Journal of Biological Control, 27 (1): 64–66, 2013

Research Note

Efficacy of bioformulations against bacterial wilt of tomato caused by *Ralstonia solanacearum*

PRANAB DUTTA

Programme Coordinator, Krishi Vigyan Kendra, West Tripura, P. O. Chebri, Khowai, Tripura 799 207, India
Present address: Scientist, Department of Plant Pathology, Assam Agricultural University, Jorhat 785 013, Assam, India
Corresponding author E-mail: pranabd1974@indiatimes.com

ABSTRACT: Bacterial wilt of tomato caused by *Ralstonia solanacearum* is the dreaded diseases causing severe yield loss (25-75%) in farmers' field. A field experiment at demonstration farm of KVK West Tripura was conducted for the evaluation different chemicals, botanicals and bioformulation against the disease. The study revealed that all the treatments were significantly effective over the control. However, soil drench with antibiotic @ 100 ppm was found best with lowest (23.6%) disease incidence and highest yield (228.2 q/ha). This was followed by copper oxychloride in terms of disease incidence (28.4%) and Biofor Pf in terms of yield (220.6 q/ha). Highest disease incidence (78.67%) with lowest yield(86.5 q/ha) was recorded in control plot .

KEY WORDS: Bacterial wilt, management, tomato

(Article chronicle: Received: 17-09-2013; Revised: 10-01-2013; Accepted: 18-02-2013)

INTRODUCTION

Bacterial wilt of tomato, *Lycopersicon esculentum* Mill, incited by *Ralstonia solanacearum* (Smith) Yabuuchi *et al.,* (Syn. *Pseudomonas solanacearum* E. F. Smith) is one of the devastating diseases affecting vascular bundles of plants. The disease causes 25–75% yield loss of solanaceous vegetables in India (Rao and Sohi, 1977). The disease is very difficult to manage because of its wide host range and the exceptional ability of the pathogen to survive in the roots of non-host plants and in the soil (Kumar and Sood, 2001). The pathogen has a very wide range of host and almost all the solanaceous vegetables are susceptible. In India, plant species belonging to 37 families are attacked by bacterial wilt pathogen (Shekhawat *et al.,* 1992). Perusal of literature indicated that considerable attempts have been made to manage the disease in various crops and in different places with the use of host resistance, changes in cultural practices, bioagents and chemicals (Dubey *et al.,* 1996; Biswas and Singh, 2008; Kishore *et al.,* 1996). However, the disease is still a major problem in tomato cultivation. Hence, the present study was carried out to find out most effective control measure against the bacterial wilt of tomato under the agro-climatic conditions of Tripura where severe outbreak of the disease occurs in tilla (hillock) land of sandy loam soil.

The present investigation was carried out in the Instructional cum Demonstration Farm of Krishi Vigyan Kendra, West Tripura during the winter crop season of 2008-09 and 2009-10 (October to April). Tomato genotype *viz.,* Arka Vikash was used in this experiment. The experiment was set up by transplanting 20 day old seedlings in a bacterial sick plot using RBD design of four replications to compare 5 treatments (including control). The plot size was 2.5 x 5 m^2 with 60 x 45 cm^2 spacing between rows and plants. Fertilizer schedule was FYM @ 10 ton/ha, NPK @ 120:80:60 Kg/ha, half of N and full doses of FYM, P_2O_5 and K_2O was applied as basal and the remaining half of N was top dressed 30 days after. One weeding was done at 20 days after transplanting. The plants were irrigated 4 times at an internal of 15 days. The number of plants wilted per plot was recorded starting from 15 days after transplanting and then at 15 days intervals following the method of Mew and Ho (1976). Bacterial ooze test was conducted on wilted plants to confirm the disease.

Four treatment combinations were tried *viz.,* 2 chemicals (Plantomycin @ 100 ppm and copper oxychloride @ 0.3% w/v), 2 botanicals (Hing / Asafoetida and Turmeric @ 1:5) and a bioformulation (Biofor Pf, a *Pseudomonas flourescens* and *Trichoderma harzianum* based bioformulation developed by Assam Agricultural

University, Jorhat against *R. solanacearum.* Chemicals and botanicals were applied as soil drenching @ 400 ml/plant, bioformulation was applied in circular ring, 15 cm away from the plant base @ 100 gm/plant. For soil application of Biofor Pf, 1 kg of the formulation was mixed with 10 kg dry cow dung and applied the mixture @ 100 gm/plant. All the management approaches were tried for three applications i.e. at 15, 30 and 45 days after transplanting.

Percentage mortality due to bacterial wilt was recorded per plot. The data were analysed using Fisher's method of analysis of variance. The per cent values were transformed to corresponding angular values before analysis.

