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Efficacy of Tricyclazole with integrated disease management against the disease control and yield improvement of rice

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Abstract
Rice "the queen of cereals" occupies 11% of world's crop area and is a staple food for above 60% world's population. Chhattisgarh state is known as rice bowl in the India. Bastar plateau sub-humid agro-climatic zone, agriculture is still largely traditional with low crop productivity. Critical inputs viz. improved seed, fertilizer, organic manure, chemicals, etc. are also not easily available and use by the farmers. Farmers do not use proper crop rotation techniques and plant protection measures due to that diseases and pest problem are higher every year. A crop failure, for any reason, poses a real threat of starvation. Blast of Rice caused by *Magnaporthe grisea* (Hebert) Barr is an important disease of rice, which accounts for serious yield losses in all rice growing areas of the country. The fungus *Pyricularia grisea* attacks at all stages of the crop and symptoms appear on leaves and nodes (Seebold *et al.*, 2004). Bhatt (1988) reported more than 65 % loss in yield in the susceptible rice cultivars. For every 10% of neck blast about 6% yield reduction and 5% increase in chalky kernels are recorded (Katsube and Koshimizu, 1970). Rice blast and blight caused by fungus, causes lesions to form on leaves, stems, peduncles, panicles, seeds, and even roots. So great is the potential threat for crop failure from this disease that it has been ranked among the most important plant diseases of them all. With the aim of controlling the rice blast by using integrated control methods the present investigation was undertaken in the field trail experiments against the disease in order to find out suitable management methods of blast.
Integrated Disease Management (IDM) is important for reducing threat to environment and for sustaining higher yields. There is need to test and demonstrate IDM technique at farmers fields for their wide adoptability. On-farm trials and front line demonstrations were conducted through Krishi Vigyan Kendra Bastar in *Kharif* 2012 and 2013, to popularize IDM module to boost rice production in diseases prone area of Bastar platue. Mainly focus in IDM on resistant variety, weed free field, seed treatment with Trycyclazole @ 0.1% followed by foliar spray of Tricyclazole @ 0.06% at appearance of disease.
Yield improved to the tune of 33.5 per cent by the IDM module over farmers practice plots. Net returns (Rs. 32200) and benefit cost ratio (1.78) were also higher in same practice. An additional income of Rs. 8080/ha was obtained over the farmers practice.

Keywords: IDM, rice, blast, yield, varieties

Introduction
Bastar plateau sub-humid agro-climatic zone, agriculture is still largely traditional and rain fed based with low crop productivity. Rice is main crop of Bastar District and growing in more than 80 per cent area (1.14 lakh ha) in kharif of total cultivated area (DDA 2014). *Pyricularia grisea* (telomorph *Magnaporthe grisea*) is one of the major causes for low yields in rice crop (Rajarajeswari and Muralidharan 2006). Rice blast is more important in upland and rain fed lowland ecosystem than in other ecologies. A successful disease control program depends on a crop production system, which closely aligns with the goals of disease management. One must start with the selection of appropriate varieties, well drained irrigation system that minimizes leaf wetness, a fertilizer program that results in optimal plant growth, plant density and canopy management that afford optimal air circulation and pesticide coverage when needed, a transplant program that minimizes transplant shock, a clean seedling production program, effective disease monitoring by scouting regularly during the season, and, finally, a harvest and shipping procedure that maximizes shelf life and produce quality. Integrated Disease Management (IDM) as applied to rice diseases means using all the tactics available to the grower (cultural, biological, host-plant resistance, field scouting, chemicals) that provide acceptable yield and quality at the least cost and are compatible with the tenets of environmental stewardship.

Improve IDM technologies are available for rice crop and need to be popularized among farming community to boost agricultural productivity and production. Integrated Disease Management (IDM) module with judicious use of chemicals was needed to be tested at farmers' field to combat the blast of rice, conducted On-farm trials and Front Line Demonstrations to popularize the IDM module in rice.

Materials and Methods

Analysis the Factors Responsible of Disease

Many farmers' fields of Bastar and Kondagaon District were surveyed by KVK & SG College & Research Station scientists with the line departments to identify the loss and responsible factor of blast disease in the year 2010. During survey it was found that the higher incidence were found in low line area and microclimates of the Kondagaon and Bastar District and farming practices were quite favorable for the blast disease incidence. Blast disease is a major biological threat to crop and Bastar was identified as hot spot of rice blast (Sinha 2014) [7].

Factors which favored the Disease

Growing varieties which lack resistance

Farmers use traditional varieties Safari, Neemchuri, Gurmuthiya etc., they are prone to disease and if proper disease management practices are not taken in time there always remains risk of crop being badly hit by blast disease particularly under fluctuating weather conditions as prevalent in the study area.

Imbalance use of Fertilizers

Farmers have tendency towards using heavy doses of nitrogenous fertilizers without and a small number of them apply Potassium supplying fertilizer. This makes plant tissues succulent and more prone to blast disease. Continuously use organic manures striking a balance in the application of N and K fertilizer help some to escape severe disease attack. This signifies the importance of balanced nutrient supply in IDM.

Lack of plant protection measures against the diseases

Integrated Disease Management technology for blast disease is well established but unfortunately farmers do not follow the same resulting in considerable decline in the crop yield due to the disease. Not a single farmer even uses a simple technique of seed treatment against the disease.

Other Causes

Poor water management, in heavy rainfall whole fields are connect to each other and spread the disease through water, dense planting of seedling with 4-6 seedlings per hill, late transplanting, heavy weed infestation and lack of coordination between farmers and the line departments, due to less awareness about the technology and some other reasons which aggravated the situation. Farmer's were unaware about congenial environmental factors for blast. Bhatt (1992) [2] reported the average temperature of 22-25 C and RH % or above, higher rainfall and more number of rainy days were the congenial factors for development of foliar blast.

