

SPLAT: Innovative Approaches to Control Pink Bollworm Infestation in Cotton in India

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ABSTRACT

Cotton, known as 'white gold,' holds significant importance in India, grown extensively in states like Gujarat, Maharashtra, Karnataka, Madhya Pradesh, Punjab, Rajasthan, Haryana and Tamil Nadu. Bt cotton, introduced in 2002, initially helped to control pests effectively. However, since 2014, a rise in Pink Bollworm (PBW) infestations has posed challenges for farmers across India. Traditional pesticides are proving ineffective due to the pest developed resistance. In response, farmers are seeking eco-friendly alternatives. A promising solution is the SPLAT (Specialized Pheromone and Lure Application Technology) and PB Knot rope, offering rain resistance, easy application, long-lasting effectiveness and cost efficiency. This novel mating disruption technology could be the key to managing the pink bollworm menace in Bt cotton cultivation.

INTRODUCTION

Cotton, a versatile commercial crop cultivated for fiber, fuel, and edible oil, stands as a crucial component of agriculture supporting millions of livelihoods. However, the persistent threat of the pink bollworm with economic threshold level of

this pest is 8 adults/ trap or 10 per cent of affected flowers, buds and bolls with live caterpillars for three consecutive days has emerged as a formidable challenge for transgenic cotton, causing infestations ranging from 30-90 per cent and Reduces yields up to

90 per cent. The conventional approach of using pesticides proves ineffective due to the pest's internal feeding habits and resistance to major pesticides and Bt toxins. Surveys conducted by CICR during 2012-14 showed that pink bollworm larval survival on BG-II was recorded significantly higher in 2012, 2013 and 2014 mainly in Amreli and Bhavnagar districts in Saurashtra (Kranthi, 2015), which led cotton cultivators to shift to other crops.

Recognizing the limitations of conventional methods, the article delves into the advantages of semiochemical approaches, leveraging sex pheromones and host plant kairomones. This review article explores the potential of a novel technique, SPLAT (Specialized Pheromone and Lure Application Technology) and PB Knot rope, as an alternative to traditional practices. Several workers have tried with mass trapping tools (Karuppuchamy and Balasubramanian, 1990) and mating disruption (Attique *et al.*, 2000; Athanassiou *et al.*, 2002) tools to manage pink bollworm in Bt cotton ecosystem. This dynamic and paradigm shift in management strategies signifies a crucial step towards sustainable and effective pest control in the Bt cotton ecosystem and satisfies all the bio-safety concern as well as playing a pivotal role in combating insect pests of high-value and damage sensitive crops (Mazumder and Khalequzzaman, 2010).

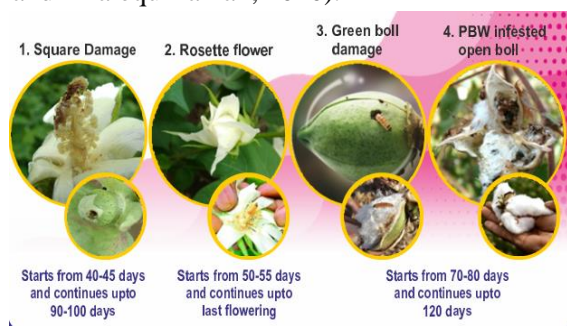


Fig. 1 Damage symptoms of pink bollworm

SPLAT technique

The use of synthetic pheromones, such as gossyplure, in pest management is a strategic

and innovative approach to disrupt the mating behaviour of insects, particularly in the case of the pink bollworm (PBW). The pink bollworm's sex pheromone, gossyplure, is naturally emitted by females to attract males for mating. However, the introduction of Synthetic Pheromone and Lure Application Technology (SPLAT) has revolutionized pest control by providing an effective means to intercept and trap male moths before successful mating can occur.

SPLAT is a specialized wax-based formulation designed for slow and sustained release of pheromones, specifically gossyplure in the case of pink bollworm. The formulation consists of the active ingredient, gossyplure ((ZZ/ZE)7,11-hexadecadienyl acetate), blended with wax and water. This unique formulation enables controlled and prolonged release of the pheromone, enhancing its effectiveness in disrupting the mating process of the pink bollworm.

The recommended dosage of SPLAT for pink bollworm control is 125 grams per acre, and it should be applied at specific intervals after sowing at 30, 60-65, 90-95, and 120-125 days. For optimal effectiveness, a minimum area of 25 acres at a single location is considered ideal. The ready-to-use SPLAT formulation is presented in the form of a paste, making it convenient for application.

Application involves placing small dollops of the SPLAT paste at the primary branch axil, positioned below 3 to 4 inches from the crop canopy. These dollops are strategically placed at 400 to 500 spots per acre in a zigzag pattern, each spot being 3 meters apart. Unlike female moths, SPLAT dollops continuously emit high doses of pheromones. The amount of sex pheromone emitted by each SPLAT dollop surpasses the natural pheromone emitted by females, creating a potent attraction for male moths.

The strategic placement of SPLAT dollops confuses male moths, attracting them towards these artificial sources, as they mistake them for females. However, in the absence of actual females, successful copulation becomes impossible. This disruption in the mating process significantly hampers the fertilization and reproduction of pink bollworms, leading to a substantial reduction in their population. Consequently, the application of SPLAT effectively protects the agricultural field from pink bollworm infestations and minimizes crop damage.



Fig.2 Commercially Available products of SPLAT in markets



Fig.3 SPLAT Applied at the base of the petiole

PB knot rope:

The adoption of a Japanese technology involving the use of PB Knot ropes for mating disruption has emerged as a promising solution for cotton farmers in Gujarat and Maharashtra, offering new hope for more effective pest control. This innovative approach, originally developed in Japan by Shin Etsu, a chemical company, is now being imported and implemented by Pesticide India Limited.

