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Original article

Field evaluation of different antibacterial antibiotic and plant extracts against bacterial blight of soybean caused by *pseudomonas syringae* pv. *glycinea*

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ABSTRACT

A field experiment was carried out to study effect of different antibacterial antibiotics and plant extracts against bacterial blight of soybean caused by *Pseudomonas syringae* pv. *glycinea*. The highest mean per cent disease incidence 35.51 per cent was observed in poushamycin treatment. The lowest mean per cent disease incidence 12.74 per cent was found in treatment streptocycline 100 ppm + Copper oxychloride (@0.25%) and recorded highest seed yield (2605 kg/ha) and test weight (14.33 g) is superior over rest of treatments which was at par with streptocycline 100 ppm (14.28%), copper oxychloride (19.40) and Bactinashak 500 ppm (25.12%). The highest mean per cent disease incidence 28.16 per cent was observed in Tulsi and lowest mean per cent disease incidence 15.03 per cent was found in treatment Neem. Sprays of Neem is superior over rest of treatment minimum disease incidence was observed in this treatments (11.00 %) and which was at par with Ginger Garlic, Onion and Tulsi.

1. Introduction

Soybean belongs to the family *Leguminoseae* and sub-family *Papilionoidae*. In India area, production and productivity of soybean during 2007-2008 were 79.720 lakh ha., 64.28 lakh metric tonnes and 802 kg/ha., respectively (Anonymous, 2007). Over hundred pathogen are known to affect soybean of which 35 are of economic importance. Generally, one or more disease can be found in fields wherever soybean is grown. The bacterial disease of soybean like the bacterial blight (*Pseudomonas syringae* pv. *glycinea)*, Bacterial pustule

(*Xanthonomas campestris* pv. *glycinea* (Nakano); Magrou and Prevot; Bacterial crinkle and chocolate spots (*Pseudomonase syringe* Van Hall) are seed borne causing considerable loss.

Among the major bacterial, bacterial blight caused by *Pseudomonas syringae* has been reported yield loss potential for this disease to range from 4 per cent to as high as 40 per cent under extreme condition (Meshram and Sheo-raj 1988 *and* 1992; Lim S.M. 1992 and *Mishra* and Krishana*,* 2001). Keeping in view the economic importance of the crop and losses caused by bacterial blight disease, present investigation was undertaken during the *Kharif*, 2009 on the research farm of the Department of Plant Pathology, College of Agriculture, Parbhani.

2. Materials and methods

2.1. Integrated disease management strategy

Field experiments were carried out in field at Soybean Research Scheme, Marathwada Agricultural University, Parbhani during 2009-10. Bacterial blight susceptible soybean variety, JS-335 was sown at 30 x 10 cm spacing on 10th July, 2009. The crop was raised as per recommended package of practices and protective irrigation was given as and when required. Per cent disease was calculated as per the standard area diagram developed by Mayee and Datar (1986).

For recording the disease intensity at field condition, 0 to 9 disease rating scale developed by Mayee and Datar (1986) was used. For this purpose five leaves located at the bottom, five middle and five top of the plant were chosen and scored.

$$PDI = \frac{\text{Sum of observed numerical ratings}}{\text{Number of leaves observed x maximum grade}} \times 100$$

PDI = Per cent disease intensity

Measurement of disease intensity (severity) was carried out on five randomly selected plants in each plot. Per cent incidence was calculated from the number of infected plants against the total number of plants at the time of observation by using following formula.

$$\text{Per cent incidence (PI)} = \frac{\text{No. of plants diseased}}{\text{Total number of plants observed}} \times 100$$

Per cent disease control (PDC) was worked out by applying formula.

$$\text{Per cent disease control (PDC)} = \frac{\text{PDI in control} - \text{PDI in treatment plot}}{\text{PDI in control plot}}$$

3. Results and Discussion

3.1. *In vivo* evaluation of chemicals

Data on disease incidence is presented in result (Table 1 and Fig. 1, 2) on disease incidence were significant at 30, 45 and 60 DAS. All the treatment recorded significantly low disease incidence over control at 30, 45 and 60 DAS. Disease incidence after 30 days of sowing was found significant over control and ranged from 9.26 to 32.38 per cent against 38.48 per cent in control plot. Treatment streptocycline 100 ppm + Copper oxychloride 0.25% is superior over rest of the treatments. Minimum disease incidence 9.26 per cent was observed in this treatment and which was at par with Streptocycline 100 ppm (14.28%), Copper oxychloride 0.25 per cent (19.40%) and 2 bromo 2 nitro propene 1-3 diol (500 ppm), 500 ppm (25.12%).

