INTEGRATED MANAGEMENT OF MAJOR FUNGAL DISEASES OF TOMATO

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ABSTRACT

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The experiment was conducted at Bangladesh Agricultural University, Mymensingh during the period from October 2004 to March 2005 to determine an eco-friendly management practices against major fungal diseases of tomato. The treatments were: T_1 = BAU - Biofungicide + Sanitation + Neem (3), T_2= MOC (Mustard oil cake) + Neem (2) + Karmacha, T_3 = BAU-Biofungicide + Neem + Karmacha (2), T_4 = BAU-Biofungicide + Karmacha (2) + Mahogony, T_5 = BAU-Biofungicide + MOC + Neem + Karmacha + Mahogony, T_6 = MOC + Karmacha + Mahogony (2), T_7 = BAU - Biofungicide + MOC + Neem + Mahogony (2), T_8 = MOC + Sanitation + Neem (3), T_9 = BAU - Biofungicide + MOC + Karmacha + Mahogony + Sanitation and T_{10} = control. In case of late blight treatment T_7 gave the lowest value but it showed statistically insignificant with rest treatments except T_{10}. Regarding early blight T_6, T_7, T_8 and T_9 exhibited more or less equally effective against the disease and they were statistically similar. As high as 33% wilt infection was recorded in T_{10} while no wilt infection was detected in all the rest treatments.

Key words: Tomato, BAU-Biofungicide, Fungal diseases

INTRODUCTION

Tomato (*Lycopersicum esculentum* Mill) is the most popular vegetable in the world because of its taste, colour and high nutritive value and also for its diversified use (Bose and Som, 1986). In Bangladesh the average yield of tomato is 2.71 metric tons per acre (B.B.S, 2004) which is lamentably low as compared to the other leading tomato producing countries (FAO, 1999). There are many factors involved in such low yield of tomato in Bangladesh; among them are infestations by fungi, bacteria, nematodes or viruses and the competing weeds are predominant (Villaral, 1980).

Over 200 diseases have been reported to affect the tomato plants in the world (Watterson, 1986). Among the fungal diseases early blight (*Alternaria solani*), late blight (*Phytophthora infestans*) and fusarial wilt (*Fusarium oxysporum*) are major. Both late and early blight can be effectively controlled by using fungicides but it is costly as well as not easily available to farmers' door. Wilt control has been restricted to use of wilt resistant cultivars, grafting on wilt resistant root stalk, crop rotation, deep ploughing of land and also use of different soil amendments. Removal of infected plants from the field will help limiting the disease spread. Considering the above points the most urgent need is to develop varieties of tomato that can resist the ravage of important fungal disease like early blight, late blight and wilt. But none of the cultivated tomato varieties in the country are found to be horizontally resistant to these diseases. Therefore, the general control of disease by employing Integrated Disease Management (IDM) program has drawn special attention to the researchers. It can reduce the cost of healthy cropping and the farmers can easily apply them in the field. The IDM practices not only save the crop from the referred field diseases but also reduce the possibility of attack by the other pathogens (fungi, viruses, bacteria and nematodes) to tomato crop in a cropping season. There is a great need to carry out farmer level research aiming to develop a holistic disease management model to manage the major diseases of tomato. In these circumstances, the present study has been undertaken to develop an eco-friendly management practices against major fungal diseases of tomato.

MATERIALS AND METHODS

The experiment was conducted at Bangladesh Agricultural University, Mymensingh during the period from October 2004 to March 2005. Seeds of tomato variety, Oxball (susceptible to diseases) were sown in seedbed on 20 October, 2004. Cow dung 10 tons per ha was applied and no chemical fertilizer was used in this experiment. The unit plot size was 1m x 1m. Row to row and plant to plant spacing was 50 cm. The experiment was laid out in the Randomized Complete Block Design (RCBD) having three replications. Distance between the blocks was 1m and between the plots was 0.5m. Apparently healthy seedlings of 35 days old were transplanted in the experimental field. There were 10 treatments as follows:

