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Integrated Pest Management in Sali Rice

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Abstract

Rice is the principal staple food of Assam and among the various rice ecotypes cultivated in the state, sali rice occupies a dominant position in terms of area and production. Despite its agronomic importance sali rice faces heavy losses due to pest infestations including insect pests, diseases, weeds and nematodes. Conventional dependence on chemical pesticides has resulted in pest resistance, resurgence, residue hazards and environmental pollution. Integrated Pest Management (IPM) offers an ecologically sustainable strategy by combining cultural, biological, mechanical and need based chemical methods to maintain pest populations below economic injury levels.

Keywords: IPM, Sali rice, insect, pests, biological control

Introduction

Rice (*Oryza sativa L.*) is the most important cereal crop of Assam where it is cultivated under diverse agro ecological conditions. Among the three major ecotypes namely ahu in the pre kharif season, sali in the kharif season and boro in the rabi season, the sali rice is the most widely grown. It occupies nearly 70% of the total rice area and contributes the largest share of rice production in the state (Government of Assam, 2022). The sali season coincides with the monsoon months from June to November. This period is marked by abundant rainfall, high humidity and moderate temperatures which are favourable for crop growth but also provide a highly suitable environment for pest development.

Pest infestations in sali rice are a serious concern as they can cause yield losses of 30 to 40 percent depending on the severity of outbreaks (Pathak & Khan, 1994). Farmers have traditionally relied on chemical pesticides for pest control. However indiscriminate use of these pesticides has disturbed the ecological balance, harmed beneficial organisms and posed risks to food safety.

In recent years, there has been increasing emphasis on Integrated Pest Management (IPM) as a sustainable and holistic solution. The Food and Agriculture Organization (FAO) defines IPM as the careful consideration of all available pest control techniques followed by the integration of appropriate measures that discourage pest build up and keep pesticide use at levels that are economically justified and safe for human health and the environment (FAO, 2010).

Major Pest Problems in Sali Rice

Sali rice in Assam is vulnerable to a wide range of biological constraints that include insect pests, diseases, weeds and nematodes. Among these, insect pests are generally the most damaging and often account for significant yield losses.

Insect pests

Insect pests play a major role in reducing both yield and quality of sali rice. Several species attack the crop from seedling to maturity **(Table 1)**.

Rice stem borer (*Scirpophaga incertulas*)

The rice stem borer is regarded as the most destructive pest of sali rice. The larvae bore into the stem and feed on the inner tissues, leading to the death of the central shoot which produces the characteristic dead heart symptom during the vegetative stage. At the reproductive stage, infestation results in white ear or empty panicles. Yield losses due to stem borer can be very high during epidemic years. The pest population builds up rapidly in warm and humid conditions which are common in Assam during the monsoon season.

Leaf folder (*Cnaphalocrocis medinalis*)

The rice leaf folder is a common pest that causes significant defoliation. The larvae fold the leaves longitudinally and scrape the green tissue, leaving behind a papery surface. Heavy infestation reduces the photosynthetic efficiency of the crop leading to poor tiller development and low grain filling. The incidence is usually higher during periods of cloudy weather with intermittent rains which favor larval survival.

Gall midge (*Orseolia oryzae*)

The rice gall midge is another major pest in sali rice. The maggot feeds inside the growing shoot and induces the formation of a tubular gall, popularly known as silver shoot. Affected tillers fail to bear panicles which results in direct yield reduction. Outbreaks are generally more severe in lowland fields where standing water is present for long periods.

Rice hispa (*Dicladispa armigera*)

The rice hispa is a serious leaf feeder in Assam. The adult beetle scrapes the green tissue of leaves while the larvae mine inside them. The attacked leaves turn whitish and dry up in severe cases. The pest appears sporadically but when conditions are favourable, particularly after drought followed by heavy rains, large scale damage can occur.