Disease incidence incidence after 45 DAS was found significant over control and ranged from 12.80 to 35.90 per cent against 40.44 per cent in control plot. The minimum disease incidence 12.80 per cent was found in chemical streptocycline 100 ppm + Copper oxychloride (0.25%) followed by streptocycline 100 ppm (17.18%) , 2

bromo 2 nitro propene 1-3 diol, 500 ppm (28.08%) Copper oxychloride 0.25 per cent (22.48%) and Poushamycin (35.90%).

Table 1
Effect of chemicals at different concentrates on Bacterial blight of soybean.

Sr. No.	Treatment	PDI			Mean	PDC			Mean
		30 DAS	45 DAS	60 DAS		30 DAS	45 DAS	60 DAS	
1	Streptocycline (100 ppm) + copper oxy-chloride (0.25%)	9.26 (5.31)	12.80 (7.35)	16.18 (9.31)	12.74	36.93 (21.67)	69.09 (43.71)	75.84 (49.40)	60.62
2	Streptocycline (100 ppm)	14.28 (8.21)	17.18 (9.89)	20.82 (12.01)	17.42	32.16 (18.75)	62.08 (38.37)	71.60 (45.72)	55.28
3	Copper oxychloride (0.25%)	19.40 (11.18)	22.48 (12.99)	25.60 (14.83)	22.49	27.18 (15.77)	54.50 (33.02)	67.12 (42.15)	49.06
4	Bactinashake (500 ppm)	25.12 (14.54)	28.08 (16.30)	31.26 (18.21)	28.15	23.16 (13.39)	47.54 (28.38)	62.78 (38.39)	44.49
5	Poushamycin (200 ppm)	32.38 (18.39)	35.90 (21.03)	38.26 (22.49)	35.51	18.68 (10.76)	39.34 (23.16)	55.66 (33.81)	37.89
6	Control (water spray)	38.48 (22.62)	40.44 (23.85)	44.36 (27.88)	41.09	5.60 (3.21)	16.38 (9.42)	32.56 (19.00)	18.18
	SE ±	0.23	0.22	0.01		0.22	0.23	0.69	
	CD at 5%	0.74	0.72	0.05		0.72	0.73	2.19	

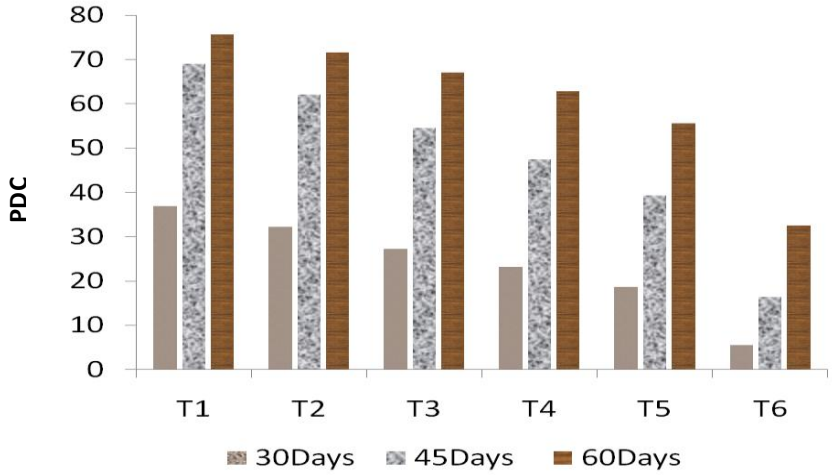

Fig. 1. *In vivo* evaluation of chemicals on Bacterial blight of soybean.