T_1 = BAU- Biofungicide + Sanitation + Neem (3)
T_2 = MOC (Mustard oil cake) + Neem (2) + Karamcha
T_3 = BAU- Biofungicide + Neem + Karamcha (2)
T_4 = BAU- Biofungicide + Karamcha (2) + Mahogony
T_5 = BAU- Biofungicide + MOC + Neem + Karamcha + Mahogony
T_6 = MOC + Karamcha + Mahogony (2)
T_7 = BAU- Biofungicide + MOC + Neem + Mahogony (2)
T_8 = MOC + Sanitation + Neem (3)
T_9 = BAU- Biofungicide + MOC + Karamcha + Mahogony + Sanitation
T_{10} = Control

The BAU-Biofungicide was added in the assigned pits @ 50g/pit and mixed well. MOC was decomposed in water for seven days after well grinding. After decomposing, it was diluted by adding plain water and applied @ 50g per plant in ring placement in soil around the base of the seedling, after 30 days of transplanting of seedlings. Sanitation was done 2 times after 30 days and 60 days of transplanting. The diseased leaves, which were 25% infected or more were removed. The dried and dead leaves were also removed from the plot. Plant extract was prepared as suggested by Sharmin (2003).

Neem (*Azadirachta indica*) Mahogony (*Swietenia Mahogony*)) and Karamcha (*Carissa carandas*) extract were applied @ 2g/l at 15days interval. First spray was given ten days after transplanting (DAT). Intercultural operations were done as and when necessasary. Data were taken on late blight infected plant, disease severity of late and early blight (0-6 scale for late blight and 0-5 scale for early blight, Vakalounakis, 1983) and wilted plants. Data were taken at 25, 40, 55 and 70 DAT. Percent data were transformed following Arcsine transformation.

RESULTS AND DISCUSSION

Late blight

Significant variation among the treatments becomes evident on percent late blighted plants regardless of data recording after days after transplanting (DAT) of tomato except 40 DAT. The late blight infected plants ranged 11.11-40.79%. At 25 DAT the treatment T_7 (Bio-fungicide+MOC+Neem+Mehogoni-2) appeared best one in reducing late blight infected plants and showed significantly better compared to rest treatments except T6 (MOC+Karamcha+Mehogoni-2), T_8 (MOC+Sanitatin+Neam-3) and T_9 (Bio-fungicide + MOC + Karamcha + Mehogoni + Sanitation). (Table 3). Significantly higher late blight infected plants was recorded by T_{10} (Control) and it differed significantly with all the rest treatments. The effect of treatments on late blight infection was insignificant at 40 DAT. At 55 DAT late blight infected plants ranged 48.15-81.48%. Although treatment T_7 gave the lowest late blight infection numerically but it showed statistically similar to all the treatments expect T_{10}. More than 92% tomato plants became infected due to late blight at 70 DAT and it differed significantly with all the rest treatments. Significantly lower infected plant was recorded by T_7 and it showed statistically similar T_5 (Bio-fungicide + MOC + Neem + Karamcha + Mehogoni) and T_9.

While disease severity of late blight was considered, there were no significant variation among the treatments whatever they were assessed at 25, 40, 55 and 70 DAT (Table 2). Late blight infection with lower disease severity prevailed at 25 DAT and it increased gradually with increasing of plant age.

Early blight

Significant variation among the treatments became well pronounced in controlling early blight of tomato in all four observations. It was evident that at 25 DAP, more than 59 percent plant became infected due to the disease in control treatment (T_{10}). The lowest early blighted plants of 18.51% were recorded in T_7 and it showed statistically insignificant with only T_6 (MOC+Karamcha+Mehogoni), T_8 and T_9. The treatment, T_7 also proved its affectivity on observations at 40, 55 and 70 DAT by exhibiting the lowest plant infection due to early blight. While statistical analysis was performed, T_7 gave significantly lower infected plants followed by T_9, T_8 and T_6 and they were statistically similar in all four times of observations.

