

Management of *Fusarium* wilt of banana using antagonistic microorganisms

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ABSTRACT: Among the eight antagonistic microorganisms tested for their efficacy in reducing *Fusarium oxysporum* f. sp. *cubense*, *Trichoderma viride* and *Pseudomonas fluorescens* were equally effective under laboratory conditions. The field trails conducted during *rabi* 1991 and *kharif* 1992 revealed that dipping of suckers in the suspension of *P. fluorescens* (10^6 CFU / ml) or *T. viride* (10^6 CFU / ml) along with the application of 500g wheat bran : saw dust inoculum (1:3) of the respective biocontrol agent three months after planting, effectively reduced the *Fusarium* wilt incidence and produced the highest yield.

KEY WORDS: Biocontrol, *Fusarium* wilt of banana, *Fusarium oxysporum* f. sp. *cubense*, *Pseudomonas fluorescens*, *Trichoderma viride*

Banana wilt disease, popularly known as Panama wilt is one of the catastrophic disease of the world. The causal agent, *Fusarium oxysporium* f. sp. *cubense* survives in soil and penetrates roots from where it spreads slowly to the corm. The occurrence of the disease has been reported in all banana growing areas (Sivamani and Gnanamanickam, 1988). Application of fungicides and sanitary measures to curtail this disease have failed. In view of the possible development of resistance by the

pathogen to chemicals and to reduce environmental pollution, it was considered essential to find out alternate methods for the management of this disease. *Pseudomonas fluorescens* Migula was reported to control wilt of banana under pot culture conditions (Sivamani and Gnanamanickam, 1988). This paper reports the selection of most effective antagonistic management of *Fusarium* wilt disease under field condition.

Different antagonistic organisms

available in the Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore were used for this study. Antagonistic organisms *viz.*, *Trichoderma viride* Pers. ex Fr., *T. harzianum* Rifai, *T. pseudokoningii* Rifai, *Gliocladium virens* Miller, Giddens and Foster, *Laetisaria arvalis*, *Pseudomonas fluorescens* and *Bacillus subtilis* cuhn, were selected to know their effectiveness against *F. oxysporium* f. sp. *cubense* by dual plate method (Table 1).

cultivar, Rasthali was used as test variety. The suspensions of all biocontrol agents were prepared to have a population of 10^6 colony forming units CFU/ml and used for dipping the suckers. Wheat bran : saw dust inoculum (1:3) of the respective antagonist was applied at the rate of 55g per plant three months after planting (Kousalya and Jeyarajan, 1990). Carbendazim was given as sucker treatment (0.05 per cent) and capsules, three and five months after planting (Prakasan and Jeyarajan, 1990).

Table 1. Effect of antagonistic organisms against *Fusarium* wilt pathogen

Antagonists	Per cent inhibition
<u>Fungal</u>	
<i>Trichoderma viride</i>	52.3 (46.3) ^c
<i>T. harzianum</i>	45.3 (42.3) ^b
<i>T. hamatum</i>	34.3 (35.8) ^a
<i>T. pseudokoningii</i>	36.7 (37.3) ^a
<u>Bacterial</u>	
<i>Bacillus subtilis</i>	45.3 (42.3) ^b
<i>Pseudomonas fluorescens</i>	49.3 (44.6) ^{bc}
<i>Gliocladium virens</i>	33.9 (35.6) ^a
<i>Laetisaria arvalis</i>	34.0 (35.7) ^a

Figures within the parentheses are arcsine transformed values Means followed by a common letter are not significantly different at P=0.05 level by DMRT

During *rabi* 1991 and *kharif* 1992, field trials were conducted in *Fusarium* wilt hot spot areas in farmers fields at Kattupalayam, Tiruppur division of Tamil Nadu. An area of 0.4 ha was selected with a plot of size, 16 x 10 m for each treatment. Six treatments, each replicated four times in a randomized block design were evaluated (Table 2). The highly susceptible

The observations on wilt incidence were recorded five, seven and nine months after planting.

