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DIPANKAR MANDAL, RINI PAL AND A. K. MOHANTY

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Department of Botany,
University of Calcutta,
Kolkata 700 019, India

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Management of Bacterial Leaf Blight of rice in an integrated way

DIPANKAR MANDAL*, RINI PAL AND A. K. MOHANTY
Regional Research and Technology Transfer Station, Orissa University of Agriculture and Technology, Chiplima 768025, Sambalpur, Odisha

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A field experiment was conducted for the management of bacterial blight of Rice during *kharif* season of two consecutive years (2013 and 2014) at Regional Research and Technology Transfer Station, O.U.A.T, Chiplima, Sambalpur, Odisha. The present investigation was carried out to know the effects of Streptocycline, Copper oxycholoride and their combination, bioagents (*Trichoderma viride* and *Pseudomonas fluorescens*), application of higher doses of potash and use of organic such as fresh cowdung slurry on bacterial blight disease severity. The result revealed that, all the treatments were superior over control in reducing the disease severity. The minimum disease severity was recorded with recommended doses of NPK (80:40:40) + higher doses of potash (24 kg/ha) + three spraying of fresh cowdung slurry @1kg in 10 l water at 10 days interval. The maximum disease control and highest grain yield was also obtained with the same treatment and was closely followed by seedling root dip with Streptocycline (0.01%) + three spraying of Streptocycline (0.01%) + Copper oxychloride (0.2%).

Key words: Bacterial leaf blight, management, rice

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important and widely cultivated cereal crops of the world and more than 60% of the world population depends on rice for their carbohydrate in diet whose production is constrained by diseases of fungal, bacterial and viral origin. Bacterial leaf blight (BLB) of rice, caused by *Xanthomonas oryzae* pv. *oryzae* is one of the oldest known diseases and most destructive diseases of rice throughout the world and was first noticed by the farmers of Japan in 1884. This disease causes serious problem in rice cultivation during the heavy rains of the monsoon seasons. In many Asian countries, bacterial blight has become endemic on rice following repeated cultivation. This disease has become serious because many improved, high yielding cultivars, when managed with high nitrogen levels and close spacing, have inadequate resistance to the pathogen.

Foliar symptoms of BLB usually become evident at the tillering stage as small, green water soaked spots at the tips and margins of fully developed leaves. The spots expand along the veins, merge and become chlorotic and then necrotic, forming white to gray coloured lesions that typically extend from the leaf tip down along the leaf veins and margins. BLB moves vertically through the leaf through primary veins but also laterally through commissural veins. Bacterial cells and extra-cellular proteins fill the xylem vessels and ooze out from hydathodes, forming beads or strands of exudate on the leaf surface, which is a characteristic sign of the disease and a source of secondary inoculum.

It is a systemic disease and depending on the severity of infection, the loss may be as high as 60-70% in the tropics. Bacterial leaf blight has gained

*Corresponding author : dipankarpath.@gmail.com

more importance during the past few years and the disease is regarded as one of the most important diseases of rice in Odisha. Keeping the point in view the present experiment was designed to manage the disease in an integrated way.

MATERIALS AND METHODS

Field experiment was conducted during *kharif* season of 2013 and 2014 at research farm of Regional Research and Technology Transfer Station (RRTTS), Chiplima, Sambalpur, Odisha. The experiment was laid out in a plot size of 4 m x 2 m following randomized block design (RBD) with five treatments and three replications. The variety MTU 1001 was transplanted in the 1st week of August during both the years of experiment. The treatments were T1= Seedling root dip with Streptocycline (0.01%) + three spraying of Streptocycline (0.01%) + Copper oxychloride (0.2%); T2= Seedling root dip with *Pseudomonas fluorescens* (1.0%) + three spraying of *Pseudomonas* (1.0%); T3=Seedling root dip with *Trichoderma viride* (1.0%) + three spraying of *T. viride* (1.0%); T4=Recommended doses of NPK + higher doses of potash (24 kg/ha) + three spraying of fresh cowdung slurry (1kg in 10 l of water) and T5 =Control. Natural infection of the disease was permitted. Observations on disease severity and yield were collected. Three sampling units of one m^2 area were fixed in each plot at random for observation of disease severity.

The final disease severity was recorded 15 days after the last spraying using SES scale where 1=1-5% disease severity, 3=6-12% disease severity, 5=13-25% disease severity, 7= 26-50% disease severity, 9=51-100% disease severity.

The Per cent Disease Index was calculated by using the following formulae:Per cent Disease Index (PDI) = [(Sum of all numerical ratings)/(No. of observations x maximum rating)] x 100

The grain yield of each plot was recorded at the time of harvest and converted to q/ha. All these collected data were analysed statistically.

