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Eco-friendly approaches for the pest management of rice in nursery and main field

Mukul Kumar [*1], Digvijay Singh[2], Abhay kr. Mishra[3] and Abhishek Ranjan[4]
[1]Department of Plant Pathology, CSAUA&T, Kanpur, U.P
[2]Department of Plant Breeding and Genetics, BAU Sabour, Bihar
[3]Department of Plant Pathology, RPCAU, Pusa, Samastipur, Bihar
[4]Department of Soil science, RPCAU, Pusa, Samastipur, Bihar
[*]*Corresponding author's email id- mukulagricoss115@gmail.com*

Abstract

Rice (*Oryza sativa* L.) is one of the most important staple food crops. 65 per cent of the Indian rely on this crop alone. It plays a crucial role in our national food security as well as livelihood for millions of rural and urban households. Insect pest and disease creates major hindrance in rice production in india. Together they cause minimum 46-55% annual yield loss. The greater incidences of disease and pest lead to greater chemical application resulting in higher input cost and agro-ecological imbalance. Therefore, an integrated approach of pest and disease management should be adopted to enhance the production and improve the ecological balance.

Keywords: *Trichogramma japonicum, Sesbania,* National food security, IPM

Introduction

Rice (*Oryza sativa* L.) is very important staple food crop for 65 per cent of the population in India. It plays a vital role in our national food security and is a means of livelihood for millions of rural households. The major constraints in attaining the desired level of rice production are the menace of insect pests which accounts 30 per cent yield loss (Dale, 1994, Grist and Lever, 1969). Pest have been associated with crops since times immemorial. But under changing environment their numbers have increased and the minor pest now have become the major ones causing greater damage to the crop. This is evident from the fact that rice crop had three major pests in 1965 which has increased to more than 15 in 2005. The greater incidences of disease and pest lead to greater chemical application resulting in higher input cost and agro-ecological imbalance. It is believed that SRI method of

cultivation in low land rice cultivation face low incidence of insect pest and disease resulting in low or no chemical pesticide application. Most of the farmers used organic pesticides as preventive measures or when the attack is below the threshold limit in SRI method of cultivation. However, under changing environmental condition and indiscriminate application of chemicals to the rice crop, the pests have also developed resistance mechanism. In such circumstances there is a possibility of disease pest attacks and to ensure a healthy crop, the SRI farmer need to be acquainted with the rice pests, damage symptoms caused by them and management options. The farmers are advised to practice the non-chemical management options, few ITKs that have been proved beneficial against certain disease pests are also suggested.

Integrated Pest Management (IPM) is a pest management approach which can be in the strongly context of the environment and the population dynamics of the pest species by utilizing all suitable techniques and methods in such a compatible manner as possible and maintains the pest populations at levels below economic threshold levels (ETL). (FAO, 1967). Thus, IPM is the best combination of physical, cultural, mechanical, biological and chemical measures that provides the cost-effective, ecologically sound and socially acceptable method of managing diseases, insects, weeds and other pests Population. Therefore, IPM is not a single step and even it does not rely on single method to minimise our pest problems. So, an "integrated" approach, is the most effective for long-term, sustainable management programs.

Major insect pests: national significance

- ***Yellow stem borer:*** *Scirpophaga incertulas*

Caterpillars produces damage by feeding inside the stem Producing “dead heart” or drying of the central whorl of leaf during the tillering stage. “white ear heads” are formed when it attacks during the panicle formation or heading stage resulting in panicle becomes chaffy.

- ***Brown plant hopper:*** *Nilaparvata lugens*

Both nymphs and adults are damaging stage. They suck the sap from the plant tissues which results in wilting and drying of the plants in clusters known as "hopper burn". It initially starts in circular patches and then covers the whole field.

- ***White backed plant hopper:*** *Sogatella furcifera*

Both nymphs and Adults suck the sap at the basal part of the plants resulting in yellowing of leaves which later turns into rust red.

- ***Leaf folder:*** *Cnaphalocrocis medinalis*

Initially young larvae feed on the leaf tissues and as they become older, they fold the leaf blade from both sides and form a tube. Further they feed by scrapping the green matter by living inside the leaf fold gives a scorched appearance.

