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Integrated Pest and Disease Management (IPDM) Capsule for Cotton

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Abstract : Adoption of IPDM capsule revealed significant reduction of bacterial blight (6.33 PDI), root rot (5%), grey mildew (3.1 PDI), leaf hoppers (1.2/3 leaves), whiteflies (1.4/3 leaves) and pink boll worm (3.24%) as against 23.67, 17.30, 22.26, 2.10, 1.72 and 7.10 respectively in control which envisages the importance of IPDM capsule. IPDM capsule may be recommended to manage bacterial leaf blight, root rot, grey mildew, leaf hoppers, whiteflies and pink boll worm in cotton.

Key words: Bacterial blight, Cotton, grey mildew, IPDM capsule, leaf hoppers, pink boll worm, root rot, whiteflies.

Cotton is the most important cash crop in India. Cotton is a soft fluffy staple fiber that grows in a boll around the seeds of cotton plants of the genus *Gossypium* in the family of Malvaceae. Among the various factors responsible for its low production and productivity, pests and diseases are considered as an important biotic constraint. Integrated Pest and Disease Management which combines biological, cultural, physical and chemical control strategies in a holistic way rather than using a single component strategy proved to be more effective and sustainable. In practice and in the majority of cropping systems today, emphasis is still being placed on a single technology. Nevertheless, the use of IPDM strategy is gaining momentum but in developing countries it often lacks the enabling environment for its successful implementation. Wide adoption of IPDM practice is a pre requisite for achieving impact at the country level. Experience over the last few decades clearly showed that adoption and support for using participatory approaches help farmers to improve their overall field management, including pest and disease management reduce costs and improves production efficiency. In this view experiment was carried out for the development of Integrated Pest and Disease Management capsule in cotton.

MATERIALS AND METHODS

Validation of IPDM In Cotton

A field experiment was conducted during 2022-23 in farmer's field at Saminathapuram village of Rajapalayam Block, Virudhunagr District, Tamil Nadu using the cotton variety CO 17.The details of the treatment imposed were

T1 – IPDM Capsule

1. Seed treatment with Imidacloprid 600 FS @ 10 g / kg and *Bacillus subtilis* (Bbv) @ 10g/kg
2. Installation of yellow sticky traps @ 12/ha at 20 days after sowing and amp; pheromone traps @ 12/ha at 40 DAS
3. Need based application of:

- Drenching collar region with chlorpyriphos 50 EC @ 1200 ml/ha on 30 and 45 days after sowing + earthing up
- Azadirachtin (0.03%) EC – 2.5 l /ha at 30 DAS
- If ETL is crossed at Vegetative stage (Sucking pests : Flonicamid (50%) WG 150g/ha, Bollworms: Chlorantraniliprole (18.5%) SC @ 150 ml/ha)
- Trifloxystrobin + tebuconazole @ 0.6g/l + need based application of Copper

Oxychloride @ 2kg / ha

- Field release of *T.chilonis* and *T.bactrae* @1.5 lakh/ha at weekly intervals from 45 DAS for 3 times

T2 **Farmers Practice**

- Fipronil (5% SC) @ 2000 ml/ha on 25 DAS + Imidacloprid 30.5 SC @ 75 g / ha on 40 DAS + Thiamethoxam (25% WG) @ 100 g / ha on 55 DAS and Profenophos (50% EC) 2 lit / ha on 75 DAS

T3 **Untreated check**

The treatments were replicated seven times in a randomized block design for the management of pests and diseases in cotton.

Sampling and observations for diseases

Disease severity/PDI was assessed with 0-4 scale/grade as per the standard evaluation system followed in All India Coordinated Research Project in Cotton. Bacterial blight was expressed in per cent disease index. Disease observations were made from 10 tagged plants at random during crop seasons. Three leaves at bottom, four leaves in the middle and three at the top of each plant. Thus, total ten leaves were collected from a tagged plant. Disease scored at peak intensity was observed by using disease grades. Depending on the scores collected, PDI was calculated by using the formula by Wheeler (1969) as given below.

$$PDI = \frac{\text{Total number of plants}}{\text{Number of diseased plants}} \times \frac{100}{\text{Maximum grade}}$$

Root rot was expressed in percentage. Each month, healthy plants and disease infected/dead plants were observed and the per cent disease incidence was calculated as per the following formula.

$$PDI = \frac{\text{Total number of plants}}{\text{Number of diseased plants}} \times \frac{100}{}$$

Sampling and observations for pests

Observations on leafhoppers and whiteflies were made from ten randomly selected plants in each plot. The population of nymphs and adults of leafhoppers were recorded from three leaves/plant from one leaf on top, middle and bottom of the plant and whitefly adults at weekly interval and expressed as per three leaves.

