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Management of bacterial leaf blight of rice caused by *Xanthomonas oryzae* pv. *oryzae* under field condition

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Abstract
Bacterial leaf blight (BLB) is considered as a major threat to rice production because of its wide spread, distribution and its destructiveness under favourable conditions. The disease is caused by *Xanthomonas oryzae* pv. *oryzae* is one of the most destructive disease in irrigated and rain fed environment in Asia and cause considerable loss. Thus, a field trial was conducted during *Kharif* 2016 at AHRS, Bavikere to know the efficacy of different commercially available antibacterial chemicals and bio-agents against the bacterial leaf blight of rice. Results indicated that, streptocycline + copper oxychloride combined treated plots showed the lowest per cent disease incidence of 22.33 per cent followed by bacterinashak, agrimycin 100, kasugamycin and the highest disease severity was recorded in control (55.53%). Highest grain yield of 56.49 q/ha was recorded in streptocycline + copper oxychloride, which was significantly superior over all the treatments, followed by bacterinashak (54.24 q/ha), kasugamycin (50.13 q/ha) and agrimycin 100 (49.38 q/ha). The least grain yield was obtained in *Bacillus subtilis* (41.33 q/ha).

Keywords: *Xanthomonas oryzae* pv. *oryzae*, Rice, Bacterial leaf blight

Introduction
Rice (*Oryza sativa* L.) is one of the most important staple food crops of India and is a major source of calories for about 60 per cent of world population and influences the livelihoods and economies of several billion people especially concentrated in Asia, Latin America, Middle East, and the West Indies. It is cultivated in five major ecosystems *viz.*, irrigated, deep water, upland, lowland and rainfed rice. About 53% of the world's rice is grown under irrigated conditions that provide 75% of total global production. Rainfed lowland rice (31% of the world rice area) is entirely dependent on rainfall, whereas, the deep water area (35%) occurs in the river deltas. Upland rice area (13%) is also rainfed but without surface water accumulation. It suffers from many diseases caused by fungi, bacteria, viruses, phytoplasma, nematodes and other non-parasitic disorders. Among the bacterial diseases, Bacterial leaf blight (BLB) is considered as a major threat to paddy production because of its wide spread, distribution and its destructiveness under favourable conditions. The disease is caused by *Xanthomonas oryzae* pv. *oryzae* is one of the most destructive diseases in irrigated and rain fed environments in Asia and cause considerable loss, especially, in areas with high yielding varieties are grown [1]. Chemicals are the important components of the integrated disease management (IDM) for mitigating the plant diseases. Hence, commercially available antibiotics and other antibacterial chemicals were evaluated against the disease. The biological control agents are also equally important components of an IDM. Therefore effort has been made in this regard to see the efficacy of some biological control agents against the target disease under field condition. The various chemicals, antagonists, botanicals and nutrient application were recommended in different rice growing area to manage the BLB. Application of bio agents that not only acts as an antagonist to pathogens but also promotes the growth of plant and induces multiple systemic disease resistance. Keeping this view in mind, the present investigation was undertaken to reduce yield losses by managing the BLB of rice. The objective of the present study is to check efficacy of new bactericides and antibiotic compounds and inhibitory effect of bio agents against the growth of bacterial leaf blight pathogen under field condition.

Materials and methods
A set inclusive of commercially available bactericides and bio-agents were evaluated against bacterial blight of rice at AHRS, Bavikere during *Kharif* 2016. The field trial was laid out in Randomized Complete Block Design (RCBD) with three replications. There were eight treatments inclusive of control.

The plots measuring 3.3 m x 2.7 m were marked and five plants at random in each plot were selected and labeled. The susceptible variety Jyothi was used for this study and twenty four day old seedlings were transplanted in the field using two seedlings/ hill with a spacing of 20 x 20 cm. The crop was transplanted during 3rd week of July. The required quantities of the chemicals were weighed and suitably dissolved in a requisite quantity of water to get desired concentrations. Treatments were imposed at the maximum tillering and panicle initiation stage of the crop. A total of two sprays were taken at an interval of 30 days with the first spray at the disease on set. Disease severity was recorded at 60 DAT and 90 DAT.

Treatment details

It includes different antibacterial chemicals *viz.*, Streptocycline + copper oxychloride @ 0.5 g+2.5 g/l, Kasugamycin @ 2 ml/l, Azadiractin @ 20 ml/l, Bacterinashak @ 0.5 g/l, Agrimycin @ 100 0.2 g/l and bio agents *viz.*, *Pseudomonas fluorescens* @ 10 g/l, *Bacillus subtilis* @ 10 g/l with untreated control.