Brown planthopper (*Nilaparvata lugens*)

The brown planthopper is one of the most feared pests of rice. It sucks sap from the base of the plant causing wilting and drying of entire patches of the crop known as hopper burn. In addition to direct damage, it also transmits viral diseases such as grassy stunt and ragged stunt. Dense plantings with high nitrogen levels favor the rapid multiplication of this pest.

Diseases

Diseases of sali rice also play a critical role in reducing yield and grain quality. The warm and humid climate during the monsoon months provides ideal conditions for the spread of several pathogens.

Blast: Blast is one of the most destructive fungal diseases of rice. It affects the crop at all growth stages, producing lesions on leaves, nodes and panicles. Severe neck blast infection can lead to complete grain loss in affected panicles. The disease thrives under high humidity and low night temperatures which are common during the sali season.

Bacterial leaf blight: Bacterial leaf blight is a devastating bacterial disease that spreads rapidly during heavy rains and strong winds. It causes wilting of seedlings and yellowing and drying of leaves in older plants. Severe infections result in significant yield reduction. The disease is particularly problematic in areas with continuous rice cultivation.

Sheath blight: Sheath blight is caused by a soil borne fungus that affects the leaf sheath and spreads upward, producing lesions that coalesce and cover large areas of the plant. High planting density and excessive use of nitrogen fertilizer favor the disease. In epidemic years, it can cause heavy losses in sali rice.

False smut: False smut has emerged as a disease of concern in Assam. It transforms healthy grains into greenish spore balls covered with velvety fungal growth. Although it may not always cause major yield loss, it affects the quality of harvested grains and poses risks due to mycotoxin contamination.

Weeds

Weeds are a major constraint in sali rice cultivation as they compete directly with the crop for light, nutrients and water. They can also harbor insect pests and pathogens, making pest management more difficult. Grassy weeds such as *Echinochloa crus galli* and *Echinochloa colona* are dominant in transplanted as well as direct seeded fields. These weeds grow vigorously and mimic rice seedlings, making manual weeding difficult. Sedges such as *Cyperus difformis* are common in waterlogged conditions. They produce numerous seeds and multiply rapidly, posing challenges to effective control. Broadleaf weeds such as *Fimbristylis miliacea* also infest sali rice fields and compete strongly with the crop. Uncontrolled weed growth during the first 40 days after transplanting can result in yield losses of up to 30 to 50 percent.

Nematodes

Nematode problems in rice have received less attention compared to insect pests and diseases, but their importance is increasing.

Rice root knot nematode (*Meloidogyne graminicola*)

This nematode is emerging as a serious pest in lowland rice ecosystems of Assam. It invades the roots and induces the formation of galls that interfere with the uptake of water and nutrients. Infected plants show stunted growth, yellowing and poor tiller formation. Continuous rice cultivation in waterlogged fields creates favourable conditions for the buildup of nematode populations.

Table 1. Major insect pests of sali rice and their management options

Pest name	Nature of damage	Suggested IPM practices
Rice stem borer	Dead hearts, white ears	Early planting, pheromone traps, release of Trichogramma, need based insecticide
Leaf folder	Leaf folding, photosynthetic loss	Light traps, conservation of natural enemies, judicious spray
Gall midge	Silver shoot formation	Resistant varieties, avoidance of late planting, seed treatment
Rice hispa	Scraping of leaves, skeletonization	Collection of adults, balanced fertilizer, neem based biopesticides
Brown planthopper	Hopper burn, vector of viruses	Avoid excessive nitrogen, maintain spacing, conserve spiders and mirid bugs

Components of Integrated Pest Management in Sali Rice

IPM is a broad-based approach that combines different methods of pest control in a compatible manner. In sali rice ecosystems several components can be effectively integrated to reduce pest pressure and ensure sustainable crop production.