Fusarium wilt

The results showed that all the tested treatments effectively controlled the wilt disease where none of plants died due to the disease except T_{10} (Control). In control more than 33% plant wilted during the entire growth period, most of which happened within 40 days of transplanting. Result revealed that integration of treatment combinations (T_1 to T_9) efficiently suppressed the causal agent of tomato wilt in the experimental field (Table 1). The results of present investigation indicate that the incidence of late blight infected plants and disease severity due to *Phytophthora* infection were rather low at the period between 25 and 40 DAT. The occurrence of late blight attained an *epiphytotic* momentum when the plants interred into their reproductive phase that means between 40 and 55 DAT. This may be happened due to congenial environmental condition of the fungus. During this period the minimum and the maximum air temperature were 12.49^0C and 22.72^0C respectively, cocepled with more than 80% relative humidity. This was in accordance with Dey *et al* (1998) who worked with late blight of potato. The treatment T_7 appeared the best against late blight where Bio-fungicide (*T. harzianum*) integrated with MOC, Neem and Mehogoni but results were not, so much encouraging. This was close agreement with the findings of Slusarski and Pieter (2003) and Dey (2004). Dey (2004) screened a good number of antagonists including *T. harzianum* and *T. viride* against late blight under artificial inoculation of *P. infestans* in net house and concluded that the antagonists have the ability to reduce the late blight infection as prophylactic, not a curative. Integration of treatments with sanitation had some positive influence against late blight which is corroborate with the findings of Cohen (1987), Tumwine (1990), Begum (2001) and Islam (2002). But all of then suggested that sanitation with fungicide spray is more effective in controlling late blight of tomato. Regarding early blight T_7 also exhibited better in controlling the disease compared to other treatment combinations. The effectiveness of *Trichoderma* against *Alternaria spp*. has been reported by Slusarski and Pieter (2003). Under the study all the integrating treatments (T_1 to T_9) performed excellent against wilt (*Fusariam oxysporum*) disease of tomato. The findings of the present study clearly supported those obtained by many researchers throughout the world (Ehteshmul *et al*. 1990, Parveen and Ghaffar, 1995; Mukherjee *et al*. 1995; Raj and Kapoor, 1996; Hossain and Fakir, 2001; Banu, 2003 and Dey, 2004) who worked on the biocontrol potentiality of different species of *Trichoderma* both in vitro and in vivo against wide range of soil-borne pathogens including *Fusarium oxysporum* Elad *et al*. (1982) claimed that *T. harzianum* excreted 1.3-glucanase and chitinase that showed antagonistic activity to control soil-borne pathogens. The affectivity of Mustard oil cake became reflected against. *F. oxyporum* under the present study which was in line with the findings Raj and kapoor (1996).

Table 1 Effect of treatments on % Wilt during the growth period under field condition

Treatments	% Wilt (up to 70 DAT)
T_1	0
T_2	0
T_3	0
T_4	0
T_5	0
T_6	0
T_7	0
T_8	0
T_9	0
T_{10}	33.33

T_1 = BAU- Bio-fungicide +Sanitation + Neem (3)
T_2 = Mustard oil cake + Neem (2) + Karamcha
T_3= BAU- Bio-fungicide + Neem + Karamcha (2)
T_4 = BAU- Bio-fungicide +Karamcha (2) + Mehogoni
T_5 = BAU- Bio-fungicide + Mustard oil cake +Neem + Karamcha +Mehogoni
T_6 = Mustard oil cake + Karamcha + Mehogoni (2)
T_7 = BAU- Bio-fungicide + Mustard oil cake +Neem +Mehogoni (2)
T_8 = Mustard oil cake + Sanitation +Neem (3)
T_9 = BAU- Bio-fungicide + Mustard oil cake +Karamcha +Mehogoni + Sanitation
T_{10} = Control

Table 2 Effect of treatments on the occurrence of early blight infection at different growing periods under field condition

