



Blast disease of basmati rice and its management

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ARTICLE INFO	ABSTRACT
<p>Original Review Article Received on April 15, 2017 Accepted on May 18, 2017</p> <p>Article Authors Vipin Kumar, Rashmi Nigam, Raju, Yachna Gupta, Gyan Manjri Rao Corresponding Author Email vipinsre489@gmail.com</p> <p style="background-color: #d9ead3;">PUBLICATION INFO</p> <p>International Journal of Agricultural Invention (IJAI) RNI: UPENG/2016/70091 ISSN: 2456-1797 (P) Vol.: 2, Issue: 1, Pages: 87-91 Journal Homepage URL http://agriinventionjournal.com/ DOI: 10.46492/IJAI/2017.2.1.20</p>	<p>Basmati rice is an important staple food grain crop in the world. Basmati rice is an important export commodity among the food grains. The biotic and abiotic factors are adversely affected the Basmati rice but Basmati rice blast caused by <i>Pyricularia oryzae</i> Cavara (synonym <i>Pyricularia grisea</i> Sacc). The anamorph of <i>Magnaporthe grisea</i> (Herbert), is one of the most destructive and wide spread diseases as compared to other diseases of Basmati rice. It causes leaf blast, neck blast and panicle blast of paddy. This disease generally causes yield loss of 10-20 percent but in severe cases yield loss may reach up to 80 percent. Management of blast disease using healthy seed, resistance varieties, many biological controls like as <i>T. harzianum</i>, <i>T. viride</i> and <i>P. fluorescens</i> @10g/kg by seed treatment and foliar spray. The chemical control by fungicides such as carbendazim, tricyclazole, isoprothilane, tebuconazole, hexaconazole reduced leaf but not neck blast; on the contrary, tricyclazole was effective against neck blast and panicle blast.</p> <p style="background-color: #d9ead3;">KEYWORDS</p> <p>Basmati Rice, Blast Disease, Fungicides, Management</p>
<p style="text-align: center;">HOW TO CITE THIS ARTICLE</p> <p>Kumar, V., Nigam, R., Raju, Gupta, Y., Rao, G. M. (2017) Blast disease of basmati rice and its management, <i>International Journal of Agricultural Invention</i>, 2(1): 87-91. DOI: 10.46492/IJAI/2017.2.1.20</p>	

Rice is an important staple food grain crop in India. Basmati rice is an important export commodity among the food grains. Basmati rice is having the characteristics of extra-long slender grains that elongate at least twice of their original size, which is responsible for soft and fluffy texture upon cooking, delicious taste, superior aroma and distinct flavour. The Basmati rice has special demand in diet and international market. In India, Basmati rice is cultivated mostly in the states of Jammu & Kashmir, Himanchal Pradesh, Punjab, Haryana, Delhi, Uttrakhand and in the Districts of Western Uttar Pradesh such as Bagpat, Bareilly, Bulandshahar, Bijnor, Meerut, Muzzaffarnagar, Moradabad, Pilibith, Rampur and Saharanpur. The total area of Basmati rice in India is about 2.10 million hectares and production is 8.70 million tonnes (Anonymous, 2014-2015). The area of Basmati rice in Uttar Pradesh is 354.39 thousand hectare with a production of 1260.69 thousand tons (Anonymous, 2014-2015). The average productivity of Pusa Basmati-1121 is 35.0 Q/ha this variety is very much in demand (Anonymous, 2014-15). The average productivity of Pusa Basmati-1121 is 35.0 Q/ha this variety is very much in demand. There are several biotic and abiotic factors in India behind the

low productivity as compared to other major rice growing countries. Among the biotic factors, diseases are responsible causing severe damage to rice crop resulting in low yield and quality. Basmati rice is an important export commodity among the food grains. But production of Basmati rice is limited due to losses caused by diseases at various stages from nursery to harvesting. Basmati rice is widely affected by many diseases caused by fungi, bacteria, viruses and mycoplasma that results in significant yield losses (Ou, 1985). The important diseases that attacks on Basmati rice are Brown leaf spot (*Helminthosporium oryzae*), False smut (*Ustilaginoidea virens*) Sheath blight (*Rhizoctonia solani*), Sheath rot (*Sarocladium oryzae*), Steam rot (*Sclerotium oryzae*), Bunt disease (*Neovossia horrida*), Bakane (*Fusarium moniliforme*), Bacterial leaf blight (*Xanthomonas oryzae* pv *oryzae*), Bacterial leaf streak (*Xanthomonas oryzae* pv *oryzicola*), Nematodes diseases such as White tips (*Aphelenchoides oryzae*), Ufra (*Detylenchus angustus*), Root knot (*Melodogyne graminis*) and Viral diseases like Rice dwarf and Rice tungro but Blast disease caused by *Magnaporthe grisea* is a most serious disease as compared to other disease