RESULTS AND DISCUSSION

All the treatments were significantly effective in reducing the wilt incidence as compared to inoculated control (Table 1). Lowest disease incidence (23.6%) was recorded in Plantomycin treated plot with highest yield (228.2 q/ha), this was followed by soil drenching with copper oxychloride and asafoetida: turmeric: water for disease incidence. Yield data recorded in Biofor Pf treated plot shows second highest in production (220.0 q/ha) but highest wilt per cent (34.68%). This was followed by soil drench with copper oxychloride and asafoetida: turmeric: water with a yield of 209.6 q/ha and 182.1q/ha respectively. Lowest disease incidence with highest yield recorded in the Plantomycin treated plot might be due to immediate antibacterial action of the chemical on the bacterial population surviving in the soil which causes quick/direct death of the bacteria and indirectly helps the plant for maximum and efficient nutrient uptake, leads to the higher yield. Plantomycin acts on ribosome and inhibits protein synthesis, and also act directly on the microorganism as killing agents or as inhibitors of growth and reproduction by binding to bacterials. Dutta *et al.*, (2009) reported that antibiotics acted against bacteria by interfering with their enzyme systems and then producing physiological disturbance which first inhibited and then they destroyed the bacteria. In the effect of bioformulation for the management of bacterial wilt of tomato, bioformulation Biofor Pf was found effective in minimizing the disease (Table 1). The efficacy of the bioagent might be attributed to the production of siderophore like metabolite which has strong inhibitory effect on *R. solanacearum* (Ciampi *et al.,* 1997). The fact behind the reduced disease incidence recorded in Biofor Pf treated plot is that *P. flourescens* rapidly colonized and inhibited certain components of the root zone microflora. The antagonist beneficially alters the composition of the rhizosphere leading to reduced plant disease incidence. Similarly higher yield observed in the Biofor Pf treated plot might be associated with reduction in disease incidence, increased uptake of soil nutrients, rejuvenation of soil and enhanced plant growth regulators (Anonymous, 2008). Jha *et al.* (2005) reported that soil application of *Pseudomonas* spp. besides reducing disease incidence helps in growth of the tomato plants.

Table 1. Effect of chemicals, botanicals and bioformulation on bacterial wilt and yield of tomato

Treatments	Disease Incidence (%) **	% disease reduction over control	Yield (q/ha) **
T_1 = Soil drench with Plantomycin (@ 100 ppm)	23.6 (29.06) *	70.00	228.2
T_2 = Soil drench with Copper Oxychloride (@ 0.3% w/v	28.4 (32.20)	63.90	209.6
T_3 = Soil drench with Asafoetida : Turmeric powder : Water (@ 1 gm: 5 gm: 10,000ml)	31.60 (34.20)	59.83	182.1
T_4 = Soil application of Biofor Pf (@ 100 gm/plant)	34.68 (36.08)	55.92	220.0
T_5 = Control (No chemicals + No botanicals + No Formulation)	78.67 (62.49)	–	86.5
CD (p = 0.05)	2.33	–	4.62

* Data in the parentheses are arcsine transformed value

** Data are mean two years and four replications

Earlier, soil application of asafoetida (1 gm) + turmeric powder (5 gm) in 10 litres of water was reported as an effective measure against tomato wilt disease in North East India (Anonymous, 2005). Copper oxychloride has been reported earlier as an effective chemical against bacterial disease of tomato. Copper ion (Cu^{2+}) is toxic to all bacterial cells because it reacts with sulphydril (–SH) groups of certain amino acids and causes denaturation of proteins and enzymes. The possible reasons for not getting total control of the disease in the present study could be due to improper and/or no coverage of bacterial sick soil by the treatments to the whole rhizosphere, failure of the treatment to penetrate the cells of already infected plants where bacterial cell still viable and infective and also the endemic nature of the disease.

ACKNOWLEDGEMENT

The authors are grateful to Indian Council of Agricultural Research, New Delhi for the financial support. The valuable suggestion and encouragement received from Dr. V. Venkatasubramanian, ADG (AE), ICAR, New Delhi, Dr. A. K. Gogoi, ZPD, Zone-III, ICAR, Meghalaya-3 and Mr. P. Kanungo, GS, Sri Ramakrishna Seva Kendra, 81, Bondel Road, Kolkata in various spheres of work is highly appreciated.

REFERENCES

Anonymous 2005. *Package of practices for horticultural crops of Assam*. Published by Department of Agriculture, Assam and Assam Agricultural University, Jorhat. pp. 193.

Anonymous 2008. *Biofor Pf-2: An organic biopesticide for management of ginger rot and wilt disease of tomato, brinjal, potato and chilli.* Assam Agricultural University, Jorhat 785 013.

Biswas S, Singh NP. 2008. Integrated management of wilt of tomato caused by *Ralstonia solanacearum. J Mycol Pl Pathol.* **38**(1): 18–20.

Ciampi L, Burzio LO, Burzio LA. 1997. Carriers for *Pseudomonas fluorescens,* antagonistic to *Pseudomonas (Ralstonia) solanacearum* causal agent to bacterial wilt. *Fitopatologia* **32**: 64–70

Dubey LN, Das KK, Hazarika DK. 1996. Evaluation of some chemicals against bacterial wilt of sesamum. *J Mycol Pl Pathol.* **26**: 94–95.

Dutta P, Neog K, Das R, Handique PK, Chakraborty R. 2009. Evaluation of some botanicals, antibiotics, carbon sources and carrier against the bacterial disease of muga silkworm, *Antheraea assamensis. Sericol.* **50**(1): 113–122.

Jha G, Bhat V, Anjaiah V. 2005. Root growth promoting activity of some rhizobacterial strains on tomato plants. *Indian Phytopath.* **58**(4): 462–465.

Kishore V, Shekhawat GS, Sunaina V. 1996. Cultural practices to reduce *Pseudomonas solanacearum* in the infested soil. *J Ind Potato Assoc.* **23**: 130–133.

Kumar P, Sood AK. 2001. Integration of antagonistic rhizobacteria and soil solarization for the management of bacterial wilt of tomato caused by *Ralstonia solanacearum. Ind Phytopath.* **54**(1): 12–15.

Mew TW, Ho WC. 1976. Varietal resistance to bacterial wilt in tomato. *Pl Dis Rptr.* **60**: 264–268.

Rao, MVB, Sohi HS. 1977. Control of bacterial wilt of Brinjal. *Indian Hort.* **22**: 11–13.

Shekhawat GS, Gadewar AV, Chakraborti SK. 1992. *Bacterial Wilt Newsletter ACIAR*, **8**: 5–6.