

MANAGEMENT OF FUSARIUM WILT OF BANANA

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ABSTRACT

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Fusarium wilt (Panama) disease caused by *Fusarium oxysporum* f. sp. *cubense* (FOC) is the most notorious disease which affecting global commercial and subsistence banana cultivation. Two field experiments were conducted at research field of BARI, Gazipur and RARS, Ishurdi, Pabna during 2017-2018 cropping season to find out an effective ecofriendly management approach against banana wilt caused by *Fusarium oxysporum* f. sp. *cubense* (Panama). Panama susceptible variety named Sabri kola was used for the experiments following Randomized Complete Block Design (RCBD). Each experiment consisted of seven treatments viz. T₁= application of poultry refuse @ 5 ton/ha, T₂= application of neem oil cake @ 300 kg/ha, T₃= application of mustard oil cake @ 600 kg/ha, T₄= application of sesame oil cake @ 600 kg/ha, T₅=application of Tricho-compost @ 3 tons/ha, T₆= use of treated sucker as well as soil drenching with

Autostin50 WDG@ 0.2%, and T₇= Control. Five replications in Gazipur and 3 replications in Ishurdi, Pabna were used respectively. All the treatments showed significant influence on disease incidence reduction and increased of yield and yield contributing characters of banana over control (unsprayed) in both locations. The incidence of wilt disease was ranged from 00 to at 80% Gazipur and from 12.50 to 60% Ishurdi. The lowest incidence was recorded from T₅ (Tricho-compost) and the highest incidence from T₇ (control) in both locations. The yield ranged from 18.0-40.5 t/ha in Gazipur and 19.1-42.8 t/ha in Ishurdi, Pabna, where highest yield parameters observed in T₅ (Tricho-compost) and the lowest yield parameters in T₇ (control) in both locations. Tricho-compost as well as neem oil cake showed more or less similar result in case of disease incidence and yield contributing characters at both locations.

Keyword: Panama, banana, management, disease incidence and yield

INTRODUCTION

Banana (*Musa* spp.) is a very popular year round fruit crop in the world including Bangladesh. It is ranked as the fourth most significant global food commodity after rice, wheat, and maize based on gross value production in the least developed countries. Banana including dessert banana, plantain, and cooking banana are the eighth most important food crop in the world (FAO 2013). It is grown in more than 130 countries and territories across the tropics and subtropics and it is the staple food for more than 400 million people (Molina and Valmayor 1999). In Bangladesh, it is cultivated 1, 20, 709 acres of land and production is 8, 33, 309 mt (BBS 2019). Diseases are

the major constraints for banana production globally including Bangladesh. The most common and widely damaging diseases of banana in Bangladesh are panama caused by *Fusarium oxysporum* f. sp. *cubense* (FOC), Sigatoka (*Mycosphaerella musicola*), burrowing nematode (*Rodopholus similis*) (Meah and Khan 1987), Mosaic and Streaks virus. Among the diseases panama (wilt) disease caused by *Fusarium oxysporum* f. sp. *cubense* (FOC) is the most notorious disease which affecting global commercial and subsistence banana production throughout the banana producing areas of the world (Ploetz 2005). The disease is ranked as one of the top 6 important plant diseases in the world (Ploetz and Pegg 1997). In terms of crop destruction, it ranks with the few most

devastating diseases such as wheat rust and potato blight (Carefoot and Sprott 1969). Currently, *Fusarium* wilt has been reported in all banana growing regions of the world (Asia, Africa, Australia and the tropical Americas) except some islands in the South Pacific, the Mediterranean, Melanesia and Somalia (Stover, 1962; Anonymous 1977; Ploetz and Pegg 2000). The characteristic symptoms include yellowing begins along the leaf margins and advances towards the midribs; finally, the whole dropping leaf turns dark brown. Yellowing and buckling progress from older to younger leaves and the entire plant dies (Su *et al.* 1986). The pathogen is extremely difficult to manage due to its long persistence in soil. Till to date no effective control measure has been found. Control strategies such as breeding for disease resistant varieties, use of soil fumigation (Herbert and Marx 1990), fungicides (Nel *et al.* 2007), molecular methods (Paul *et al.* 2011; Yip *et al.* 2011) and some biological approach have been tried with little success. Some varieties of banana cultivar seem to be resistant to panama wilt disease (Viljoen 2002; Hwang and Ko 2004; Smith *et al.* 2006), but they are not suitable for commercial planting because of the lack of consumer choice. Because of the challenges to manage this dangerous soil-borne fungus, farmers as well as scientists around the world are anxious to find out an effective eco-friendly management approach to control the disease.