of Basmati rice. It cause stem and neck blast of paddy. This disease generally causes yield loss of 10-20% but in severe cases yield loss may reach up to 80% (Chaudhary, 1999 and Koutroubas *et al.*, 2009).The disease can be managed by the use of fungicides, resistant cultivars, agronomic practices and biotechnological methods (Ribot *et al.*, 2008). However, the use of resistant cultivars is the most economical and environment friendly method for the management of rice blast (Castano *et al.*, 1990; Saifullah *et al.*, 1995; Khan *et al.*, 2001; Haq *et al.*, 2002) but the resistance is subject to break down due to appearance of new/more virulent races of the pathogen. To control the blast farmers are using fungicides such as Tricyclazole, Carbendazim, Isoprothiolane, Propiconazole, and Hexaconazole etc. The main problem in Basmati rice is incidence of Blast disease which adversely affects the export of Indian Basmati rice.

Causal Organism

Rice blast is caused by the Ascomycete fungus, caused by *Pyricularia grisea* Sacc [Telipomorph *Magnaporthe grisea* (Hebart., 1971) Brarr] is one of the important factors for low productivity of Basmati rice. Pyriform macro conidia, ca. 20 × 10 µm are produced on conidiophores which protrude from lesions on plants. The conidia was pyriform almost hyaline to pale olive, 2-septate and 3-celled. These characters are similarly described by Shirai (1896).These germinate and develop an appressorium at the tip of the germ tube, which attaches to the surface of plant tissues; an infection-peg from the appressorium penetrates into plant tissues. The wall of conidiophores and appressorium are pigmented by melanin.

Symptoms

The fungus *Magnaporthe grisea* it causes disease at seedling and adult stages on the leaves, nodes and panicles. The initial leaf blast symptoms appeared as small, water soaked, greyish dots which subsequently enlarged into spindle shaped about 0.5 – 1.0 cm wide spots with greyish white centre with a brown margin. In case of neck blast, the panicle infected was blackened and shrivelled leading to chaffy ear head in early stage. Later panicle hanged down at the neck. In case of nodal

blast nodes were infected and turned black. The size, colour and shape of the lesions, however, vary with different climatic conditions and also varietal response. The symptoms observed are in accordance with the description of Manibushan Rao (1994).

Node Blast

During heading, the stem nodes which appeared from the leaf sheaths are attacked and sometimes cause lodging. Diseased nodes are brown or black in color.

Neck Rot and Panicle Blast

Infection to the neck node produces triangular purplish lesions, followed by lesion elongation to both sides of the neck node – symptoms which are very serious for grain development. When young neck nodes are invaded, the panicles become white in colour – the so-called ‘white head’ that is sometimes misinterpreted as insect damage. Later infection causes incomplete grain filling, and poor grain quality. Panicle branches and glumes may also be infected panicles often break and fall off, or the whole inflorescence may break off at the rotten neck. Spikelets attacked by the fungus change to white in colour from the top and grains on the panicle with infected neck are mostly chaffy.

Disease Cycle in the Field

The pathogen perpetuates as mycelium and conidia on diseased rice straw and seed, and possibly on weed hosts also. The fungus produces conidia and releases in to the atmosphere when there is high relative humidity (>90%) and temperature conditions (long periods of plant surface wetness, high humidity, little or no wind at night and night temperatures between 12– 32 °C) the infection cycle can continue. In the canopy of rice plants, newly developed leaves act as receptors for the spores. The maximum number of spores produced was 20,000 on one lesion on leaves and 60,000 on one spikelet in one night. Lesions on leaves become an inoculums source for panicles. The conidia are air borne and fall on the rice plant and adhere strongly to the leaves through the mucilage produced by them at the tip. Rice

seedlings and young or tender tissues are more vulnerable than the older ones. At optimum temperatures, new blast lesions appear within 4-5 days after they fall on leaf surface. In warm and wet weather conditions, new conidia are produced within hours from the appearance of the lesions and this continues for several days. Most of the conidia are released between mid-night and sunrise. This is a polycyclic disease and completes several cycles within a season and causes epidemics. The critical growth stages are seedling stages, tillering stage and panicle initiation stage of the crop.

Management

Spray the chemicals: In blast endemic areas treat the seeds with Tricyclazole 75 wp @ 1.5 g/kg seeds or with Carbendazim 50 wp @ 2 g/kg seeds. Need based application of Tricyclazole 75 wp @ 0.6g/l or Isoprothiolane 40 EC @ 1.5 ml/l or Iprobenphos 48 EC @ 2ml/l or Carbendazim 50 wp @ 1g/l. According to Gouraminis (1996), this systemic fungicide is very active specifically against *P. grisea*. Tricyclazole protects undamaged plant parts against *P. grisea* but not those already damaged. Lazarovits *et al.*, (1989) stated that tricyclazole inhibited the synthesis of polyketides by the pathogen.