Treatments	% Early blighted plants			
	Days after transplanting (DAT)			
	25	40	55	70
T_1	44.443 b (41.78)	59.260 b (50.30)	62.963 b (52.48)	66.670 b (54.70)
T_2	40.737 bc (39.64)	55.560 bc (48.16)	59.263 bc (50.30)	70.373 ab (56.98)
T_3	40.737 bc (39.64)	59.263 b (50.30)	62.967 b (52.48)	70.373 ab (56.98)
T_4	40.737 bc (39.64)	51.853 bc (46.03)	55.557 bc (48.16)	62.967 bc (52.48)
T_5	37.033 bcd (37.47)	48.147 bcd (43.91)	55.557 bc (48.16)	62.967 bc (52.48)
T_6	25.923 de (30.59)	40.740 cde (39.64)	44.443 cd (41.78)	55.557 bc (48.16)
T_7	18.517 e (25.48)	25.930 e (30.59)	29.627 d (32.96)	33.330 d (35.24)
T_8	29.627 cde (32.96)	40.737 cde (39.64)	44.443 cd (41.78)	48.147 cd (43.91)
T_9	25.923 de (30.59)	33.330 de (35.24)	37.033 d (37.47)	37.033 d (37.47)
T_{10}	59.263 a (50.30)	77.780 a (61.82)	81.483 a (64.45)	85.187 a (67.29)
Level of significance (p=0.05)	**	**	**	**

*Figures in parenthesis indicate the transformed value, ** =Significant at 1% level.

Table 3 Effect of treatments on the occurrence of late blight infection at different growing periods under field condition

Treatments	% late blighted plants			
	Days after transplanting (DAT)			
	25	40	55	70
T_1	33.330 b (35.24)	37.033 (37.47)	70.373 ab (56.98)	74.077 b (59.34)
T_2	29.627 bc (32.96)	33.330 (35.24)	66.670 ab (54.70)	74.077 b (59.34)
T_3	29.627 bc (32.96)	37.033 (37.47)	66.670 ab (54.70)	74.077 b (59.34)
T_4	29.627 bc (32.96)	33.330 (35.24)	66.670 ab (54.70)	66.670 bc (54.70)
T_5	25.923 bcd (30.59)	29.627 (32.96)	55.557 b (48.16)	59.263 bcd (50.30)
T_6	14.813 de (22.63)	25.923 (30.59)	55.557 b (48.16)	66.670 bc (54.70)
T_7	11.110 e (19.46)	18.517 (25.48)	48.150 b (43.91)	44.443 d (41.78)
T_8	18.517 cde (25.48)	25.923 (30.59)	62.967 ab (52.48)	62.967 bc (52.48)
T_9	14.813 de (22.63)	22.220 (28.11)	48.147 b (43.91)	55.557 cd (48.16)
T_{10}	40.737 a (39.64)	48.147 (43.91)	81.483 a (64.45)	92.593 a (74.11)
Level of significance (0.05)	**	NS	*	**

*Figures in parenthesis indicate the transformed value, ** =Significant at 1% level.
* = Significant at 5% level, NS = Non significant

Table 4 Effect of %leaf infection/plant due to late blight under different treatments as different days after transplanting in the field

Treatments	Disease severity			
	% Leaf spot/leaf blighted symptom bearing leaves			
	Infected plants Days After Transplanting (DAT)			
	25	40	55	70
T_1	22.220 (28.11)	33.330 (35.24)	59.263 (50.30)	92.593 (74.11)
T_2	33.330 (35.24)	48.147 (43.91)	48.147 (43.91)	81.483 (64.45)
T_3	22.220 (28.11)	37.033 (37.47)	51.853 (46.03)	85.187 (67.29)
T_4	22.220 (28.11)	37.037 (37.47)	44.447 (41.78)	77.777 (61.82)
T_5	22.220 (28.11)	37.037 (37.47)	37.037 (37.47)	70.370 (56.98)
T_6	18.517 (25.48)	33.330 (35.24)	62.967 (52.48)	96.297 (78.76)
T_7	11.110 (19.46)	25.923 (30.59)	40.740 (39.64)	74.077 (59.34)
T_8	18.517 (25.48)	29.627 (32.96)	44.447 (41.78)	77.777 (61.82)
T_9	14.813 (22.63)	25.923 (30.59)	40.740 (39.64)	74.077 (59.34)
T_{10}	25.923 (30.59)	55.557 (48.16)	74.077 (59.34)	97.407 (80.19)

*Figures in parenthesis indicate the transformed value

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