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Integrated Disease Management in Rice

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Rice (*Oryza sativa* L.) is the world's most significant cereal crop and also fastener food of over half of the world's people. Rice rank second among the all most cereals in terms of total grain production after maize world-wide.

Rice is cultivated about 169 million hectares with 780.9 million tons of total world production. India is a leading country and donate in an area and production of rice is 43.79 mh and 116.42 mt, respectively with average productivity of 2659 kg/ha. Among the chief yield limiting factors pests are said to be a significant one. Pest causes 33% production losses in India, the most important pest weed causes 12.5 % whereas insect 9.5% and disease 6.5%. There are several constraints in the production of rice crop. It is affected by different biotic and abiotic factors which are answerable for its low yield. Among the biotic factors disease caused by fungi, bacteria, virus, nematodes and insects are responsible for major economic losses in diverse part of our country.

In this view IDM is a science based approach to managing pest and diseases by considerate the environment, the pest or disease, and the conditions the encourage survival, the crop and its growing situation and natures ecology and relations with natural enemies. The use of biodegradable pesticides are only applied and use as a last remedy based on careful environmental monitoring. Here we will talk about some significant diseases of rice and their management in an integrated way.

Brown spot

Brown spot is most imperative fungal disease of rice that can infect both seedlings and full-grown plants. The disease causes blight on seedlings, which are grown from greatly infected seeds, and can cause 10-58% seedling mortality. The disease was considered to be the major thing contributing to the *"Great Bengal Famine"* in 1942.

Symptoms

- This disease might be manifested as seedling blight or as a foliar and glume disease of full-grown plants. In seedlings the fungus produces small, circular brown lesions which may girdle the coleoptiles and cause alteration of the leaves. Infected seedlings are undersized or killed.
- In grown-up plants, the lesions on the leaves are light brown to gray in the center and

have a reddish brown margin and lesions may vary between 1mm to 14mm long. Later, lesions may unite in harsh infections killing large areas of pretentious leaves.

- The fungus be capable of infect the glumes and the grains, thus reduces the number of grains per panicle and the kernel weight.

Causal organism: The causal organism of brown spot of rice is *Bipolaris oryzae, Cochilobolus miyabeans* (synonyms *Dreschlera oryzae*, *Helminthosporium oryzae*). The somatic structures of the fungus consist of black velvety mycelial mats which are made up of desperate hyphae and erect sporophores. The hyphae are abundant, branching, and anastomosing. They are dark brown or olivaceous and measure 8-15 µm or more in diameter.

Disease cycle and Epidemiology: The impure seeds are the most ordinary source of primary infection. The fungus also survives on collateral hosts. It can stay alive in the seed for over 4 years. The fungus is able to extend from plant to plant and in the field by airborne spores. The most favorable temperature ranging from 25°C -30°C with and high humidity 86-100%.

Management

- Give the well balanced nutrients for the soil.
- Clean all rice garbage and weeds from fields which sources of inoculum.
- Avoid water stress conditions and use resistant/tolerant cultivars
- The fungus be capable of survive on seeds for up to 4 years, therefore, seed treatment with captan.
- Soaking seed in hot water 53-54°C for 10-12 minutes may also be effective.
- Seed treatment with tricyclazole followed by spraying of mancozeb + tricyclazole at tillering and late booting stages give good management of the disease.

Rice blast

Rice blast is a significant disease world-wide and known since most primitive times as a overwhelming problem in Asia. The disease is also called as rotten neck or rice fever in China. In India, its first incidence was recorded in 1918. The disease is predictable to cause grain loss up to 70 to 80%.

Symptoms: Blast is a foliar disease violent above-ground plant parts but the majority is found on leaves (leaf and collar blast) or the panicles (neck and panicle blast). On top of the leaves, very untimely lesions (spots) are off-white to gray-green in color with a dark green border and only 1/16 - 1/8" across. These spots quickly twist gray or gray-white in the center with a brown to reddish brown border.

As regards a week after infection, the fungus sporulates inside the lesion producing a dark, gray powdery appearance, especially in the near the beginning of mornings or on the underside of the lesion during the day. It is very general for blast to attack the bottom of the flag leaf (collar blast), prematurely killing it, and infecting the sub panicle node as it exerts through this infected area.. At caption, blast attacks the node just below the panicle (neck blast) killing the entire panicle before grain fill is complete.

Causal pathogen: Blast is caused by the fungus, *Pyricularia grisea* (formerly *Pyricularia oryzae*). The fungus has sexual stage known as *Magnaporthe grisea*, which has simply been observed in the laboratory.