Observations were drawn for the bacterial blight incidence on randomly selected 5 plants at 60 DAT and 90 DAT using 0-9 scale developed by [2]. Observations on plant height, No. of tillers, disease severity and yield recorded during investigation and data was analyzed statistically.

Results and discussion

The experiment was carried out with eight treatments during *Kharif* 2016 to know the efficacy of antibacterial chemicals and bio agents for management of bacterial blight of rice under field condition. The results indicated that disease intensity in all the plots before the application of treatments were non-significant and significant difference among the treatments was observed after first spray.

At 60 days after transplanting, the plots treated with combination of Streptocycline (0.5g/l) + copper oxychloride (2.5g/l) was recorded minimum disease severity of 24.50 per cent and which was on par with bacterinashak (0.5g/l) treated plot which showed a disease severity of 26.67 per cent followed by kasugamycin (2 ml/l) and agrimycin 100 (0.2g/l) with a disease severity of 28.67 and 28.83 per cent respectively and highest disease severity was recorded in untreated control (44.50%). The similar trend was observed at 90 days after transplanting (Table 1 and Figure 1).

The results obtained in the present study can be better compared with the findings of [3]who reported that bactrinashak at 0.041 per cent was the most effective in reducing the bacterial leaf blight followed by bactrinashak at 0.033 per cent, Streptocycline (streptomycin sulphate + tetracycline hydrochloride, 9:1) + copper sulphate at 0.01 per cent. *Pseudomonas fluorescens* at 1 per cent and Nimbicidin (300 ppm Azadirachtin) at 7.5 ml per liter were least effective.

Results of the present study also support by findings of [4] who studied the effect of antibiotics and fungicides on bacterial blight of paddy. Among the different chemicals tested, seed treatment with Streptocycline (100ppm) along with foliar spray in combination with COC (100 ppm + 500 ppm) gave the best result against bacterial blight in all the consecutive years (2003, 2004 and 2005) showing 10.9 per cent, 9.7 per cent and 10.8 per cent disease intensity respectively. The maximum disease intensity of 21.45 per cent, 17.64 per cent and 18.67 per cent were recorded in control plot of respective consecutive years.

The data pertaining to grain yield, the highest grain yield of 56.49 q/ha was recorded in streptocycline + copper oxychloride, which was significantly superior over all the treatments, followed by bacterinashak (54.24 q/ha), kasugamycin (50.13 q/ha) and agrimycin 100 (49.38 q/ha). The least grain yield was obtained in *B. subtilis* (41.33 q/ha).The results indicated that plant height and number of tillers of treatments was non-significant in all the treatments.

Table 1: Management of bacterial leaf blight of rice under field condition.

Sl. No.	Treatments	Concentration	% disease severity 60 DAT	% disease severity 90 DAT	% disease decrease over control	Plant height (cm)	No. of tillers	Yield (q/ha)
1	Streptocycline+copper oxychloride	0.5g+2.5g/l	24.50* (29.57)	22.33 (28.86)	59.78	73.10	17.00	56.49
2	*Pseudomonas fluorescens*	10g/l	30.47 (33.48)	32.33 (32.76)	41.77	69.03	16.33	46.01
3	*Bacillus subtilis*	10g/l	32.17 (34.43)	34.83 (33.69)	37.27	71.17	17.67	41.33
4	Kasugamycin	2ml/l	28.67 (32.35)	30.75 (31.80)	44.62	69.50	16.20	50.13
5	Azadiractin	20ml/l	31.33 (34.02)	31.85 (33.38)	42.64	68.67	17.60	45.26
6	Bacterinashak	0.5g/l	26.67 (31.07)	28.17 (30.65)	49.27	74.00	17.00	54.24
7	Agrimycin 100	0.2g/l	28.83 (32.44)	29.33 (31.40)	47.18	71.33	17.20	49.38
8	Control		44.50 (41.82)	55.53 (42.47)	–	69.17	15.87	33.67
SE.m±			1.51	1.82		1.59	0.65	2.11
CD at 5%			4.59	6.11		4.83	1.97	6.41

*Figures in the parenthesis arc sine are transformed values.

A) Before spray B) After two spray

Plate 1: Severity of bacterial leaf blight of rice under field condition

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