- ***Gundhi bug:*** *Leptocorisa acuta*

The nymphs and adults are active during early morning and late afternoon only. It feeds on the milk of the rice during the milky stage. It creates puncture hole which acts as a point of entry of several pathogens. The infested plant turns into brown colour (grain discolouration). It also attacks in dough stage resulting into shrivelled grains.

- ***Gall midge:*** *Orseolia oryzae*

Maggot feed at the growing primordial (tip) inside the growing stem and injecting a toxin "cecidogen" which results in a hollow tubular gall known as "silver shoot" which resembles like onion leaf. Affected tillers do not bear panicles. Early infestation enhances profuse tillering and stunted growth of the plants

- ***Swarming caterpillar:*** *Spodoptera mauritia*

The caterpillars mainly feed on the leaves and tender shoots of rice results in complete defoliation. They are also known as ‘Army worm’ which is active during late afternoon, night and early morning. During day time they hide themselves in grasses, cracks and crevices in the field bunds. In severe attack the field appears as grazed by cattle. They migrate from one field to another in mass when food is over in one field.

Major diseases of national significance

- ***Rice blast:*** *Pyricularia oryzae*

Spindle shaped lesions on leaves can be seen. Neck and panicle infection results into chaffy and shriveled grains. The node becomes black and breaks from the joints

- ***Bacterial leaf blight:*** *Xanthomonas campestris* pv *oryzae*

Straw to yellow-coloured irregular lesions appear at the tip region leaf and margins appears in wavy manner. Characteristics Kersek Phase appear due to occurrence of the disease in nursery which creates patches of wilted plants. In advance stage of infection leaves roll up, turn grey, foliage becomes withers and ultimately plants die.

- ***Sheath blight:*** *Rhizoctonia solani*

The symptoms first appear on lower leaves near the water level during tillering stage with lesions which are oblong or elliptical greenish grey in colour, water soaked and about 1cm in length. These lesions appear as regular dark brown border and central region have greyish in colour. Infected plants produce chaffy grains. Infected field have characteristics brown mustard shaped sclerotia appear.

- ***False smut:*** *Ustilaginoidea virens*

This disease appeared only in the ear head Individual grains are converted initially into velvety orange yellow balls which later becomes dark green or almost black in colour.

- ***Brown spot:*** *Helminthosporium oryzae*

This disease can be noticed after appearance of ellipsoidal, oval to circular lesion on the different parts of plant like coleoptile, leaf blade, leaf sheath and glume. Farmer can easily identify this disease in field by seeing Light brown grey centre with dark or reddish-brown margin, blackened grains and burnt and scorched appearance of field.

- ***Sheath rot:*** *Sarocladium oryzae*

The disease appears on the uppermost leaf sheath. Severe infection results into poor exertion of panicles and poor grain setting.

Major nematodes of national significance

- ***Root knot nematode:*** *Meloidogyne graminicola*

The nematode mainly attacks the rice plants when the soil becomes dry in nursery / early growth stage of SRI. Initially the leaves become orange yellow, later it dries resulting in appearance of yellow patches in the field. Affected plants show galls (Knot) on the roots.

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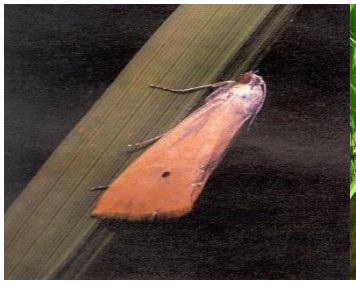
- ***White tip nematode:*** *Aphelehchoides besseyi*

It is parasitic on aerial parts of the rice plants due to which the upper leaf tip (2-5) cm becomes white or pale yellow in colour. Flag leaves characteristically shortened and twisted in the apical region with loss of vigour, stunted growth and emergence of smaller panicles. The plant infected with this nematode become sterile, produce distorted glumes and deformed grains. Nematode remains between grain and husk and carried to next generation.



Rice Stem Borer

Symptom-Dead Heart

Symptom- White ear head

Rice Gall Midge

Silver Shoot/ Onion Shoot

Brown Plant Hopper

Hopper Burn symptom

Rice Blast

Bacterial leaf blight

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Sheath Rot | Sheath Blight | False Smut

Preventive Measures

Pest Monitoring

1. Survey: Survey should be done at every 10 km distance at 7-10 days intervals (depending upon pest population). According to Dash *et al.,* (2006) every day at least 20 spots should be observed
2. Scouting: - Field scouting should be done by both scientist and farmers once in 3-5 days to workout ETL.