Action Plan

All important causes of outbreak of blast disease in paddy were taken into consideration while farming a strategy to combat this disease and *vis-à-vis* to improve rice production. On farm trial were conducted in the year 2011-12 and 2012-13, which revealed that the disease incidence was remarkably higher with farmers practices (16.75 per cent) against assessed improve technology (2.35 per cent). Yield was appreciably higher in improve technology compare to the farmer practices. In view of this results, front line demonstration programme with following technical inputs were conducted in the area (Table 1).

1. **Variety:** local seed material Safari, Neemchuri, Gurmuthiya etc., in low land area which are susceptible to blast replace with the improve varieties as Mahamaya and Bamleshwari (130-140 days) which exhibits resistance to blast disease.
2. **Seed and sapling treatment:** Seed treatment with Trycyclazole @ 0.1% followed by sapling treatment by Tricyclazole @ 0.1 % (20min) and if required one foliar spray of Tricyclazole @ 0.06% at appearance of disease.
3. **Seedbed preparation:** Temperature fluctuation during nursery raising period may cause rotting in crop. Spray of Carbendazim 63 % + Mancozeb 8 % @ 0.20 % was done as it has been found effective against diseases. Raised bed (5-8 cm height) nursery preparation with well drained soil is promoted.
4. **Sowing time:** In Bastar region farmers were rice transplanted up to end of September, in which blast incidence was higher. Early and timely sowing and transplanting up to second fortnight of August was promoted.
5. **Balance dose of fertilizer:** Use of balanced fertilizers was demonstrated to the FLD beneficiaries as per package of practices. They were advised to strictly follow the recommendations with regard to the dose and time of fertilizer application. Emphasis was laid on the application of well decomposed Farmyard Manure.
6. **Plant Population:** Farmers were given training programmes on raising of healthy rice seedlings and at the same time were instructed to transplant 2-3 healthy rice seedling per hill with 35-45plants/sq.m area.
7. **Water management:** Impounding of water (3-4cm) was advocated for the first 15-20 days after transplanting and remove the excess water in the field time to time and keep the soil saturated with moisture.

Results and Discussion

Integrated disease management in rice against the menace of blast diseases in demonstration plots gave excellent results compared to the farmers practice. Tricyclazole 75% WP is effective with control of blast as seed treatment and foliar spray (Verma *et al.* 2013) [8]. Yields ranged from 38 to 46 qt/ha in demonstration plots. Average yield was 43.50 qt/ha (Table 1) against the farmers practices (32.60 qt/ha). Demonstration yield was 33.44 percent higher than the yield realized in the control plots. Gross return, net profit and benefit cost ratio per hectare under technology demonstration were Rs.52350, Rs.32200 and 1.78, respectively against Rs. 39300, Rs.24120 and 1.52 registered in the control. An additional income of Rs. 8080/ha was obtained with the demonstrated technology over the farmers practice (control). Paddy straw and grain quality is also very good as compared to infected ones.

Table 1: Summary of farmers practice and assessed technology demonstrated (FLD).

Parameter	Farmers practice (Control)	Technology Demonstrated
Variety	Safari, Neemchuri, Gurmuthiya	Improve variety Mahamaya and Bamleshwari
Seed rate/ha for transplanting	>60 kg	40 kg
Seed treatment/kg seed	No seed treatment	Trycyclazole @ 0.1%
Seedbed Preparation	Nursery prepared in Flat field	Raised bed (7-10 cm height) Nursery
Sapling treatment/liter water	No sapling treatment	Trycyclazole @ 0.1% for 20 minute
Age of transplanting seedling & method	35-40 days in Haphazard	20-25 days Line transplanting @ 25 X 10 cm RXP
Fertilizer dose (N, P_2O_5, K_2O)	Imbalance dose	100:60:50
Plant per hill	5-8	2-3
Time of fertilizer application	No knowledge	½ N, full dose of P_2O_5 & K_2O as basal and ¼ N at tillering stage and rest ¼ at panicle initiation stage
Standing water level	No remove excess water	Water change at 10-15 days intervals
Disease Incidence (Rice Blast)	16.75 %	2.35 %
Crop yield/ha	32.60 qt	43.50 qt
Net return/ha	Rs. 24120	Rs. 32200
B:C ratio	1.52	1.78

Impact

Successful demonstration of Mahamaya and Bamleshwari varieties and assessed related technology has highly convinced the other farmers of the Kondagaon and Bastar to adopt the technology at much greater speed and horizontal spread the technology in 132 acre (2013-14). Higher yield potential, less mortality percentage and show tolerance against the blast disease of paddy. Adaptation was dramatic in villages most severely affected by blast disease. Exchange of seed among farmers paved the way for speedy spread of the technology.

Conclusion

Safari, Neemchuri, Gurmuthiya are favorite's varieties of farmers and users but under the microclimatic condition of Bastar regions susceptible to blast disease, so adopting recommended management practices against the blast disease becomes essential. Under the situation when farmer fails to execute the disease management practices in time, there always remains a risk of crop being damaged by the blast disease. Moreover, Integrated Disease Management (IDM) which is a well-established technology to reduce the disease pressure on a crop not only reduced cost of cultivation by curtailment in expenditure on fungicide purchase and labour but also increases farm income through improvement in crop yield. This approach is environmentally safe and farmers friendly. It promises higher yield and at the same time minimizes threat to the environment. In IDM approach, development and adaptation of disease resistant / tolerant high yielding crop variety plays a pivotal role.

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