

Integrated Pest Management in Rice

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SUMMARY

Rice is the staple food crop for more than half of the world's population though its cultivation is done in only 11% of the world's cultivable land. Several pests attack rice in different ways at different stages. Increased reliance on pesticides for pest control is found to be unsustainable and cost-ineffective. To overcome the biotic constraints mainly pests and diseases for realizing yield potential of rice, development of suitable Integrated Pest Management (IPM) strategy is important. So, Integrated Pest Management (IPM) has been introduced as the best alternative for pest management in rice. IPM in rice helps to minimize risks to the environment and human health. Rice IPM uses the combination of cultural, use of resistant varieties, biological, physical, and chemical practices for pest control.

INTRODUCTION

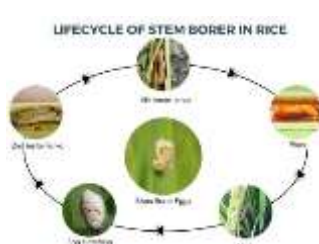
Paddy is one of the most important cereal crops in Maharashtra State. In India, more than 70 pests have been recorded on this crop, both in the field as well as in storage. In our state 24 pest have so far been reported. There are many reasons for the decline in yield per hectare of rice crop. The main reason is the lack of pest and disease management. This is an important component of integrated rice crop management. IPM programs have a significant impact on minimizing the adverse effects of insecticides and in increasing the profitability of rice production. In this article we will see how to manage pests of rice crop.

Integrated Rice Pest Management:

More than 100 pests have been recorded on rice crop. In Maharashtra, the main infestation of insects like paddy stem borer, brown plant hoppers, green leaf hoppers, paddy leaf folder, armyworms, rice hispa, rice earhead bug, paddy gall midge or gall fly, crabs, etc. observed on rice plants.

Paddy stem borer : *Scirpophaga incertulas* Pyralidae : Lepidoptera

- Moths of this pest are yellowish in colour and medium in size with one black spot on the underside of the female's wing. It is not present in males.
- A female of this pest lays a cluster of 100 to 200 eggs on a leaf.
- The larva hatches from the egg in 5 to 8 days.
- The caterpillars initially feed on the tender leaves and then bore into the stem and feed internally thus causing death of central shoot called "dead heart".
- When the attack is in seedling stage, seedling is killed, whereas during tillering stage, dead heart formed tiller gets damaged.
- If they attack the crop in the later stage, the plants bear empty ears, locally known as "Palinj" or white ear head.
- Full-grown larvae are yellowish in colour and the head area is yellowish-orange. This larva goes through six stages in 16 to 17 days and enters the pupal stage in the stem.
- The pupal period is 9 to 12 days.
- One generation of this pest is completed in 31 to 40 days.



Paddy stem borer (*Scirpophaga incertulas*)

Brown plant hoppers : *Nilparvata lugens* Delphacidae : Hemiptera

- The infestation of this insect has been increased in the last three to four years.
- The hoppers are small in size.
- The female lays 180 to 200 eggs in the leaf sheath or midvein.
- Nymphs emerge from it in 7 to 9 days. They grow fully in 2 to 3 weeks.
- The colour of the hoppers is like dried grass, then it turns to brown.
- The brown plant hoppers have a peculiar habit of attacking the crop from the middle of the fields.
- Both nymphs and adults suck the plant sap from the leaf sheath.
- Attacked plants turn yellowish with drying of the leaves from the tips. Later plants wither and dry up. Thus, circular damage patches are noticed in the field spreading all rounds if pest is not controlled in time and such circular reddish-brown patches is called as “Hopper burn”.
- They can be quickly identified due to their oblique and full gait. In the field, long feathery hoppers appear on the underside of the trunk.



Brown plant hoppers (*Nilparvata lugens*)

Green leaf hoppers : *Nephotettix virescens*, *N. nigropictus* and *N. cincticeps*, Cicadellidae : Hemiptera

- These hoppers are small in size and green in colour.
- The adult also green in colour with blackish apical margin and black spot on each forewing.
- The nymphs are also greenish in colour but are smaller and wingless.
- Female hoppers scrape the surface of the leaf and lay eggs in the leaf axil or midvein of the leaf.
- Nymphs emerges in 4 to 8 days and are grown fully in 2 to 3 weeks. They moult 4 to 5 times during this period.
- Adult hoppers are 4 to 5 mm long. It takes 18 to 25 days to complete one generation.
- Both nymphs and adults of green hopper suck the cell sap from leaves.
- In case of serious attack, leaves initially become pale yellow, later on turn brown and ultimately wither, without producing ears.
- However, When the attack during earhead emergence stage, the pest devitalizes the plants and grain filling is adversely affected and proportion of incompletely full grain is increased.
- The green leaf hopper transmits “tungro”, “rice yellow dwarf” and “transitory yellowing” virus disease.