T1-Streptocycline (100 ppm) + copper oxy-chloride (0.25%)
T2-Streptocycline (100 ppm)
T3-Copper oxychloride (0.25%)
T4-Bactinashake (500 ppm)
T5-Poushamycin (200 ppm)
T6-Control (water spray)

Disease incidence after 60 DAS was found significant over control and ranged from 16.18 to 38.26 as against 44.36 per cent in control plot. The minimum disease incidence 16.18 per cent was found in chemical streptocycline 100 ppm + Copper oxychloride (20.82%) followed by streptocycline 100 ppm (20.82%), Copper oxychloride (25.60%) Poushamycin (10.22%) and 2 bromo 2 nitro propene 1-3 diol, 500 ppm (31.26%).

The highest mean per cent disease incidence 35.51 per cent was observed in poushamycin (200 ppm) treatment. The lowest mean per cent disease incidence 12.74 per cent was found in treatment streptocycline (100 ppm) + Copper oxychloride (0.25%). Per cent disease control after first and second spraying was ranged from 18.68 to 36.93 and 39.34 to 69.09 per cent respectively. After third spray maximum disease control was recorded in chemical streptocycline 100 ppm + copper oxychloride 0.25% to the tune of 75.84 per cent followed by streptocycline 100 ppm (71.60%), Copper oxychloride 0.25% (67.12%), 2 bromo 2 nitro propene 1-3 diol, 500 ppm (62.78%), poushamycin (55.66%).

Mean disease control achieved with all treatments ranged from 37.89 to 60.62 per cent. The highest mean disease control of 60.62 per cent recorded in chemical streptocycline 100 ppm + Copper oxychloride 0.25%. The Second and thirds best antibiotic were streptocycline (55.28%), copper oxychloride (49.06). This result was similar to the scientists those who reported earlier by Thind and Mehara (1992) and Govindappa et *al*., (2008).

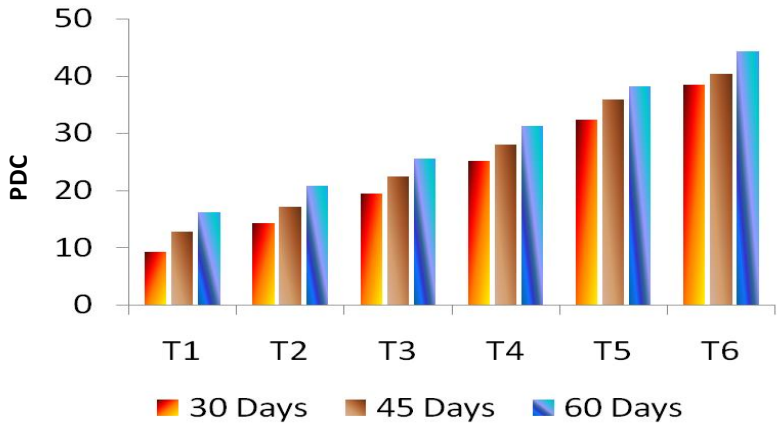

Fig. 2. Effect of chemicals at different concentrates on bacterial blight of soybean.

T1 Streptocycline + copper oxy-chloride T2 Streptocycline
T3 Copper oxychloride T4 2 bromo 2 nitro propene 1-3 diol
T5 Poushamycin T6 Control (water spray)

3.2. *In vivo* effect of plant extract

Results (Table 2 and Fig 3) revealed that all the treatments were recorded significantly low disease incidence over control at 30, 45 and 60 DAS. Disease incidence after 30 days of sowing was found significant over control and ranged from 11.00to 24.12 per cent against 28.30 per cent in control plot. Treatment Neem is superior over rest of the treatments. Minimum disease incidence 11.00 per cent was observed in 18.28%), onion (21.26%) and tulsi (24.12%)

Disease incidence after 45 DAS was found significant over control and ranged from 15.50 to 28.16 per cent against 32.18 per cent in control plot. The minimum disease incidence 15.50 per cent was found in chemical Neem followed by Ginger (18.38%), Garlic (23.20%), onion (26.40%), Tulsi (28.16%).

Disease incidence after 60 DAS was found significant over control and ranged from 19.40 to 32.20 as against 37.60 per cent in control plot. The minimum disease incidence 19.40 per cent was found in Neem followed by Ginger (22.26%), Garlic (26.40), Onion (30.12%) and Tulsi (32.20%).