Cultural Practices

1. Raise *Sesbania* or sunhemp and incorporate 45 days old crop in soil during land preparation.
2. Select suitable resistant or moderately resistant variety.
3. Use disease and insect free pure seed.
4. Timely planting/sowing.
5. Pre-sowing irrigation: Many weeds can be controlled by applying pre-sowing irrigation to area where nursery or seedlings are to be transplanted. The emerged weeds can be ploughed under.
6. Raising of healthy nursery.
7. Normal spacing with 30-36 hills/ m^2 depending on the duration of the variety (Singh and Dhaliwal, 1994.)
8. Balanced use of fertilizers and micro-nutrients as per local recommendations.
9. Proper water management (alternate wetting and drying to avoid water stagnation) in plant hopper, bacterial blight and stem rot endemic areas.

10. In direct sown rice, the crop should be sown in lines at recommended spacing to facilitate interweeding operations.
11. Harvest close to ground level to destroy insect pest present in the internodes/stubbles.
12. After harvest, the fields should be thoroughly flooded with water and ploughed with discs or rotators to kill hibernating larvae of stem borer present in the stubbles.

Mechanical Practices

1. Collection of egg masses and larvae of pest to be placed in bamboo cages for conservation of biocontrol agents.
2. Removal and destruction (burn) of diseased/pest infested plant parts.
3. Clipping of rice seedlings tips at the time of transplanting to minimize carryover of rice hispa, caseworm and stem borer infestation from seed bed to the transplanted fields.
4. Use of coir rope in rice crop for dislodging case worm, cut worm and swarming caterpillar and leaf folder larvae etc.

Augmentation and conservation

1. *Trichogramma japonicum* and *T chilonis* may be released @ 1 lakh/ha on appearance of egg masses / moth of yellow stem borer and leaf folder in the field.
2. Natural biocontrol agents such as spiders, drynids, water bugs, mirid bugs, damsel flies, dragonflies, meadow grasshoppers, staphylinid beetles, carabids, coccinellids, *Apanteles, Tetrastichus, Telenomus, Trichogramma, Bracon, Platygaster* etc. should be conserved (Jha and Kim 2010).
3. Collection of egg masses of borers and putting them in a bamboo cage-cum-percher till flowering which will permit the escape of egg parasites and trap and kill the hatching larvae. Besides, these would allow perching of predatory birds.
4. Habitat management: Protection of natural habitats within the farm boundary may help in conserving natural enemies of pests. Cultivation/ intercropping of flowering weeds like marigold, sun hemp increases beneficial natural enemy population and also reduce the incidence of root knot nematodes.

Chemical control measures

1. Carbofuran 3% CG @ 25000-66600 g/ha or cartap hydrochloride 4% granules @ 18750 g/ha or cartap hydrochloride 50% SP @ 1000 g/ha or monocrotophos 36 % SL @ 625-1250 ml/ha (Kharbade *et al*., 2015).
2. Cartap hydrochloride 4% granules @ 18750 g/ha or cartap hydrochloride 50% SP @ 1000 g/ha.
3. Spray of imidacloprid 70% WG @ 30-35 g/ha or imidacloprid 30.5% m/m SC @ 60-75 ml/ha or ethofenoprox 10% EC @ 500-750 ml/ha or acephate 75% SP @ 666-1000 g/ha or buprofezin 25% SC @800 ml/ha.
4. Spray with carbendazim 50% WP @ 250-500 g/ha or isoprothiolan 40% EC @ 750 ml/ha or tricyclozole 75% WP @ 300-400 g/ha or tricyclazole 70% WG @ 300 g/ha.
5. Spray streptocycline 100 to 150 ppm solution at early root stage. Second spray, if necessary, before grain set. Application of nitrogenous fertilizers should be reduced and apply only when needed only small dose of N in more split doses. Chemicals as recommended earlier.
6. Apply validamycin 3% L @ 2000 g/ha or hexaconazole 5% EC @ 1000 ml/ha or propiconazole 25% EC @750 ml/ha or propiconazole 10.7% + tricyclazole 34.2% SE @ 500 ml/ha.

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