Green leaf hoppers

Paddy leaf folder : *Cnaphalocrocis medinalis* Pyralidae : Lepidoptera

- The moths of this insect are small, pale-yellow with black, wavy patterns on the edges of their wings.
- The female lays 300 eggs near the main vein on the leaf.
- The newly hatched larvae are whitish-green in colour. It turns yellowish green after full growth in 15 to 17 days.
- The larvae live inside the rolled leaf and feed on the green matter on the surface. Due to this, the leaves turn white and dry.

- The larvae go into the pupal stage for a week and the hatched moths live for 3 to 4 days. A generation is completed in about a month.



Paddy leaf folder (*Cnaphalocrocis medinalis*)

Army Worms : *Mythimna separate* Noctuide : Lepidoptera

- This pest is called 'army worms' because of their habit of attacking in groups like an army.
- The caterpillar attacks the crop at dusk and dawn and hides in the leaf whorl or the soil during daylight.
- Moths are strong and brown in colour. Larva is greenish black in colour with yellowish vertical lines on body.
- Female moths lay 200 to 300 eggs in small groups on rice and grass and covered with grey threads.
- The larvae emerge from the egg within a week and damage the rice crop.
- These larvae feed on the entire leaves and earhead of rice.
- They also feed on the grass on bunds and leave only the leaf veins and sticks behind.
- The larval stage is 20 to 25 days and the pupal stage is 10 to 15 days. A generation is completed in 30 to 40 days.



Army Worms (*Mythimna separate*)

Rice hispa : *Dicladispa armigera* Chrysomelidae : Coleoptera

- Adult beetles are small, somewhat square shaped measuring 4 to 5 mm in length.
- They are dark blue or blackish in colour having spines all over the wings.
- A female lays an average of 55 eggs and the grubs hatch in 3 to 5 days.
- Grubs are very small and leaf miners. It grows fully in 2 weeks.
- Pupal stage is 4 to 6 days.
- The grubs and beetles of these insects damage the crop. While the beetles scrape off the green part of the leaf, the grubs bore the leaves and leave crazy long white spots.



Rice hispa (*Dicladispa armigera*)

Rice Earhead bug or Gundhi bug : *Leptocoris acuta* Alydidae : Hemiptera

- If there is a heavy infestation of this pest in the fields in earhead, there will be a typical offensive buggy odour, hence this pest is also called as “Gundhi bug”.
- The adult bug is long, slender bodied insect greenish yellow in colour and measures about 15 mm in length and long legged.
- Nymphs are green and brown in colour.

- Both nymphs and adults suck the juice from the milky grains while filling them causing them to shrivel. Therefore, the earhead remains empty there by affecting the yield.
- In case of severe infestation only chaffy husk is left on the ear.
- The pest disappears when the grains become hard.



Rice Earhead bug or Gundhi bug (*Leptocorisa acuta*)

Paddy gall midge or gall fly : *Orseolia oryzae* Cecidomyiidae : Diptera

- The adult is dipterous fly, with a wing span of 2 mm and having long slender legs like mosquitoes. The larva is legless maggot tapering to the anterior end.
- Female is reddish brown and male is ashy grey in colour.
- The adult fly lays 150 to 200 long, pale pink or yellowish eggs on the leaf surface or underside. Maggots hatches from eggs in 3 to 4 days.
- The young maggot after hatching creeps down the leaf sheath and gets access to the growing bud and lacerate the tissue stopping the normal apical growth. Thus, the bud cannot produce the normal shoot but a tubular structure called as “Silver Shoot” or “Onion Leaf” is formed due to the feeding by the larvae.
- The pest attack is seen even in the seedling stage, but the infestation is highest in the tillering stage.
- The late planted crop has more attack of the pest.
- The larva enters the pupal stage after 15 to 20 days. This pest complete one generation within 3 weeks.



