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Increasing Insect Pests Problems of Cotton Production and their Management

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INTRODUCTION

Cotton is the main fiber crop of the world. Cotton is now found in almost all the continents. Cotton, often referred to as "White Gold" is one of the most important cash and fibre crops in India and plays a dominant role in agricultural and industrial economy of the country. It has adapted itself to every type of climate, region and soil. It is a natural fiber used for making clothes. More than half of the world's population wears clothes made of cotton. In India, cotton is used cultivation takes place between 8-32˚ North latitude and 70-80˚ East longitude, in areas with altitude of 0 to 950 meters and rainfall of 250 to 1500 mm. It is legally planted in different types of lands. In the World cotton area, India is at first rank followed by China similarly, in the world cotton production, China is at first rank followed by India in the year 2022-2023. In India it has been cultivated in an area of 130.49 Lakh ha with production of 337.23 lakh bales (1 bale = 170 kg) and average productivity of 439 Kg of lint per hectare. Cotton is used to produce a wide range of products, including clothing, textiles, and medical supplies. A major insect pest of cotton likes sucking insects and bollworms (Pink bollworm, spotted bollworm and American bollworm) etc. insect pest problems increase day by day and severe infestation in cotton crops of the world. The pink boll worm originally reported in India in 1842. The crop is cultivated in more than 100 countries in 32 million hectares. Earlier, a loss to the extent of 2.8 to 61.9 % in seed cotton yield, 2.1 to 47.10 % loss in oil content and 10.70 to 59.20 % loss in normal opening of bolls were caused by pink bollworm infestation in cotton. Pink boll worm is emerging as a serious pest and its activity period from January to till the end of the pest has been frequently noticed from early flowering. Soon after emergence the pink boll worm larva, enter the fruiting body. As a result, the farmers caused by pink boll worm until the boll opening and hence could not exercise any target specific control measure against the pest.

Insect pests infesting cotton can cause significant damage to the crop, leading to lower yields and economic losses. Sucking pests, leaf feeders and bollworms cause serious damage to cotton crops which if not managed at right time would lead to 40 – 50% of crop loss. However, multifarious problems of changing rainfall pattern and temperatures during cotton crop growth and development, emergence of alternate cotton pests such as aphids, jassids, whitefly, cotton leaf curl virus, resistance and resurgence of sucking pests to insecticidal measures and sub optimal suppression of Lepidopterous larvae especially pink bollworm and Spodoptera litura by the Bt transgenic are the plant protection associated issues on Bt cotton.

List of Major insect pest of cotton

Name	Scientific Name	Order	Family	Damaging Stages
Pink bollworm	*Pectinophora Gossypiella*	Lepidoptera	Gelechiidae	Larvae
Spotted bollworm	*Earias vittella* *Earias insulana*	Lepidoptera	Noctuidae	Larvae
American bollworm	*Helicoverpa armigera*	Lepidoptera	Noctuidae	Larvae
Tobacco caterpillar	*Spodoptera litura*	Lepidoptera	Noctuidae	Larvae
Aphid	*Aphis gossypii*	Hemiptera	Aphididae	Nymph and Adult
Jassid	*Amrasca devastans*	Hemiptera	Cicadeliidae	Nymph and Adult
Thrips	*Thrips tabaci*	Thysanoptera	Thripidae	Nymph and Adult
Whitefly	*Bemisia tabaci*	Hemiptera	Aleuroididae	Nymph and Adult
Red cotton bug	*Dysdercus cingulatus,* *D. koenigii*	Hemiptera	Pyrrhocoridae	Nymph and Adult
Cotton grey weevil	*Myllocerus maculosus*	Coleoptera	Curculionidae	Grubs and Adult

Management strategies

Cotton, being a major global crop, faces several insect pests that can significantly impact its yield and quality. Here are some of the major insect pests of cotton and various management strategies used to control them:

1. **Cultural Practices:**

- **Crop Rotation:** Rotating cotton with other crops can disrupt the life cycle of insect pests and reduce their populations.
- **Tillage:** Proper tillage practices can help manage pests by destroying their habitat or overwintering sites.
- **Planting Date and Density:** Early planting or altering planting densities can influence pest populations.
- **Sanitation:** Removing crop residues after harvest can reduce overwintering sites for pests.
- **Use of Resistant Varieties:** Planting cotton varieties that are genetically resistant/ tolerant to specific pests can minimize damage.

