J. Mycopathol. Res. ***51(2)*** *: 323-326, 2013;* (ISSN 0971-3719)

Efficacy evaluation of different chemicals for the management of Early Blight of tomato caused by *Alternaria solani* (Ell. and Mart.) under field condition

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Received : 05.12.2012 Accepted : 06.04.2013 Published : 28.10.2013

IIn an experiment conducted during 2009 and 2010, six different chemicals were tested as per their recommended doses for the management of early blight of tomato caused by *Alternariasolani* (Ell. And Mart.)underthe gangetic plain of West Bengal. Throughout the experiment one susceptible tomato cultivar "Patharkuchi" was used and natural epiphytotic conditions were permitted. The pooled results revealed that Mancozeb was the most effective in reducing disease severity that recorded minimum AUDPC=6.24 and maximum fruit yield was 154.12 qha^{-1}.Maximum disease severity was observed in Propiconazole treated plot AUDPC= 9.75. In Difenconazole treated plot disease severity was found to be AUDPC= 8.89 but fruit yield obtained was 118.00 qha^{-1}which was next to Mancozeb. Taking both disease severity and yield factor into consideration the experiment resulted Mancozeb is the best one and which is followed by Difenconazole and Hexaconazole respectively.

Key words: Early blight, *Alternaria solani,* chemicals (fungicides), AUDPC

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill) is one of the most popular vegetables grown all over the world. In India tomato has wider coverage in comparison to other vegetables. The leading tomato growing states are Uttar Pradesh, Karnataka, Maharashtra, Haryana, Punjab, West Bengal, Assam and Bihar. West Bengal is the leading producer of vegetables accounting 17.85% of India's total vegetable production and it has 17.6% of total area under vegetable cultivation in the country (Annonymous 2009). Tomato universally treated as "Protective Food" is being extensively grown as annual plant all over the world. It is a very good source of income to small and marginal farmers and contributes to the nutrition of the consumers. Tomato is a rich source of minerals, vitamins and organic acids. There are various types of flavouring compounds found in the fruits, which enrich the taste.

Every year cultivation of tomato is declining due to different biotic and abiotic stresses. Among the biotic stress diseases play pivotal role and among the fungal diseases, Early Blight caused by (*Alternaria solani*) is the most destructive one (Doo little, 1948). Tomescu and Negru (2003) have also reported that the main fungi causing the economical losses in all region is *Alternaria solani.* The infection occurs on all the plant parts, leaves, stem, petiole, calyx and fruits. It is prevalent throughout the tomato growing areas in the world (Calvo *et al.*, 1990) and also causes major yield loss (Waals *et al.,* 2001). Yield losses ranges between 50-86 per cent (Mathur and Shekhawat, 1986). Effective management of the disease is possible with the application of different chemicals like Mancozeb

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@ 2.5 g/lit, Carbendazim @0.5 g/lit and Captan @2.5 g/lit etc. (Mohammad, 1988) and Propiconazole @ 1 ml/lit (Singh *et al.*, 2001). The present study evaluates the effective chemicals for management of Early Blight of tomato under the gangetic plains of West Bengal.

MATERIALS AND METHODS

A field experiment was carried out for two consecutive years (2009 and 2010) to evaluate various chemicals (fungicides) like Mancozeb (Indofil M45 75 %WP), Carbendazim (Bavistin 50 %WP), Propiconazole (Tilt 25%EC), Chlorothalonil (Isshan 75%WP), Hexaconazole (Mass Plus 5% SC) and Difenaconazole (Score 25% EC) against Early Blight of tomato cv. Patharkuchi under natural conditions at Jaguli Instructional Farm, Mohanpur. The experiment was laid out in randomized block design and replicated three times. Healthy tomato seedlings of 21 days old were transplanted into the main field with the spacing 60 × 30 cm in the plot measuring 5×5 sq.m. All the other recommended cultural practices were followed. Three sprays of different fungicides were given and the first spray was given at the initiation of disease and then twice at 15 days interval after first spray. Five plants were selected randomly in each plot and observations on disease severity were recorded at 10 days intervals up to the harvest of the crop and recorded by using 0 – 9 scale (Mayee and Datar, 1986). Disease severity was calculated as Area under Disease Progress Curve (AUDPC) and statistical analysis was done to evaluate the effectiveness of different fungicides for disease management.