Cultural management: Cultural management is considered the foundation of IPM in rice. Certain crop husbandry practices directly influence pest incidence and severity. Timely planting and synchronous planting within a locality help in reducing pest carryover and minimize chances of outbreaks. For example, early planting of sali rice often avoids severe stem borer damage while synchronous planting in a village reduces gall midge infestation (Heinrichs, 1994). Crop rotation with non-host crops breaks the life cycle of pests and pathogens. Proper spacing between plants improves aeration and reduces disease incidence. Balanced use of fertilizers is also crucial. Application of organic manures along with chemical fertilizers improves soil health and minimizes pest buildup, while avoiding excessive nitrogen helps in preventing outbreaks of brown planthopper and leaf folder.

Resistant varieties: Development and cultivation of pest resistant rice varieties is one of the most effective and environmentally friendly approaches in IPM. In Assam several high yielding varieties such as Ranjit, Bahadur and Mahsuri Sub1 have been reported to possess tolerance against major insect pests and diseases (Assam Agricultural University, 2020). Wider adoption of resistant varieties reduces dependence on pesticides and provides a reliable base for sustainable pest management.

Biological control: Biological control is an important component of IPM that relies on natural enemies of pests. Parasitoids, predators and microbial pathogens regulate pest populations under natural conditions. For instance, the egg parasitoid *Trichogramma japonicum* is highly effective against stem borer, while predators such as spiders (*Lycosa* spp), mirid bugs (*Cyrtorhinus lividipennis*) and dragonflies help suppress hopper populations. Entomopathogenic fungi such as *Beauveria bassiana* and *Metarhizium anisopliae* have shown promise against several insect pests. Conservation of these natural enemies through reduced and judicious pesticide use along with habitat management is emphasized in IPM programs.

Echinochloa crus galli *Echinochloa colona*

Cyperus difformis *Fimbristylis miliacea*

Mechanical and physical methods: Mechanical and physical measures provide low cost and eco-friendly options for pest management. Farmers commonly use light traps to attract and kill nocturnal insects. Pheromone traps are used both for monitoring and for mass trapping of yellow stem borer moths, which has become popular in many rice growing areas. Hand collection and destruction of insect pests or their egg masses is another simple but effective practice adopted by smallholder farmers.

Chemical control: Chemical pesticides are considered only as a last option in IPM when pest populations cross the economic threshold level. In such cases insecticides such as cartap hydrochloride and chlorantraniliprole are used in a targeted and judicious manner. Biopesticides such as neem-based formulations are also recommended for safer control. While using chemical pesticides it is important to adopt safe application techniques, avoid overuse and ensure proper pre harvest intervals to minimize pesticide residues and protect food safety.

Challenges in Adoption of IPM in Sali Rice

Although Integrated Pest Management has been widely promoted, its adoption among farmers in Assam continues to face several constraints. Limited awareness and inadequate training often prevent farmers from fully understanding and implementing IPM practices. The availability of biological control agents is poor and access to quality bio pesticides remains limited. The dominance of chemical pesticide marketing further discourages the use of eco-friendly alternatives. Community level practices such as synchronized planting are often difficult to achieve because of fragmented land holdings and lack of collective action. Policy support for IPM is also relatively weak compared to programs that promote high input farming. In addition, climate variability has created unpredictable pest dynamics and the emergence of new pests and diseases has further complicated the implementation of IPM strategies. These factors together reduce the pace of adoption despite the proven benefits of IPM.

Conclusion

Sali rice forms the backbone of food security in Assam but the crop remains highly vulnerable to diverse pest pressures. Integrated Pest Management provides a practical and sustainable approach to address the twin challenges of ensuring effective pest control and protecting the environment. By combining cultural practices, resistant varieties, biological control, mechanical measures and judicious use of chemical pesticides, IPM minimizes over reliance on chemicals and helps maintain ecological balance. For successful adoption of IPM in Assam, strengthening farmer awareness and training, ensuring reliable availability of bio control agents and providing supportive policy measures are

essential. Wider adoption of IPM will not only enhance rice productivity but also contribute to safer food, healthier ecosystems and sustainable rural livelihoods.

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