogenic fungi (EPF) and Entomo-pathogenic nematodes (EPN) can also be employed.
- Use of sex pheromones - for mass trapping and mating disruption.
- Use of light traps - Pink bollworm moths are nocturnal; hence, use of 1 light trap per hectare helps in attracting the moths.

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