The area under disease progress curve was calculated as per Wilcoxon *et.al* (1975). The formula was used as follows:

$$AUDPC = \Sigma [(Y_{i+1} + y_i)/ 2 (X_{i+1} - X_i)]$$

Y_i = severity at 1st observation,

X_i = Time (days) at first observation

N = Total number of observation

The following fungicides used along with their respective doses

Trade Name	Common Name	Manufacturer source	Dose
Bavistin	Carbendazim 50% WP	BASF India Limited, P.O. Box. no. 19108, S.K. Ahire Marg, Mumbai-400025	1.0g/lit
Mass Plus	Hexaconazole 5% EC	Nagarjuna Agrichem Ltd, Plot No. 12A, C N Block, Laxmi Tower, Nagarjuna Hills, Hyderabad-500082, AndraPradesh.	1.5 ml/lit
Score	Difenconazole 25% EC	Syngenta India Ltd., 14, J.Tata Road, Mumbai – 400 020.	0.5 ml/lit
Indofil M 45	Mancozeb 75% WP	Indofil Chemicals Company, Nirlon House, Dr.A.B. Road, Worli, Mumbai- 400025	2.5 g/lit
Tilt	Propiconazole 25% EC	Syngenta India Ltd., 14, J.Tata Road, Mumbai – 400 020.	1.0 ml/lit
Ishaan	Chlorothalonil 75% WP	Rallis India Ltd., 156/157 15th Floor NarimanBhawan, 227 Nariman point Mumbai – 400 021.	2.0 g/lit

Table 1 : Efficacy of different chemicals on early blight disease severity and yield of tomato for two consecutive years (2009 and 2010) and pooled.

Treatment	Disease Severity (AUDPC)*			Fruit Yield (q ha^{-1})		
	2009	2010	Pooled mean	2009	2010	Pooled mean
Mancozeb	7.04	5.44	6.24	158.33	149.90	154.12
Propiconazole	10.47	9.51	9.75	98.00	89.95	93.97
Hexaconazole	7.23	6.71	6.97	112.92	116.08	114.50
Carbendazim	7.55	5.90	6.73	80.25	88.36	84.30
Chlorothalonil	9.00	8.54	8.78	103.00	108.00	105.50
Difenconazole	9.50	8.27	8.89	111.00	125.00	118.00
Control	12.29	11.50	11.90	62.50	57.33	59.92
SEm(±)	0.40	0.45	0.42	11.88	12.05	9.61
CD (P=0.05)	0.87	0.99	0.91	36.62	39.77	27.94

*AUDPC= Area under disease progress curve

RESULTS AND DISCUSSION

Results of both years revealed that, all the treatments were significantly effective in controlling the Early Blight of tomato in comparison to untreated control. The result indicated that Mancozeb was found significantly superior in controlling Early Blight (AUDPC : 7.04) followed by Hexaconazole (AUDPC : 7.23). Both the fungicides were at par with each other for controlling this disease. Other fungicides like Carbendazim (AUDPC: 7.55), Chlorothalonil (AUDPC: 9.00), Difenconazole(AUDPC: 9.50) and Propiconazole(AUDPC: 10.47) were next effective in reducing Early Blight of tomato in the year 2009.Whereas Mancozeb (AUDPC: 5.44) was found most effective fungicide but statistically at par with Carbendazim (AUDPC: 5.90) in reducing the Early Blight disease in the year 2010. While Hexaconazole (AUDPC: 6.71),Difenconazole (AUDPC: 8.27), Chlorothalonil (AUDPC: 8.54), and Propiconazole (AUDPC: 9.51) were found next effective fungicides in the year 2010, though the differences in disease severity were statistically significant among themselves. Two years pooled data revealed that the minimum disease severity (AUDPC: 6.24) was recorded in Mancozeb closely followed by Carbendazim (AUDPC : 6.73) and Hexaconazole (AUDPC : 6.97) were at par with each other but significantly superior over rest of the fungicidal treatments. The next best in order of merit was Chlorothalonil (AUDPC: 8.78) followed by Difenconazole (AUDPC: 8.89) and Propiconazole (AUDPC : 9.75) in reducing the Early Blight of tomato under field condition.