The highest mean per cent disease incidence 28.16 per cent was observed in tulsi treatment. The lowest mean per cent disease incidence 15.3per cent was found in treatment neem. Per cent disease control after first and second spraying was ranged from 8.24 to 20.00 and 12.40 to 26.40per cent respectively after third spraying maximum disease control was recorded in Neem to the tune of 25.92 per cent followed by Ginger (22.83%), Garlic

(19.15%), onion (16.16) and tulsi (11.94%). Plant extract of tulsi was found least effective against test pathogen. Mean disease control achieved with all treatments ranged from 25.92 to 11.94per cent. The highest mean disease control of 25.92 per cent recorded in Neem. The Second and thirds best plant extract Ginger (22.83), Garlic (19.15%). Results obtained in respect of efficacy of plant extracts in effectively managing the *Xanthomonas* are in conformity with those reported earlier by Ginger (22.83), Garlic (19.15%). Iauk L. *et al.,* (2003).

Table 2
In vivo effect of different plant extract on PDI and PDC.

Sr. No.	Treatment	PDI			Mean	PDC			Mean
		30 DAS	45 DAS	60 DAS		30 DAS	45 DAS	60 DAS	
1	Ginger (15%)	14.40 (8.27)	18.38 (10.59)	22.26 (12.86)	18.34	17.40 (10.02)	23.80 (13.76)	27.30 (15.84)	22.83
2	Neem (15%)	11.00 (6.31)	15.50 (8.91)	19.40 (11.18)	15.03	20.00 (11.53)	26.40 (15.30)	31.38 (18.28)	25.92
3	Garlic (15%)	18.28 (10.05)	23.20 (13.41)	26.40 (15.30)	22.62	14.20 (8.16)	20.12 (11.60)	23.13 (13.37)	19.15
4	Onion (15%)	21.26 (12.27)	26.40 (15.30)	30.12 (17.52)	25.92	11.17 (6.41)	17.20 (9.90)	20.12 (11.60)	16.16
5	Tulsi (15%)	24.12 (13.95)	28.16 (16.35)	32.20 (18.78)	28.16	8.24 (4.72)	12.40 (7.12)	15.26 (8.77)	11.94
6	Contol	28.30 (16.43)	32.18 (18.77)	37.60 (22.08)	98.08	0 (0.00)	0 (0.00)	0 (0.00)	
7	SE ±	0.21	0.005	0.04		0.46	0.46	0.47	
8	CD at 5%	0.06	0.01	0.1		1.46	1.47	1.48	

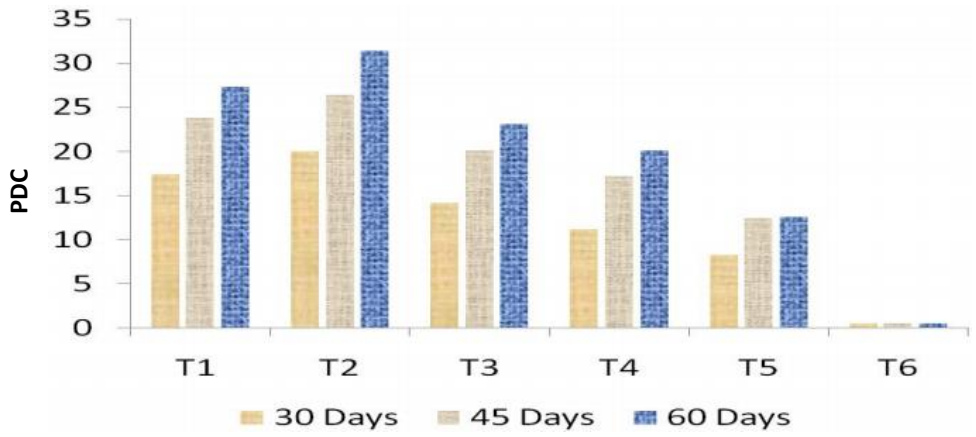

Fig. 3. *In vivo* effect of different plant extract on PDC.

