INTEGRATED PEST MANAGEMENT TECHNIQUES FOR RICE-FED ECOSYSTEMS THE RAIN

Devendra Pal Singh

Assistant Professor, College of Agriculture Sciences,
Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email Id- dpsinghevs@gmail.com

ABSTRACT

In India, 55% of the land is planted with rice, and 30% of the nation's rice is produced using this method. In rainfed rice ecologies, rice yield is constrained by rice tango disease blast, sheath blight, brown plant hopper white backed plant hopper green leaf hopper (glh), and other biotic variables. At various stages of growth, a variety of insect pests and diseases harm the rice crop, causing an annual loss of rice production of roughly 10%, or rs 5,000 crores. The loss can rise to as much as 20% in some years. A brown spot disease outbreak in Bengal in 1943 caused the great Bengal famine, which resulted in the starvation deaths of around 3 million people. In both the pre- and post-semi-dwarf hive eras, leaf and panicle blast was a serious disease in rice grown in upland areas and in hilly places. Following the introduction of hive in the late 1960s, bacterial leaf blight (blb) and rtd emerged as serious issues. Several rice pests' status has recently seen a significant alteration as well. The production of semi-dwarf cultivars and intensive farming are to blame for this. Many once-minor pests are now considered to be serious pests.

KEYWORDS: Ecosystems, Pests Management, Rainfed, Weed.

INTRODUCTION

Blast, BLB, RTD, sheath blight, fake smut, brown spot, sheath rot, and sheath rot are some of the prevalent diseases at the moment. Insects include the yellow stem borer (YSB), BPH, GLH, gall midge, hispid, leaf folder, and gundi bug. New pathotypes and biotypes have continued to evolve even after resistant cultivars were introduced. The development of pesticide resistance in many pest insects is another difficulty. In recent years, mites and nematodes which were previously unimportant in rainfed ecologies have grown in importance. 10 IPM modules have been created for various rainfed rice growing ecologies and production systems in India, of which 4 are for irrigated rice and 6 are for rainfed rice (Singh and Gangopadhyay, 2000). Each module's pest problem and how it is managed varies depending on the region. The main types of rice grown in each state.

Ecology of Rainfed Upland Rice

There are over 6 million hectares of upland rice. Due to biotic restrictions such root knot nematode, termites, weeds, leaf and panicle blasts, brown spot, gundi insect, and grain discoloration, its production is modest. Pest issues are also made worse by abiotic factors like as dryness, poor soil quality, and acidic highland soils. However, by successfully managing these, upland rice productivity can be increased to 3.0 t/ha. A comprehensive IPM program for upland rice should put an emphasis on weed management using economical techniques. Because weeds serve as alternative hosts for many pests, efficient weed removal also reduces the prevalence of insects and diseases. Such an IPM strategy should be aware of how to control nematodes, weeds, illnesses, and insects in concert with one another lists the IPM strategy created for this ecosystem. Table 1 IPM module for irrigated and ramified rice ecologies and production systems in India.

Table 1: IPM module for irrigated and ramified rice ecologies and production systems in India.

Modules	Ecologies and production system	Area (m ha)	Region*
1.	Irrigated rice, wet season	14.0	H, NW, NE, E, C, S
2.	Irrigated rice, dry season	4.0	E, NE, S
3.	Hybrid rice	0.5	E,S,N
4.	Scented rice	2.0	NW
5.	Upland rice	6.0	H, E, NE, C, W
6.	Rainfed lowland, shallow drought prone	4.0	C, E, NW
7.	Rainfed lowland, shallow favourable	4.0	E, NE, C
8.	Medium-deep waterlogged and flood prone	5.0	E, NE
9.	Deep-water rice	4.0	E, NE
10.	Coastal wetlands	1.0	E, W
	Total	**44.5**	

* H= Hills; NW= North West; E= Eastern; NE= North East; C= Central; S= Southern; W= Western

The ideal rice variety for red and lateritic uplands that are prone to dryness should be weed competitive and disease- and insect-tolerant. Weed competitiveness and disease tolerance are characteristics of the varieties Kalinga III and Vandana. In several upland areas of eastern India, these cultivars have been flourishing. The yield is significantly increased when weeds are controlled using a variety of techniques, such as off-season tillage, correct soil preparation, optimal seed rates, row seeding, delivery of moderate quantities of nitrogen in split applications, and balanced fertilization. Application of herbicides such butachlor, thiogenic, pendimethalin, and but anil, along with hand weeding, aid in the cost-effective management of weeds. Fields with insufficient soil moisture promote the growth of termites and illnesses like brown spot and blast. Bundling of plots and summer poling are two useful in situ moisture conservation techniques. By treating seeds with chlorpyrifos (0.02%), which minimizes termite infestation, which significantly affects plant stand in lateritic soils, termite problems can be efficiently handled.