Significantly higher fruit yield was recorded from Mancozeb (158.33 q ha^{-1}) followed by Hexaconazole (112.92 q ha^{-1}) and their difference was statistically significant. Hexaconazole and Difenconazole 112.92 q ha^{-1} and 111.00 q ha^{-1} respectively showed similar result in fruit yield of tomato and their difference was statistically at par. It was also observed that minimum fruit yield was obtained from Carbendazim applied plots (80.25 q ha^{-1}) which was statistically at par with Propiconazole (98.00 q ha^{-1}), which was Chlorothalonil (103.00 q ha^{-1}) and Difenconazole (111.00 q ha^{-1}) in the year 2009. Similarly maximum fruit yield was obtained from Mancozeb (149.90 q ha^{-1}) which was statistically at par with Defenconazole(125.00q ha^{-1}). In the year 2010, minimum fruits were harvested from Carbendazim (88.36 q ha^{-1}) which was statistically at par with Propiconazole (89.95 q ha^{-1}), though Chlorothalonil (108.00 q ha^{-1}),Difenconazole(125.00 q ha^{-1}), Hexaconazole (116.08 q ha^{-1}) showed similar result in fruit production of tomato and they were statistically at par with each other.The two years pooled mean data showed maximum fruit yield from Mancozeb treated plots (154.12 q ha^{-1}) and minimum in Carbendazim treated plots (84.30 q ha^{-1}). Other fungicidal treatments were also had similar results and statistically at par with each other for production of fruit yield of tomato.

Mohammad (1988) and Choulwar and Datar (1988) reported that preventive spray of Mancozeb (0.25%) gave effective control in Early Blight of tomato.

Present study also emphasizes that the treatment cost involved in the use of fungicides must be taken into consideration while selecting the fungicides for the effective and economical control.

CONCLUSION

Six fungicides were used against Early Blight of tomato to find out the effective chemicals against this disease. Two years experiments showed differences in disease severity and fruit yield. The two years pooled mean data showed that all the chemicals reduced disease severity significantly as compared to untreated control. Maximum disease severity was observed in Propiconazole (AUDPC= 9.75) followed by Difenconazole (AUDPC=8.89) and their differences were statistically at par. Minimum disease severity was observed in Mancozeb (AUDPC=6.24) which was statistically at par with Carbendazim (AUDPC=6.73) and Hexaconazole (AUDPC=6.97).

Yield increased with the reduction in disease severity. Maximum yield was observed in Mancozeb (154.12 q ha^{-1}) followed by Difenconazole (118.00 qha^{-1}) and Hexaconazole (114.50 qha^{-1}) and their differences was statistically significant. Minimum yield obtained from Carbendazim (84.30 q ha^{-1}) treated plot followed by Propiconazole (93.97 q ha^{-1}) and they were statistically at par to each other.

So, it is evident from the above mentioned facts

that among the chemicals Mancozeb is the best one for managing Early Blight disease of tomato as well as from the fruit yield point of view. The next two were Difenconazole and Hexaconazole respectively.

Devanthan and Ramanujam (1995) reported Mancozeb as most effective chemical against *A. solani.* The above finding also support the report by Chaulwar*et al.*(1992), Follas *et al.*(1992) and Mate *et al.*(2005). The result obtained for yield contradicts that of Arunakumara *et al.*(2010) where they obtained maximum yield from Propiconazole treated plot followed by Mancozeb that is also in accordance with the result of Maheswari and Gupta (1991).

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