Observations on the incidence of pink bollworms were made based on the number of rosette flowers due to pink bollworm in 50 randomly selected cotton flowers. The flowers were manually opened and inspected for PBW larvae. The infestation ratio was determined by counting infected bolls and then represented as a percentage

RESULTS AND DISCUSSION

Bacterial blight of cotton is a disease of economic significance throughout the world. The pathogen attacks host plant during all growth stage, infecting stems, leaves, bracts, bolls and causes seedling blight, black arm, angular leaf spot and boll lesions (Verma, 1986). Yield losses due to bacterial blight range between 1 and 27 per cent depending on the cultivar and crop age. (Mishra and Ashok Krisna, 2001). Results of the present study showed that the adoption of IPDM capsule reduced the bacterial blight severity to the tune of 6.33 PDI as against 10.66 and 23.67 PDI in farmers practice and control plot respectively (Table 1). Salaheddin *et al.*, (2010) also documented that application of mixture of *Pseudomonas fluorescens* and *Bacillus subtilis* to seed, soil and foliage significantly reduced the bacterial blight incidence and increased the yield under field condition.

Root rot caused by *Macrophomina phaseolina* is one of the limiting factors for cotton

Table 1. Impact of IPDM capsule on cotton pests and diseases

Treatments	Bacterial leaf blight (PDI)	Root rot (%)	Grey mildew (PDI)	Leaf hopper/ 3 leaves	Whitefly 3/leaves	Pink boll worm damage (%)	*Kapas* yield (kg/ha)	Per cent yield increase over control	BCR
T_1-IPDM capsule	6.33 (14.83)	5.00 (13.05)	3.12 (10.22)	1.20 (1.09)	1.40 (1.19)	3.24 (10.37)	2079.0	29.13	2.25
T_2- Farmers practice	10.66 (18.01)	12.00 (20.72)	14.43 (22.34)	1.42 (1.19)	1.60 (1.26)	5.42 (13.46)	1907.0	18.44	1.99
T_3- Control	23.67 (28.72)	17.30 (24.22)	22.26 (27.14)	2.10 (1.44)	1.72 (1.31)	7.10 (15.45)	1610.0	-	1.70
CD (P=0.05)	2.16	1.73	1.93	0.04	0.01	0.16	162	-	-

Figures in parentheses are arcsine transformed values for diseases and square root transformed values for pests

production. The sclerotia of *M. phaseolina* survives in the soil, crop residues and on seeds. It causes pre and post emergence seedling mortality, rotting of seedling and mature plants. If the affected plants are pulled out and examined, the entire root system may be found rotten (Mukesh Kumar *et al.*, 2022). Root rot incidence was observed to be ranging from 31.7 to 69.1 per cent in cotton (Monga and Sheoraj, 2002). In the present study, it was observed that the IPDM followed plot registered only 5 per cent root rot incidence as against 12 and 17.3 per cent in farmers practice & control respectively (Table1). Muhammed Saleem Haider *et al.*, (2018) reported that *Bacillus strains viz.*, *B. megaterium* ZMR 4 and *B. subtilis* IAGS 174 not only provided protection against charcoal root rot but also enhanced the growth and yield of cotton plants under field condition.

Cotton plant is ravaged by sucking pests like leaf hopper (*Amrasca devastens*), aphids (A*phis gossypii*), thrips (*Thrips tabaci*) and white fly (*Bemisia tabaci*) which causes major threat and destruction of cotton crops. Results of the IPDM capsule adopted plots showed that the mean population of leaf hopper was 1.2 /3 leaves as against 2.1/3 leaves in control (Table 1). With regard to whiteflies, lowest population of 1.4/3 leaves was observed in IPDM practice followed by 1.6/3 leaves and 1.72/3 leaves in farmers practice and control respectively (Table 1). Ajantra Birah *et al.*, (2019) reported that sucking pests can be managed by adopting IPM strategy in addition to conservation of natural enemies with minimum application of insecticides.

Pink boll worm (*Pectinophora gossypiella*) is considered as one of the most harmful cotton pests causing severe damage to cotton crop worldwide (Rajput, 2017). In the present study, IPDM imposed plots recorded less pink boll worm damage (3.24%) as against 7.1 per cent in control plot. The reduction in pink boll worm damage over control in IPDM capsule imposed plot was 54.36 per cent (Table 1). Nadeem *et al.*, (2023) documented that Pb rope traps had maximum control over the pink boll worm population followed by delta traps and light traps.

With regard to yield, the highest yield of 2079 kg/ha was registered in IPDM capsule imposed plots as against 1610 kg/ha in control. In farmers practice, yield of 1907 kg/ha was observed. All the treatments differed significantly from each other in terms of yield and the maximum benefit cost ratio of 1:2:25 was recorded in IPDM capsule imposed plot (Table 1) Adoption of IPDM package in cotton recorded lowest incidence of bacterial blight, root rot, lowest population of leaf hoppers, white flies and lowest damage of pink boll worm and higher yield and ultimately the highest economic return (1:2.25).

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