Need-based applications of dust formulations like monostrophe’s 36EC or chlorpyrifos have been found to be effective at controlling the gundi bug. By administering Bavistin as a preventative seed therapy, the blast disease can be managed. It is advised to spray beam 75, Hinson, or Bavistin on the area if the economic threshold level (ETL) has been exceeded. To effectively reduce blast, it has been found useful to use environmentally friendly botanicals such aqueous extracts of bagel leaves (Aegle Mar melas) and Tulsi leaves. We still don't fully understand the interactions between seed treatment, chlorpyrifos, and Bavistin (or other chemicals), and we need more research. Chlorpyrifos seed treatment is successful in regions with root knot nematode infestations. Similar to this, rotating pulse crops like pigeonpox, sesame, green gram, and black gram (urbane) lowers nematode infection. Nematode numbers are also decreased by using neem cake and carbofuran. Based on the requirements specific to the site, the historical context, and the financial efficiency, several approaches may be employed. Research should find common methods with many advantages when creating a holistic bundle.

DISCUSSION

Million hectares of rainfed lowland rice are cultivated in India, a country with a slow adoption of high yielding varieties. Depending on the moisture stress and water depth, this ecosystem can be further split into three main categories: shallow drought prone, shallow advantageous, and medium-deep waterlogged. Root knot nematode, weeds, brown spot, leaf and panicle blasts, sheath 57 rot, and stem borer are the main issues in 4 million hectares of shallow rainfed lowland drought-prone zones. In this environment, land races predominate. However, numerous enhanced cultivars that are chosen from land races, such as Sarri 17, T141, BR 8, BR 34, Sudha, Janaki, and Vaidehi, are also well-liked. In this environment, managing pests includes weeds as a key element. Even though weeds are less of an issue in lowland rice than in upland rice, hand weeding and the use of weedicides for weed control should be judiciously coupled to achieve cost-effective weed control. The developed IPM package is provided [1].

Favourable Rainfed Lowland-Shallow Ecology

This ecology and the irrigated ecology are comparable. Many pests, which are one of the main obstacles to raising rice output, thrive in the warm, humid atmosphere. Therefore, it is crucial to develop appropriate, site-specific pest management solutions that are both financially and environmentally sound. A number of rice pests have recently seen a shift in status. Even while stem borer is still the principal insect issue, other smaller pests and weeds have become more significant. In this ecosystem, improved varieties like Sambha Mahsuri, Pankaj, Savitri, Gayatri, Moti, Pooja, Monohedral, Rajshree, and Ranjit are grown. Its size is roughly 4.0 million acres. The main pests include the gall midge, false smut, leaf folder, hasp, mites, BPH and WBPH, and panicle blasts.

Limited progress has been made in developing genetic resistance to pests such stem borer, bacterial blight, RTD, and sheath blight; for the most part, chemical control is used to address these problems. Inoculative or inundate releases of biocontrol agents, a crucial element of IPM, have had only patchy success. Consequently, it is important to protect natural biocontrol agents in this ecosystem. Recently, it has been discovered that pest monitoring and bulk yellow stem borer trapping utilizing pheromone traps are both effective. For the management of stem borers, a number of cultural measures have been recommended, including glowing following paddy harvest and, in extreme circumstances, burning of stubbles. In the absence of alternative management techniques, it is vital to employ chemicals and botanicals based on need for the management of various pests, therefore numerous compounds and their application techniques have been found. The created IPM package is provided [2]–[5].

Ecology of Coastal Wetlands

Wetlands, or simply a "wetland," is a particular habitat that experiences seasonal or permanent flooding or saturation by water over a period of weeks or months. When there is flooding, anoxic (oxygen-free) processes take over, especially in the soils. Figure the peculiar flora of aquatic plants, adapted to the special anoxic hydric soils, is the main property that distinguishes wetlands from terrestrial land formations or water bodies. Wetlands, which are home to a variety of plant and animal species, are among the habitats with the greatest biological diversity. For many areas of the world, methods for evaluating wetland functions, wetland ecological health, and overall wetland status have been established. These techniques have helped preserve wetlands in part by increasing public awareness of the uses some wetlands serve. Built-in wetlands are intended to redirect stormwater runoff and treat industrial and municipal wastewater. A component of water-sensitive urban design may also include constructed wetlands.