Control Measures

Burning or composting of diseased tissues, diseased straw and stubble must be burned or composted; otherwise they can become inoculum sources for the next crop season.

Healthy Seed

To obtain healthy seeds, the seeds must be collected from the field located under unfavourable conditions for the pathogen, and fungicide must be applied if necessary. Gravity separation methods for seeds are useful. Salt solution, 200 g l⁻¹, or ammonium sulfate solution, 230 g l⁻¹, is used to separate sufficiently matured seeds, followed by chemical treatment for seed disinfection against a range of pathogens.

Fertilizer Management

Nitrogen and phosphorus content in the plants affects disease proneness. Excess nitrogen fertilizer encourages disease development, while silica application reduces disease development. Therefore the amount and type of fertilizer must be carefully decided upon according to the cultivar used, soil condition, climatic conditions and disease risk. However, Kumar, and Singh, (2003) observed the highest number of grains per panicle up to 60 kg N/ha. Excess nitrogen application might have reduced carbohydrate content resulted an abnormal development of pollen grains as observed by Sharma and Singh (1999).

Cultural Systems

Sowing into water eliminates disease transmission from seeds to seedlings because of the anaerobic condition that is unfavourable to the pathogen. On the contrary, sowing on wet soil allows seed transmission. Shade affects disease occurrence because of the longer wet condition.

Biological Control

Rice disease management strategies mainly aim at prevention of outbreak or epidemics through the use of host plant resistance and chemical pesticides. The persistent, injudicious use of chemicals has toxic effects on non-target organisms and can cause undesirable changes in the environment. Bio control of Basmati rice diseases special significance being an eco-friendly and cost effective strategy which can be used in integration with other strategies for a greater level of protection with sustained rice yields. Seed treatment and with different bio agents such as *Trichoderma harzianum*, *Trichoderma viride* and *Pseudomonas fluorescens* @ 10g/kg each agents foliar spray @ 10 g/lit water. The evaluated different species of *Trichoderma* against 24 airborne plant pathogens including *M. oryzae* and found that *T. harzianum*, *T. koningii*, *T. pseudo koningii* and *T. viride* had strong antagonistic potential Watanabe (1985).

Chemical Management

Seed Treatment

Seed treatment with different fungicides at various doses such Tricyclazole @ 3.0g, Hexaconazole @ 0.5ml, Carbendazim @ 2.0g, Propiconazole @ 1.0ml and Isoprothiolane @ 1.5ml. The many fungicides are used against blast disease, including, tricyclazole, Carbendazim, Isoprothiolane, Propiconazole, edifenphos, tebuconazole, iprobenfos, and Hexaconazole and antibiotics such as blasticidin and kasugamycin. Systemic fungicides are widely used to protect against leaf blast by seedling application and also to protect against panicle blast when applied more than 20 days before heading. The composition, amount, timing and application method of fungicide applied depends on the disease forecast or level of disease present. To avoid pathogen resistance problems chemical control must involve the use of chemicals, which illustrate how well established chemicals with different modes of action can continued to find a place in protection against rice blast from their contribution toward the avoidance of resistance problems.

Resistant Cultivars

Race-specific and race-nonspecific resistant cultivars have been bred all over the world. Based on the information of distribution of races, these cultivars can be selected. Evaluating 20 varieties, out of these varieties none of the variety was immune and five varieties were found to be moderately resistant against blast. Five Basmati varieties were found moderately susceptible. Eight varieties were susceptible and only two varieties showed highly susceptible response. Mohanta *et al.*, (2003) in screening trials at Bangladesh reported that among twenty eight restored line and four standard checks, three were highly resistant, 12 resistant, 16 moderately susceptible.

Conclusion

Basmati rice is an important export commodity among the food grains. But production of Basmati rice is limited due to losses caused by various diseases, damaging the crop from nursery to harvesting. Among the biotic factors, diseases are important factors resulting in low yield and poor quality of Basmati rice. Blast disease caused by *Pyricularia grisea* also causes economic yield losses to the Basmati rice production. Blast disease

can be controlled by an integrated management system using a variety of methods – resistant cultivars, cultural practices and biological application control will continue to have a role to play in fighting blast. For management of blast disease generally farmers are using high doses of fungicides. Due to injudicious use of fungicides, sometimes fungicidal residues have been recovered from rice grains which may be harmful for human consumption. Rice with pesticide residue is also likely to be rejected for export purposes. Therefore, it is imperative to advise the farmers to adopt eco-friendly disease management strategies for managing this important disease of Basmati rice.

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