T1 Ginger T2 Neem T3 Garlic
T4 Onion T5 Tulsi T6 Contol

3.3. Seed yield and test weight

Results (Table 3) obtained in respect of efficacy of chemicals, botanicals and bioagents against bacterial blight of soybean and their effect on seed yield and test weight of soybean indicated that all the treatments significantly

reduced the bacterial blight intensity and defoliation over unsprayed control and thereby increased the seed yield and test weight.

Among chemicals tested, Streptocycline (100 ppm) + copper oxychloride (0.25 %) (@ 0.1%) recorded highest seed yield (2605 kg/ha) and test weight (14.33 g) and thereby increased the seed yield and test weight by 30.95 and 17.44, per cent respectively, over unsprayed control (yield, 1799 kg/ha, test weight, 11.83 g) with minimum mean disease intensity (8.93%) and pod infection (4.22%). The second best chemical found was *Streptocycline* (100 ppm) which recorded seed yield of 2505 kg/ha and test weight of 14.00 g with minimum mean disease intensity (9.43%) and pod infection (5.22%) and thereby increased the seed yield by 28.18 per cent and test weight by 15.50 per cent over unsprayed control. This was followed by chemicals, copper oxychloride (0.25%), 2 bromo, 2 nitro propene 1-3 diol (500 ppm), *Poushamycin* (200 ppm) respectively and test weight of 13.50, 13.16 and 13.11g, respectively with the mean disease intensities of 11.18, 13.74 and 12.27 per cent, respectively and mean pod infections of 8.24, 12.90 and 13.10 per cent, respectively. Chemicals poushamycin (200 ppm) was found on par with each other in respect of the seed yield. The per cent increase in seed yield and test weight recorded by the chemicals, Copper oxychloride (0.25 %) 2 bromo, 2 nitro propene 1-3 diol (500 ppm) over unsprayed control were 25.22, 19.97 and 28.18 per cent and 12.67, 10.10, and 9.76 respectively. This study was same to Meshram and Sheo Raj (1992), Mishra and Krishna (2001). Thus, all the chemicals evaluated under field conditions against bacterial blight of soybean were found most effective in reducing the disease as well as increasing the seed yield and test weight over unsprayed control.

Table 3

Effect of chemicalson per cent pod infection (PPI) and bacterial blight intensity (PDI) on seed yield and test weight in soybean Cv. JS-335.

Tr. No.	Treatments	Mean *PPI*	Mean PDI	Seed yield* (kg/ha)	Test weight* (g)	% increase over control	
						Seed yield	Test weight
T_1	Streptocycline (100 ppm) + copper oxychloride (0.25 %)	4.22	12.74	2605	14.33	30.95	17.44
T_2	*Streptocycline (100 ppm)*	5.22	17.42	2505	14.00	28.18	15.50
T_3	2 bromo 2 nitro propene 1-3 diol (500 ppm)	12.90	22.49	2248	13.16	19.97	10.10
T_4	Copper oxychloride 0.25%	8.24	28.15	2406	13.50	25.22	12.67
T_5	Poushamycin (200 ppm)	13.10	35.51	2205	13.11	27.41	9.76
T_6	Control	37.68	41.09	1799	11.83	-	-
S.E. ±					0.25	-	-
C.D. (P=0.05)					0.75	-	-

*Average of three replications.

Figures in parenthesis are angular transformed values

4. Conclusion

The protective action of streptocycline (100 ppm) + copper oxychloride (0.25%) against the *P. syringae* was observed in field. However, the disease control was significant only up to 60 DAS and a partial yield increase was obtained. All the five botanicals / plant extracts tested *in vivo* at various concentrations significantly inhibited the growth of *P, syringae.* However, Neem found most effective followed by Ginger, Garlic, Onion, while plant extract of Tulsi was found least effective against test pathogen. The inhibitory action of neem may be due to azadirchtin present in seed kernels which retards the growth and activation of the pathogen. The effectiveness of onion bulb

extract may be due to presence of antifungal compounds such as cycloallin and carbohydrate propenyl sulphuric acid.

In view of the changing agricultural policies throughout the world, complete disease control is no longer a target of plant pathologists. Reducing the pest or pathogen populations below an economical threshold level using cost-effective and eco-friendly management option is the focus of the day. In this context, identification of plant extract of Neem as a fungicide effective against bacterial blight is of highly significant.

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