MATERIALS AND METHODS

Two field experiments were conducted at the Plant Pathology research field of BARI, Gazipur and RARS, Ishurdi, Pabna during the cropping season 2017-2018 to find out an effective control measure against wilt disease of banana. Panama susceptible variety named Sabri kola was used for the management of panama disease of banana. Seven treatments have been used for both the location with 5 replications in Gazipur where each plant considered as one replication and 3 replications in Ishurdi, Pabna where each replication comprising four plants. The experimental land was well ploughed and properly leveled. Weeds and stubbles were removed from the field. The unit plot size was 4.0 m x 4.0 m and the sucker was planted in field at 2.0 m x 2.0 m spacing in both locations. The Randomized Complete Block Design (RCBD) design was followed. The treatments

were: T₁= Soil application with poultry refuse @ 5 ton/ha; T₂= Soil application with neem oil cake @ 300 kg/ha; T₃= Soil application with mustard oil cake @ 600 kg/ha; T₄= Soil application with sesame oil cake @ 600 kg/ha; T₅= Soil application with Tricho-compost @ 3 ton/ha; T₆= Use of treated sucker and soil drenching with Autostin 50 WDG @ 0.2%; and T₇= Control. Poultry refuse, neem oil cake, mustard oil cake and sesame oil cake were applied three weeks before the sucker planting in field to be incorporated with the soil properly for well decomposition. Tricho-compost was applied one week before sucker planting into the soil. Sucker treatments with Autostin 50 WDG had been done just before the one hour of planting and three times soil drenching were done at 20 days interval. Fertilization, irrigation and other cultural management have been done as per recommendation and when necessary. Data on disease incidence, yield contributing characters and yield were recorded three times after emerging the disease at both Gazipur and Ishurdi, Pabna. The data were analyzed by using MSTATC program following the standard statistical procedures. Treatment means computed using least significant difference (LSD) test.

RESULTS AND DISCUSSION

Wilt disease incidence was significantly influenced by the treatments. The effects of treatments on panama disease of banana are presented in Table 1 and Figure 1. The incidence of wilt disease ranged from 0.00 - 80% in Gazipur and 12.50-60% in Ishurdi, Pabna respectively. No disease incidence (00%) was found in Tricho-compost treated plots and the highest incidence (80%) was recorded in control plot in Gazipur while the lowest 12.50% disease incidence was found in Tricho-compost treated plots and the highest incidence (60%) was recorded in control treated plot in Ishurdi, Pabna. At both locations, application of neem oil cake in soil and sucker treatment as well as soil drenching with Autostin 50 WDG performed good and statistically identical with Tricho-compost for controlling wilt disease of banana (Table 1). The highest yield (40.5 t/ha) was obtained from Tricho-compost treated plots whereas the lowest (18.0 t/ha) from control plots at Gazipur (Table 2). In Ishurdi, Pabna, the highest yield (42.8t/ha) was obtained from Tricho-compost treated plots and the lowest (19.1 t/ha) from control plots (Table 3).

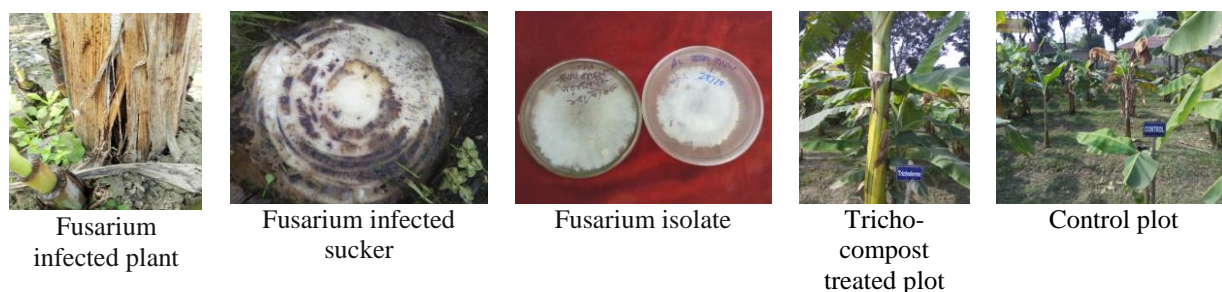


Figure 1. Effect of Tricho-compost in controlling panama disease of banana

Table 1: Effect of treatment on the incidence of panama disease of banana in Gazipur and Ishurdi, Pabna