Natural wetlands can be found on every continent. Wetlands typically contain freshwater, brackish water, or saltwater. The primary wetland kinds are categorized according to the prevalent vegetation and/or the water source. Swamps, on the other hand, are wetlands where woody vegetation, such as trees and shrubs, predominates (although reed swamps in Europe are dominated by reeds, not trees). For instance, marshes are wetlands where emergent vegetation, such as reeds, cattails, and sedges, predominate.

Figure: Costal Wetlands

Tidal wetlands water from overflowed rivers or lakes, springs, seeps, and fens groundwater discharge out onto the surface and bogs and vernal ponds rainfall or meltwater are a few examples of wetlands classified by their sources of water. Some wetlands are challenging to categorize because they support a variety of plant species and receive water from various sources. The Amazon River basin, the West Siberian Plain, the Pantanal in South America, the Sundarbans in the Ganges-Brahmaputra delta, and other areas are home to some of the largest wetlands on earth. There are several benefits for individuals that wetlands provide. Water purification, groundwater replenishment, shoreline stabilization, storm protection, water storage, flood control, processing of carbon fixation, decomposition, and sequestration processing of other nutrients and pollutants, and support of plants and animals are some of these so-called ecosystem services. Wetlands provide wetland products and serve as biodiversity reservoirs. Wetlands are more impacted by environmental deterioration than any other ecosystem on Earth, according to the UN Millennium Ecosystem Assessment. Depending on the specific wetland, wetlands can be significant sources and sinks of carbon.

As a result, they will play a significant role in climate change and must be taken into account in efforts to reduce it. But certain wetlands produce a sizable amount of methane emissions, and some of them also produce nitrous oxide emissions.

During the monsoon season, rice is a significant crop in the coastal areas. Old traditional rice varieties are grown by farmers. Salinity of the soil. IPM deepwater module Pest Name Sol No. Control measures 1. Pests collared stem After harvesting the borer (YSB) deep-water crop in December and January, the ground is flowed. YSB monitoring at 5 pheromone traps per hectare and above ETL bulk trapping at 20 traps per hectare Release T. japonium at 50,000/ha three times while the eggs are incubating Mealybug Spot application of portae @1.0 kg a.i./ha Hsipaw Use phosphamide at a rate of 0.5 kg a.i./ha. illness bacterial Before water builds up in the field, spray foliar leaf blight with cow dung slurry at a rate of 2 kg/litre. When grain discoloration first occurs, apply a foliar spray of dithiane M-45 (1%) or false smut Klaasen @ 2 g/litre. RTD Develop hardy varieties like Sabita (West Bengal) and Durga (Orissa) [6]–[8].

Nematode Ufra: Soak seeds in hot water before planting; sprinkle with arbuscular at 0.04% twice: once at the PI stage and once at the heading stage. Rats and mice Rats are a problem in these locations; the bait is 1% (W/W) zinc phosphide. Salts build up on the soil surface during the dry season in some areas when the groundwater is likewise salty. Insect pests such stem borer, gall midge, and leaf folder, as well as bacterial leaf blight and sheath rot, as well as weeds like wild rice, Chinalco species, Cyperus species, and Spheroplasts species, are frequent. The yield in coastal regions is thus low, averaging 1.5 t/ha on average, which is lower than the national average. A need-based integrated pest control strategy is required for an economical and sustainable yield in coastal salinity settings to address these issues. Plant defines techniques include nursery treatment (carbofuran or portae @ 1.0 kg a.i./ha), seedling root dip (0.02% chlorpyrifos), monitoring and controlling of YSB through sex pheromone traps and troche-cards, seed treatment for sheath rot, control of vector for RTD, and need-based fungicide application. Additionally, integrated weed management techniques including summer ploughing, pre-emergence herbicide application (followed by the use of butachlor @ 1.5-2 kg a.i./ha), and hand weeding 34–40 days following sowing aid in reducing weed growth. Since the field conditions do not allow for fertilizer top dressing [9]–[11].

Specialized terminology

Wetland is defined as "an area of land that is typically saturated with water" in its simplest form. Wetlands, to be more precise, are places where "water covers the soil, or is present either at or near the surface of the soil either all year or for varying periods of time during the year, including during the growing season" Even when a piece of land is wet, it may not necessarily be referred to be a "wetland" if it forms pools of water after a rainstorm. Wetlands are distinct from other water bodies or landforms due to their specific features, like their water level and the kinds of plants that thrive there. In particular, wetlands are defined as having a water table that is at or close to the surface of the land for an amount of time each year that is sufficient to support aquatic vegetation.