At the heart of this technology is the PB Knot rope, a 30 cm plastic vinyl rope designed to release large doses of female sex pheromones of the pink bollworm, a notorious cotton pest. Unlike traditional methods, where the female pink bollworm naturally releases approximately 3 mg of sex pheromones, each PB Knot rope releases an impressive 158-160 mg. This substantial increase in dosage is strategically designed to confuse male moths during their search for potential mates.

The implementation of this technology involves tagging the PB Knot ropes at a rate of 160 knots per acre over an area of 50 acres. The high dosage of sex pheromones emitted by these ropes creates a pervasive environment of confusion for male moths. The male moth's failed attempts to locate an actual female among the numerous pheromone sources ultimately lead to exhaustion and, in many cases, death. This disruption of the mating process proves to be an effective means of pest control.

Crucial to the success of this technology is the timing of the tagging, which should be carried out 35-40 days after sowing. This specific timeframe aligns with the critical period when the pink bollworm is actively seeking mates for reproduction. Implementing this technology on a community basis over a minimum of 50 acres is essential for optimal effectiveness. The collaborative approach ensures a more comprehensive and widespread disruption of the pink bollworm mating process across the agricultural landscape.

The technology not only provides a more efficient and environmentally friendly alternative to traditional pest control methods but also offers a ray of hope for cotton farmers facing the challenges posed by the pink bollworm. By adopting this Japanese innovation, farmers in Gujarat and Maharashtra are not only protecting their crops from pest infestations but also contributing to

sustainable and effective agricultural practices. (The Hindu, November 06, 2023 07:26 am)



Fig.4 PB Knot rope tied to a cotton plant in a demonstration field.

Despite the existence of various tools for pink bollworm management, the drawbacks associated with most of them outweigh the benefits. However, a distinct and farmer-friendly solution has emerged, offering both ecological sustainability and ease of use. This ready-to-use (RTU) formulation stands out as a unique and innovative approach that addresses the limitations of other methods. One of the key advantages of this solution is its user-friendliness. The RTU formulation is designed to be easily applied by farmers, requiring minimal labour and effort. Furthermore, the eco-friendly nature of these formulations adds to their appeal. By minimizing the ecological impact, this solution aligns with sustainable farming practices, providing an environmentally conscious alternative to conventional pest management methods.

In addition to being user-friendly and eco-friendly, these formulations exhibit rain fastness on vegetation. This quality ensures that the efficacy of the solution is maintained even in the face of adverse weather conditions, such as rain. The rain-resistant feature enhances the reliability of the solution, making it more robust and dependable for farmers who often contend with unpredictable weather patterns.

Another notable attribute is the long-lasting effect of these formulations. The sustained

release of the active ingredients contributes to an extended period of effectiveness, providing continuous protection against pink bollworm infestations. This long-lasting quality not only reduces the frequency of applications but also contributes to cost-effectiveness for farmers over time (Shrinivas, A.G *et al* 2019).

SPLAT field tests in Bhainichanderpal, Rohtak (50 acres) show promising results in controlling pink bollworm. ICAR-National Research Center for Integrated Pest Management and ICAR-Central Institute of Cotton Research collaborated on trials. Additionally, 25 acres were tested in Khandwa, Madhya Pradesh, in partnership with Agriculture College, Rajmata Vijayraje Scindia Agricultural University, and ICAR-Central Cotton Research Institute. The technology is gaining traction among cotton farmers, proving effective in Integrated Pest Management for improved yield and a healthier environment. The PB Knot rope project in Andhra Pradesh (Kurnool) involves 30 small and marginal farmers, indicating SPLAT's potential as a game changer in cotton farming. It must be an integral part of Integrated Pest Management (IPM) strategies to optimize cotton yield along with healthy environment.

Integrated management of pink bollworm

The following IPM strategy using SPLAT technology may be adopted for effective pink bollworm

1. Grow non-Bt cotton alongside Bt cotton.
2. Remove cotton residue from fields.
3. Avoid storing insect-infested cotton in godowns.
4. Set up pheromone traps 45 days after sowing to monitor pink bollworm activity.

5. Apply SPLAT formulation (125g/acre) at 400-500 spots when moths are captured in pheromone traps.
6. Apply PB Knot ropes at a rate of 160 knots per acre over an area of 50 acres.
7. Regularly monitor pest infestation levels.
8. Collect and destroy fallen buds/flowers/bolls infested with pink bollworm.
9. Complete harvest by the end of December and dispose of crop residues.

SUMMARY

The escalating threat posed by the pink bollworm demands an urgent and effective action plan. A promising solution is the implementation of Specialized Pheromone and Lure Application Technology (SPLAT), a wax-based formulation designed for the slow and sustained release of pheromones, specifically gossypure. This innovative approach disrupts the mating of the pink bollworm, thereby curbing population growth.

While various tools exist for managing pink bollworm infestations, the drawbacks associated with each outweigh their benefits. SPLAT and PB Knot rope stands out not only for its efficacy but also for its eco-friendly nature, positioning it as a potential cornerstone in Integrated Pest Management (IPM) strategies. The technology's unique formulation and controlled release mechanism make it a powerful tool in restricting the reproductive capabilities of the pink bollworm. To address the current threat comprehensively, it is imperative to demonstrate and popularize SPLAT and PB Knot rope technology among farmers. By highlighting the eco-friendly aspect and effectiveness of SPLAT and PB Knot rope, agricultural communities can be encouraged to adopt this technology, ensuring

a sustainable and efficient approach to pink bollworm management.

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