Disease cycle and Epidemiology: The rice blast fungus only attacks on rice and has no other plant host. Intimately-related forms of the blast fungus infect uncultivated grasses and some turf grasses but do not infect rice.

The rice blast fungus survives among rice crops in infested rice residue or on seed. Because the spores are airborne, faction between fields through the season is familiar and rapid. Cooler temperatures than normal, cloudy, and rainy weather enhance blast incidence and severity in susceptible or moderately vulnerable cultivars.

Management

- Use resistant variety such as CO 47 and remove collateral weed hosts from bunds and channels.
- Use only disease free seedlings and avoid excess nitrogen.
- Apply N in three split doses (50% basal, 25% in tillering phase and 25% N in panicle initiation stage).
- Spray after observing initial infection of the disease, Carbendazim 50WP @ 500g/ha (or) Tricyclozole 75 WP @ 500g/ha.

Rice sheath blight

Sheath blight of rice is one of the major and devastating disease of rice subsequently to blast. The disease was earliest reported in Japan by Miyake in 1910. Later, its incidence was recorded all over the temperate and tropical rice growing areas, worldwide. In India, the disease was earliest reported by Paracerand Chahalin 1963 from Gurdaspur, Punjab. The disease causes as regards 11.1-58% losses in yield depending on the disease brutality and varietal resistance.

Symptoms: Primarily the disease shows as elliptical or oval to irregular 1-3 cm long, greenish gray spots with brown margin at or on top of the water line on leaf sheath at active tillering stage which later gives the look of snake skin. The infected plants are typically found in a circular blueprint, locally referred to as 'bird's nest'. Under damp conditions, brown silky mycelium and brown to dark brown sclerotia are originate.

Causal pathogen: Sheath blight is a fungal disease of rice caused by a necrotrophic soil-borne fungus *Rhizoctonia solani* with telomorpic stage *Thanatephorus cucumeris* freely attached on the lesions, which obtain simply dislodged from the plants at adulthood. The immature hyphae are colourless but happen to yellow and eventually brown with age, 8-12 µm. The figure of the sclerotia is roughly spherical or rather flattened and unequal. Young sclerotia are posses of solid masses of hyphal cells about 5 µm wide, the cell wall 0.9 µm thick.

Disease cycle and Epidemiology: Sheath blight is a customized single cycle disease. The pathogen survives in soil inside crop garbage as mycelia or sclerotia during unfavourable ecological conditions for numerous years. Subsequent to rice harvest, *R. solani* sclerotia from

infected plants endure in the soil for periods of up to 3 years and act as a basis of infection for succeeding crop cycles.

Highest air temperature, morning relative humidity and leaf dampness have been reported to be the key factors for disease expansion in the field. The highest disease development was recorded at a temperature range of 25-30°C and 80-100 % relative humidity.

Management

- Summer deep ploughing and burning of stubbles.
- Utilize a reasonable level of fertilizer and destruction of weeds.
- Breeding disease-resistant rice cultivars is believed to be one of the most hopeful approaches to manage the disease.
- Soil amendment with organic manures like *Sesbania aculate*, and *Gliricidia aculate* leaves were efficient against sheath blight.
- Seed treatment by Bavistin and Benlate, soil appliance of Benlate, Kitazin and Hinosan, foliar use of Topsin-M has been reported ssuccessful in reducing this disease.

False smut

The false smut of rice is a significant disease that formerly recorded as a negligible disease of rice but at the present it occurs in further 40 countries, particularly in the rice producing countries of Asia, although also in the U.S.

Symptoms: As the familiar name suggests, it is not a true smut (fungus) as it is belong to Ascomycotina. False smut does not swap all or component of the kernel with a mass of black spores. Plants tainted with false smut have individual rice grain, altered into a mass of spore balls. Such spore balls are primarily 1 cm in size and orange in colour, which revolve into greenish black when these grown-up.

Causal organism: The Rice False Smut (RFS) is caused by *Ustilagi noidea virens.*The conidia are oblique with diameters ranging from 3 to 5 µm. Ahead maturation or under adverse conditions, conidia may build up to rounded chlamydospores with well-known spines on the shell.

Disease cycle and Epidemiology: *U. virens* has a strange life cycle. The fungus attacks rice flowers and forms balls enclosed with chlamydospores and produce sclerotia, which are considered as crucial inocula of this disease. During its life cycle, *U. virens* undergoes a sexual (ascospores) stage as well as an asexual (chlamydospores) stage. They take shelter in the field and might survive up to 10 months with maintaining germination capability to produce ascospores under 25°C and elevated humidity.