A community made up of hydrophytes and hydric soil is a clearer definition

Wetlands are sometimes referred to as ecotones because they serve as a transitional area between dry ground and water. Wetlands are at the interface between truly terrestrial ecosystems and aquatic systems, making them inherently different from each other, yet highly dependent on both." There are agreed-upon subsets of definitions that are used in environmental decision-making to make regulatory and policy judgments.

CONCLUSION

In various Indian states since 1965, over 630 different rice types have been introduced. However, most farmers in rainfed ecosystems cultivate land races or varieties of land races. Pest incidence and management are greatly influenced by the timing of sowing and planting as well as the careful use of fertilizers. To prevent a pest resurgence, pesticides must be used as needed and according to a timetable. It must be incorporated into every module that is suggested for various ecologies. Plant spacing, irrigation from plot to plot, and nitrous fertilizer all have an impact on the prevalence of diseases like BLB. Spraying should be avoided in these situations in order to conserve the natural parasite and predator populations. According to economic analysis, host plant resistance is the most profitable IPM technology. After a disease or insect outbreak, susceptible kinds are wiped out. It is necessary to create numerous host plant kinds that are resistant to worms, diseases, and insects. However, because of the pest's shifting selection pressure, it is also crucial to apply biopesticides based on need and supplement them with biocontrol agents, cultural practices, cow dung, and urine, among other things.

REFERENCES

[1] M. Nurhayati, "Peran Tenaga Medis Dalam Pelayanan Kesehatan Masyarakat Di Puskesmas Pembantu Linggang Amer Kecamatan Linggang Bigung Kabupaten Kutai Barat," *ejournal Adm. Negara*, 2018.

[2] A. Kumar *et al.*, "High-yielding, drought-tolerant, stable rice genotypes for the shallow rainfed lowland drought-prone ecosystem," *F. Crop. Res.*, 2012, doi: 10.1016/j.fcr.2012.03.007.

[3] L. J. Wade *et al.*, "Genotype by environment interactions across diverse rainfed lowland rice environments," *F. Crop. Res.*, 1999, doi: 10.1016/S0378-4290(99)00049-0.

[4] R. Singh, D. K. Kundu, and K. K. Bandyopadhyay, "Enhancing Agricultural Productivity through Enhanced Water Use Efficiency," *J. Agric. Phys.*, 2010.

[5] K. Homma, A. Mochizuki, T. Horie, T. Shiraiwa, and N. Supapoj, "Nutrient defciency in the rice-stylo (Stylosanthes guianensis) relay-intercropping system in rainfed lowland rice ecosystem in Northeast Thailand," *Plant Prod. Sci.*, 2009, doi: 10.1626/pps.12.390.

[6] M. K. Cheung, C. K. Wong, K. H. Chu, and H. S. Kwan, "Community Structure, Dynamics and Interactions of Bacteria, Archaea and Fungi in Subtropical Coastal Wetland Sediments," *Sci. Rep.*, 2018, doi: 10.1038/s41598-018-32529-5.

[7] S. Ramachandran, S. Sundaramoorthy, R. Krishnamoorthy, J. Devasenapathy, and M. Thanikachalam, "Application of remote sensing and GIS to coastal wetland ecology of Tamil Nadu and Andaman and Nicobar group of islands with special reference to

mangroves," *Curr. Sci.*, 1998.

[8] D. M. Kidwell, J. C. Dietrich, S. C. Hagen, and S. C. Medeiros, "An Earth's Future Special Collection: Impacts of the coastal dynamics of sea level rise on low-gradient coastal landscapes," *Earth's Futur.*, 2017, doi: 10.1002/2016EF000493.

[9] J. S. Prasad and K. S. Varaprasad, "Ufra nematode, Ditylenchus angustus is seed borne!," *Crop Prot.*, 2002, doi: 10.1016/S0261-2194(01)00064-3.

[10] S. Khanam, A. M. Akanda, M. A. Ali, T. Kyndt, and G. Gheysen, "Identification of Bangladeshi rice varieties resistant to ufra disease caused by the nematode Ditylenchus angustus," *Crop Prot.*, 2016, doi: 10.1016/j.cropro.2015.09.009.

[11] M. A. Latif, A. Haque, M. I. Tajul, M. A. Monsur, and M. Y. Rafii, "Interactions between the nematodes Ditylenchus angustus and Aphelenchoides besseyi on rice: Population dynamics and grain yield reductions," *Phytopathol. Mediterr.*, 2013.