The results from the field trials conducted during *rabi* 1991 and *kharif* 1992 revealed that sucker treatment with *P. fluorescens* was equally effective to sucker treatment with *T. viride* in reducing

Table 2. Effect of biocontrol agents and other treatments on the incidence of *Fusarium* wilt of banana under field conditions

Treatment	Per cent wilt incidence						Yield (t/ha)			Mean
	Rabi		Kharif			Menas of two seasons	Rabi	Kharif		
	5th month	7th month	9th month	5th month	7th month		9th month	Rabi		
1. Dipping suckers in a suspension of <i>T. viride</i> (10^6 CFU / ml) + 500g of wheat bran: saw dust inoculum / plant after 3 months	2.5 ^a	3.5 ^a	5.0 ^a	1.8 ^a	3.5 ^a	4.0 ^a	4.5	15.0 ^e	14.9 ^e	14.95
2. Dipping suckers in a <i>T. hazarianum</i> suspension (10^6 CFU / ml) + 500g of wheat bran: saw dust inoculum / plant after 3 months	6.3 ^{bc}	8.8 ^c	12.8 ^c	5.0 ^b	6.5 ^b	7.0 ^b	9.9	11.5 ^c	12.0 ^c	11.8
3. Dipping suckers in a <i>T. subtilis</i> suspension (10^6 CFU / ml) + 500g of wheat bran: saw dust inoculum / plant after 3 months	7.3 ^c	10.8 ^d	15.3 ^d	4.7 ^b	7.5 ^b	8.0 ^b	11.7	10.4 ^b	11.2 ^b	10.8
4. Dipping suckers in a <i>P. fluorescens</i> suspension (10^6 CFU / ml) + 500g of wheat bran: saw dust inoculum / plant after 3 months	2.5 ^a	3.5 ^a	4.5 ^a	1.3 ^a	3.3 ^a	3.8 ^a	4.1	15.4 ^e	15.8 ^f	15.6
5. Carbendazim @ 0.05% + Capsule application 3 and 5 months planting	5.0 ^a	7.3 ^b	8.8 ^b	1.8 ^a	6.0 ^b	8.0 ^b	8.4	13.5 ^d	13.6 ^d	13.6
6. Control	10.0 ^a	15.3 ^c	19.3 ^c	7.5 ^c	10.0 ^c	16.0 ^c	17.7	9.6 ^a	9.0 ^a	9.3

Means within column by a letter are not significantly different at P=0.5 level by DMRT

wilt incidence even from fifth month onwards. These two treatments were significantly different from other treatments and were on par with each other. At an early stage of planting, sucker treatment with carbendazim was equally effective in reducing the disease incidence but not in later stages. Least wilt incidence was noticed in the *P. fluorescens* treated suckers (4.1%) followed by *T. viride* treated suckers (4.5%) whereas control recorded 17.7 per cent wilt incidence.

The effect of *T. harzianum* in controlling *F. oxysporium* f. sp. *cubense* was studied by Narendrappa and Gowda (1995). The present study revealed that *P. fluorescens* and *T. viride* were equally effective not only in reducing the wilt incidence but also significantly increasing the yield in both kharif and rabi seasons. The yield data recorded during these two seasons showed that sucker treatment with *P. fluorescens* gave maximum yield (15.6 t/ha) followed by *T. viride* (14.95 t/ha) whereas control recorded only 9.3 t/ha.

Control of Fusarial wilt diseases in various crops by certain strains of fluorescent pseudomonads have been reported by several workers (Sneh *et al.*, 1984; Gamliel and Katan, 1993; Lemanceau *et al.*, 1993). Vidhyasekaran *et al.* (1997) reported the effect of present study demonstrated the effectiveness of *P. fluorescens* in the reduction of *Fusarium* wilt of banana under field conditions.

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