2. **Biological Control:**

- **Predators and Parasitoids:** Encouraging the presence of natural enemies like ladybird beetle, spiders, preying mantids, lacewings, parasitic wasps, and predatory insects to control pest populations.
- **Microbial Agents:** Using beneficial microorganisms or pathogens that specifically target pests can be an effective biological control method.

3. **Mechanical and Physical Controls:**

- **Traps and Barriers:** Pheromone traps or yellow sticky traps can monitor pest populations or directly trap insects. Physical barriers like row covers can also prevent insect access.
- **Mulching and Cultivation Techniques:** Using reflective or colored mulches that deter pests, or employing specific cultivation techniques that disrupt pest life cycles.

- **SPLAT P.B.W:** SPLAT PBW stands for "Specialized Pheromone & Lure Application Technology" designed for the management of Pink Bollworms (*Pectinophora gossypiella*) in cotton fields. Pink Bollworms are significant pests that infest cotton plants and damage cotton bolls, affecting yield and quality. SPLAT PBW involves a pheromone-based technology that utilizes a formulation known as SPLAT (Specialized Pheromone & Lure Application Technology). This formulation is a combination of a food-grade wax and other ingredients that can slowly release synthetic pheromones. Pheromones are chemicals naturally produced by insects to communicate, often used in trapping, mating disruption, or monitoring pest populations.

SPLAT P.B.W. system typically operates in the following manner:

- **Disruption of Mating:** SPLAT PBW releases synthetic pheromones in the field. These artificial pheromones confuse male pink bollworms by overwhelming their senses, making it difficult for them to locate female counterparts for mating.
- **Reduced Reproduction:** As mating is disrupted, the reproductive cycle of pink bollworms is affected, leading to a decrease in the number of eggs laid by female moths.
- **Decreased Pest Population:** With reduced mating success and subsequent egg-laying, the overall population of pink bollworms in the cotton field decreases, mitigating the damage they cause to cotton plants and bolls.

  SPLAT PBW technology offers an environmentally friendly approach to manage pink bollworms without heavy reliance on conventional chemical pesticides. It is part of integrated pest management (IPM) strategies, aiming to reduce pesticide use, minimize environmental impact, and sustainably control pest populations.

4. **Chemical Control:**
- **Insecticides:** Using insecticides judiciously when pest populations reach economically damaging levels. Targeted application methods to reduce non-target effects.
- **Insect Growth Regulators:** Chemicals that disrupt the growth and development of insects can be used selectively.

5. **Monitoring and Decision Making:** Regular monitoring of fields to assess pest populations and the presence of beneficial organisms. Establishing economic thresholds to determine when action is necessary based on the level of pest infestation and potential damage.
6. **Integrated Approaches:** Utilizing a combination of the above strategies in an integrated manner to create a sustainable and effective pest management plan.
7. **Information and Education:** Providing farmers with education and information on pest biology, suitable management strategies, and the importance of sustainable practices.
8. **Resistant Varieties and GMOs:** In India Genetic Engineering Approval Committee (GEAC) of Ministry of Environment, Forest and Climate Change allowed commercial cultivation of Bt cotton in six states viz- Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka and Tamil Nadu in 2002. The varieties approved for commercialization in India are: RCH 2 Bt Bt Mech 12, 162 and 184 varieties (Monsanto in collaboration with Mahyco). The four Bt cotton hybrids allowed for commercial cultivation in south India are: MRC-6322 Bt and MRC-6918 Bt (Mahyco) and RCH-20 Bt and RCH-368 Bt (Rasi Seed). Bollgard II cotton contains the cry 1Ac and cry2Ab genes which produce delta endotoxin proteins (Bt toxins) that are toxic to *Helicoverp*a and pink bollworm of cotton.

CONCLUSION

Managing insect pests in cotton cultivation is crucial for ensuring optimal yields, sustaining crop quality, and safeguarding environmental health. Employing a multifaceted approach that integrates various strategies is essential for effective pest control while minimizing adverse impacts. Integrated Pest Management (IPM), a comprehensive framework, encompasses several techniques such as monitoring, cultural practices, biological controls, and selective chemical applications. IPM aims to strike a balance between pest control and environmental preservation. Successful pest management in cotton involves a dynamic and adaptable approach, as pest pressures, environmental conditions, and pest resistance can change over time. By employing a combination of strategies and continually adapting methods based on research and experience, farmers can effectively manage insect pests in cotton while maintaining sustainable and profitable agricultural practices.