RESULTS AND DISCUSSION

The results revealed that all the treatments reduced bacterial blight disease severity and increased grain yield as compared to control plots. The per-cent disease index (PDI) reached 43.89% and 47.78% in control plots during 2013 and 2014 respectively. The least disease severity was obtained from the treatment (T4) with recommended doses of NPK and higher doses of potash (24 kg/ha) and three spraying of fresh cowdung slurry @ 1kg/10 l water, during both the years of experiment. Pooled mean data of 2013 and 2014 also revealed the same exhibiting the lowest PDI value of 15.84% as well as maximum disease reduction of 65.4% from the same treatment. It has been reported that phosphorous and potassium deficiencies may lead to incidences of BLB. A number of previous workers also reported that bacterial leaf blight of rice decreased with application of potash fertilizers. It is reported that combined fertilizer including K and P had inhibitory effect on BLB infection.

The next best treatment was T1, i.e, seedling root dip with Streptocycline @ 0.01% and spraying of streptocycline @ 0.01% and copper oxychloride @ 0.2% which showed a pooled disease index of 17.78% (pooled of 2013 and 2014) and achieved 61.2% disease reduction over control plot. Both the above mentioned treatments were found statistically at par with each other. Suresh *et al*. (2014) also concluded after a field experiment that, spraying of streptocycline (0.05%) in combination with copper oxychloride (0.2%) was significantly effective than all other treatments recording the lowest per cent disease incidence of 14.07.

Application of biocontrol agents was also found effective against the disease as compared to control plots. Seedling root dip with *Pseudomonas fluorescens* (1.0%)+ sprayingof *P. fluorescens* (1.0%) exhibited a pooled PDI of 24.17% resulting 47.3% disease reduction over control plots and was followed by seedling root dip with *Trichoderma viride* (1.0%) + three spraying of *T. viride* (1.0%) resulting 40% disease reduction against control plots with 27.5% pooled disease index. Both the biocontrol treatments differed significantly from each other as well as control plots. Higher effectivity of *Trichoderma* isolates obtained from rice phylloplane against bacterial leaf blight pathogen was reported by Gangwar and Sinha (2012). *T. harzianum*was also found highly effective against bacterial blight pathogen *X. oryzae* pv. *oryzae* under *in vitro* screening (Gangwar and Sinha, 2010, 2012).*Trichoderma* isolates are known to secret some cell wall degrading enzymes like β-1 glucanse, cellulase etc. and by help of these mecha-

Table 1: Effect of different treatments on the severity of Bacterial leaf blight disease and yield of rice

Treatments	Percentage Disease Index (PDI)		Pooled	Disease reduction (%)	Grain yield (q/ha)		Pooled	Yield increase (%)
	2013	2014			2013	2014		
T_1=Seedling root dip with streptocycline (0.01%) + spraying of streptocycline (0.01%) + copper oxychloride (0.2%)	17.22 (24.43)*	18.33 (25.25)	17.78 (24.86)	61.2	34.67	46.00	41.34	30.8
T_2=Seedling root dip with *Pseudomonas fluorescens* (1.0%) + spraying of *P. fluorescens* (1.0%)	20.56 (26.89)	27.78 (31.77)	24.17 (29.43)	47.3	30.67	44.67	37.67	24.1
T_3=Seedling root dip with *Trichoderma viride* (1.0%) + three spraying of *T. viride* (1.0%)	25.0 (29.90)	30.00 (33.18)	27.50 (31.60)	40.0	32.34	42.50	37.42	23.6
T_4=Recommended doses of NPK + higher doses of potash (24 kg/ha) + three spraying of fresh cowdung slurry (1kg in 10 lit of water).	15.0 (22.67)	16.67 (24.03)	15.84 (23.38)	65.4	39.67	48.00	43.84	34.8
T_5=Control	43.89 (41.48)	47.78 (43.70)	45.84 (42.59)	-	22.34	34.84	28.59	-
SE(m)±	1.39	0.83	0.55		2.14	1.01	1.10	
CD (0.05)	4.27	2.60	1.71		6.60	3.15	3.43	

*****angular transformed values are indicated in parenthesis

nism they inhibit a wide variety of plant pathogens and thus act as a broad spectrum antagonistic **(**Karthikeyan *et al.* 2013**).**

While considering the yield, highest grain yield was obtained from the treatment (T4) with recommended doses of NPK and higher doses of potash and three spraying of fresh cowdung slurry during both the years of experiment recording a pooled yield of 43.84 q/ha as against a pooled yield of 28.59 q/ha in control plot. With regards to yield also, the next best treatment was T1 i.e, seedling root dip with streptocycline and spraying of streptocycline and copper oxychloride recording a pooled yield of 41.34 q/ha with 30.8% yield increase over control. Treatment with biocontrol agents T2 and T3 also gave good yield resulting 24.1% and 23.6% yield increase over control respectively. After considering all the treatments, recommended doses of NPK and additional K application and fresh cowdung slurry is advisable to the farmers for managing BLB of rice which is environment friendly as well as economically viable.

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