Treatments	Wilt disease incidence (%)	
	Gazipur	Ishurdi, Pabna
T ₁ =Poultry refuse	40	41.66
T ₂ =Mustard oil cake	40	33.33
T ₃ =Seasum oil cake	60	50.00
T ₄ =Neem oil cake	20	16.67
T ₅ =Tricho-compost	00	12.50
T ₆ =Autostin 50 WDG	20	25.00
T ₇ =Control	80	60.00

Table 2: Effect of treatments on yield and yield contributing characters of banana against wilt disease in Gazipur

Treatments	Wt. of bunch (kg)	No. of hands/ bunch	No. of fingers/ bunch	Length of finger (cm)	Yield (t/ha)
T ₁ =Poultry refuse	7.3 bc	6.0 ab	51.4 b	13.3 abc	27.0 c
T ₂ =MOC	7.5 b	5.5 b	51.3 b	13.4 ab	31.6 b
T ₃ =SOC	6.0 cd	5.8 b	47.7 b	12.2 bc	24.4 c
T ₄ =NOC	7.3bc	6.1 ab	56.9 ab	13.8 ab	33.8 b
T ₅ =Tricho-compost	8.9 a	6.8 a	65.8 a	14.8 a	40.5 a
T ₆ =Autostin	7.6 b	6.3 ab	57.8 ab	14.4 a	34.2 b
T ₇ =Control	5.4 d	4.2 c	34.4 c	11.2 c	18.0 d
CV (%)	10.37	8.38	10.42	8.50	7.12

*Values within the same column having the common letter do not differ significantly (p=0.05)

Table 3: Effect of treatments on yield and yield contributing characters of banana against wilt disease in Ishurdi, Pabna

Treatments	Wt. of bunch (kg)	No. of hands/ bunch	No. of fingers/ bunch	Length of finger (cm)	Yield* (t/ha)
T ₁ =Poultry refuse	7.7 b	6.5 bc	54.1 c	13.5 ab	29.3 d
T ₂ =MOC	8 ab	6.0 bc	55.0 c	13.6 ab	30.7 cd
T ₃ =SOC	6.5 bc	7.0 ab	48.5 d	12.8 ab	27.2 d
T ₄ =NOC	8.1 ab	7.3 ab	59.5 b	13.9 ab	34.5 bc
T ₅ =Tricho-compost	9.9 a	8.5 a	70.5 a	15.0 a	42.8 a
T ₆ =Autostin	8.5 ab	7.5 ab	60.0 b	14.5 a	36.4 b
T ₇ =Control	5.1 c	5.0 c	36.0 e	11.0 b	19.1 e
CV (%)	14.41	12.33	4.12	11.27	7.43

*Values within the same column having the common letter do not differ significantly (p=0.05)

Incidence of banana wilt disease was found varied at two locations of BARI, Gazipur and RARS, Ishurdi, Pabna. The incidence of wilt disease ranged from 0.0 to 80.0 % in Gazipur and 12.00 to 60.0 % in Ishurdi, Pabna (Table 1). Earlier in Bangladesh, Hossain and Rashid (1999) reported that 24.0% disease incidence was recorded from Jessore in Sabrikola variety. Higher incidence of *Fusarium* wilt disease ranging from 7.51 to 43.11 % was reported by Alam (1995) in “Sabri” and “Sagar” (Gross Michel) who also observed that both the variety was susceptible to FOC which confirmed to the present findings. In India, the incidence of panama diseases ranged from 0.5 to 20 % in main crop and the maximum of 85.0 % in second crop (Thangavelu *et al.* 1999) where as 30% infection of panama disease was found in Batticaloa district of Sri Lanka (Shanika and Prasannath 2016).

The present investigation indicated that biopesticide such as Tricho-compost has potential effect in controlling panama disease of banana. From the experiments, it was found that application of Tricho-compost @ 3 ton/ha reduced wilt incidence around 80 % and enhanced the yield contributing characters that resulting into higher yield that was approximately 56 % in both locations over control.

Thangavelu (2002) reported that application of *T. harzianum* Th-10, as dried banana leaf formulation @ 10 g/plant containing 4X10³¹ cfu/g in basal + top dressing on 2, 4 and 6 months after planting in cv. Rasthali recorded the highest reduction of disease incidence (51.16 %) followed by *Bacillus subtilis* or *Pseudomonas fluorescens* (41.17 %) applications as talc based formulation under both glass house and field conditions. Pushpavathi *et al.* (2015) reported that, Sucker treatment before planting with biocontrol agents *Trichoderma viride* and *Pseudomonas fluorescens* and soil drenching with same biocontrol agents twice at 30 and 180 DAP as booster application, effectively reduced the *Fusarium* disease incidence and intensity thereby increasing the yield.

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