Paddy gall midge or gall fly (*Orseolia oryzae*)

Crab :

- Crab belongs to the phylum Arthropoda and class crustacea.
- Paddy field crabs are divided into mutha and chimbori.
- The crabs found in the burrow near the bunds and feed on the young rice plants near the ground and take them to the burrow to eat.
- In the first one and a half months, most of the infestation is seen in the crop.
- They are active during night; as they are nocturnal.
- Besides their crop damaging activity, they prepare a series of burrows in the paddy field. Due to which water is not retained in the field and the bunds get damaged. This results in a double loss of standing crop loss and later construction costs.
- Thus, crab is major crustacean pest of paddy crop, it requires intensive control.



Crabs

Rats :

- Rodents damages the rice crop at all stages of growth.
- This loss is particularly high during the grain filling stage.
- Minor damage done by rats is not easily seen. If observed closely, this damage is only visible.
- In other cases, their damage appears to be concentrated in the centre of the field.
- Rat cuts diagonally to developing tillers normally 5 to 10 cm above the water level.
- If the active number of rats in the field is high, the rice crop will be severely damaged.

**Rats****Integrated Pest Management :**

1. After the harvesting of paddy, the land is deeply ploughed in summer. Deep ploughing of the infested fields after the harvest of the crop to expose hibernating pupae to the action of weathering agencies and birds.
2. Stubbles should be collected and destroyed, this will destroy the dormant stages of pests like stem borer, army worms.
3. While rectifying bunds for cultivation, plan to have narrow bunds in the field and the field land should be levelled.
4. Pest resistant varieties should be planted.
5. In the paddy fields various predator insects like mirid bugs, spiders, etc. are naturally observed. They should be conserved.
6. Install the 4 pheromones traps per acre for biological control of paddy stem borer.
7. Release the adults of parasitoid, *Trichogramma japonicum* after one month of planting at 1 lakh adults per hectare for four times at weekly intervals for biological control of paddy stem borer.
8. If an infestation of paddy leaf folder is observed, release the adults of parasitoid, *Trichogramma chilonis* at 1 lakh adults per hectare for four times at weekly intervals.
9. At the beginning of the season or after crab infestation is observed, use toxic bait for control of crabs.
10. For control of the rats, deep ploughing of field and pruning of the field embankment should be done. At the time of land preparation, destroy old burrows and destroy their habitat. Along with this, 10 grams of zinc phosphide (2.5 %) in 10 ml of edible oil should be mixed with 380 grams of coarse grain and prepared into pellets and kept in the field.

Chemical control :

If the following pests appear, they should be controlled by proper spraying.

Paddy stem borer :

- Fipronil 0.3 G @ 33 kg or Cartap hydrochloride 4 G @ 25 kg per hectare should be applied through soil. It is necessary to have moisture in the soil at the time of application.
- If it is not possible to apply through soil, then spraying should be done with Cartap hydrochloride 50 SP @ 1 kg per 500 litres of water or Chlorantraniliprole 18.5 SC @ 150 ml per 500 litres of water.

Brown plant hoppers :

- Imidacloprid 17.8 SL @ 125 ml per 500 litres of water or Fipronil 5 SC @ 1500 ml per 500 litres of water.

Paddy leaf folder :

- Cartap hydrochloride 50 SP @ 1 kg per 500 litres of water.

Hoppers, paddy leaf folder and paddy stem borer :

- NSKE 5% per 500 litres of water or Cartap hydrochloride 50 SP @ 1 kg per 500 litres of water or quinolphos 25 EC @ 1500 ml per 500 litres of water.

Hoppers, Paddy stem borer and Paddy gall fly :

- Fipronil 5 SC @ 1500 ml per 500 litres of water.

Paddy leaf folder and hoppers :

- Cartap hydrochloride 50 SP @ 1000 g per 500 litres of water.

Army worm and rice earhead bug :

- Chlorpyrifos 20 EC @ 1000 ml per 500 litres of water or quinolphos 25 EC @ 1200 ml per 500 litres of water or Lambda cyhalothrene 2.5 EC @ 500 ml per 500 litres of water.

CONCLUSION

Humid climate, high humidity, stagnant water, irregular rainfall are favourable conditions for development of pests on rice crop. Due to this, there is a heavy loss of the crop and the production is reduced by 25 to 30 percent. Prevention of such a loss should constitute one of the important methods of augmenting our food security. Adoption of integrated pest management (IPM) strategies is the best solution to tackle the pest problems. Rice IPM provides a framework for integrating knowledge, skills and information on rice pest management. An IPM practice in rice production initiatives includes regular pest monitoring, research on the optimal use of pesticides, complementary weed control strategies, and alternative cultural and biological controls.

REFERENCES

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