Management

- Use of disease-free seeds that are selected from healthy crop.
- Split relevance of nitrogenous fertilizer.
- Elimination and appropriate disposal of contaminated plant debris.
- At the time of harvesting, sickly plants should be detached and shattered so that sclerotia do not fall in the field.

- Eliminate alternate weed hosts.
- Seed treatment by carbendazim 2 g/kg of seeds.
- Spraying of copper oxychloride at 2.5 g/litre or Propiconazole at 1.0 ml/litre at boot leaf and milky stages will be more useful to put off the fungal infection.

Bacterial Leaf Blight (BLB)

Rice bacterial blight, also well-known as bacterial blight of rice. It is amongst the cruelest disease of cultivated rice (*Oryza sativa* and *O.glaberrima*). Bacterial blight has been realistic in rice-emergent regions, prosperous in warm and damp environments such as Asia, the western coast of Africa, Australia, Latin America, and the Caribbean. In malicious epidemics, crop hammering may be as eminent as 75 percent, and millions of hectares of rice are infected annually.

Symptoms: The typical symptoms of this disease come into view in two stages: seedling blight or kresek phase and Leaf blight phase.

Seedling wilt or kresek Phase: This phase might be pragmatic at 1-3 weeks subsequent to transplanting. Firstly, green water-soaked film along the cut section or leaf tip leaves are characterized as premature symptom. Afterward, leaves wilt and roll up and turn into grayish green to yellow, ensuing absolute wilting of whole plant.

Leaf blight Phase

The symptoms initialy become visible as water-soaked to yellowish stripes on leaf blades or starting on leaf tips by a curvy margin. Such tainted leaves with undulated yellowish white or golden yellow trivial necrosis, drying flipside as of tip and curling, leaving mid rib intact are the most important symptoms. Near the beginning of morning, bacterial ooze appeared that resembling a milky or dense droplet on infantile lesions. Rigorously infected leaves be predisposed to dehydrated quickly.

Disease cycle and Epidemiology: *Xanthomonas oryzae* survives throughout rice kernel, impure crop debris to facilitate are gone behind at harvest, in addition to unconventional weed hosts. *X. oryzae* lives on lifeless plants and seeds are most likely moves plant-to-plant best throughout patty water commencing irrigation or storms. The pathogen grew healthy on temperature ranges 26-30°C; 20°C being the finest temperature for early growth.

Management

- Grow Tolerant varieties (IR 2, IR 72, TKM 6).
- Avoid clipping of seedlings during transplanting.
- Unbiased fertilization, avoid excess N – application.
- Destruction of alternate weeds and collateral hosts and maintain proper plant spacing.
- Seed treatment - seed soaking for 8 hours in Agrimycin (0.025%) and wettable ceresan (0.05%) followed by hot water treatment for 30 min at 52-54°C.
- Spray Streptomycin sulphate + Tetracycline combination 300 g + Copper oxychloride 1.25kg/ha. If necessary, repeat 15 days later.

Bakanae /foolish disease

The most primitive recognized statement of *bakanae* is from 1828; it was earliest described systematically in 1898 by Japanese researcher Shotaro Hori. In outbreak cases yield wounded could reach up to 20% or more.

Symptoms: The impure plants are several inches taller than normal plants, etiolated and chlorotic. They are too thin, by means of yellowish green and pale green foliage. Premature

infection be able to cause seedlings to pass away at early tillering stage. Afterward infection fall out in plants that build up only some tillers and include dry leaves. If the plants live on to adulthood stage, they grow partially filled grains, sterile or vacant grains.

Causal organism: The causal organism was earliest identified by Hori (1808) as *Fusarium hetrosporium*. The sexual stage of fungus was described as *Lisea fugikuroi* by Sawada (1917) which was passed in 1931 to *Gibberella fusikuroi* by Ito and Kimura, who besides recognized the asexual phase as *Fusarium moniliforme.*

Disease cycle and Epidemiology: It is a monocyclic disease and the pathogen is both soil and seed borne. The most advantageous warmth for pathogen infection is 27- 30^0C and for disease ulum is further considerable source as soil borne inoculum is redeced rapidelly passage of time.

Management

- Make use of salt water to separate lightweight, infected seeds during soaking.
- Exploit fungicides as seed treatments. applying a fungicide containing benomyl or benomyl-t (at 1-2% of seed weight) for dry seed covering to treat contaminated seed can be efficient.
- Soaked seed in a fungicide solution of 1:1000 for one hour or 1:2000 for five hours has also been shown to be useful. .