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In vitro evaluation of fungicides against growth of *Fusarium oxysporum* f. sp. *cubense* causing panama wilt disease of Banana

Ram Niwas, Gireesh Chand and Chandra Shekhar Azad

Abstract

The banana crop suffers from a number of devastating diseases caused by fungi, bacteria, viruses, nematodes, and a number of environmental factors. The major losses of banana at present by Panama wilt disease pathogen of banana and its management is very typical because it is caused by a soil-borne pathogen (*Fusarium oxysporum* f. sp. *cubense*). An experiment of fungicides was conducted in the laboratory of plant pathology BAU, Sabour for *In-vitro* evaluation of the fungicides viz. carbendazim, azoxystrobin and propiconazole against *Fusarium oxysporum* f. sp. *cubense* causing Panama wilt disease of banana. The results of the experiment revealed that among the fungicides used, carbendazim @ 500 and 750 ppm completely inhibited the mycelial growth of Foc followed by azoxystrobin (32.96, 11.30, 8.12 and 7.16 mm at 100, 250, 500 and 750 ppm respectively). The incorporation of carbendazim at higher concentrations viz., 500 and 750 ppm is very effective for the management of Panama wilt disease of banana.

Keywords: Banana, *Fusarium*, fungicides, panama wilt

Introduction

Banana is one of the most important food crops after wheat, rice, and maize in the world. To meet the growing food needs of the increasing population in the country and there is a need to raise Banana productivity. In order to the needs of the escalating population, banana production needs to be doubled and estimated production requirement by 2020 is around 25 million tons (Annon, 1996). Efforts for enhancing productivity are limited by a number of biotic and abiotic stresses. The crop suffers from a number of devastating diseases caused by fungi, bacteria, viruses, nematodes, and a number of environmental factors. Among all these diseases, Panama disease is also known as *Fusarium* wilt or vascular wilt incited by *Fusarium oxysporum* f.sp. *cubense* (E.F. Smith) Snyder and Hans. In this context, the present study has been undertaken with the aim of managing *Fusarium oxysporum* f. sp. *cubense* with fungicides.

Materials and Methods

Potato Dextrose Agar (PDA) medium was mixed with different micronutrients and fungicides viz., carbendazim, azoxystrobin and propiconazole at four different concentrations viz., 100, 250, 500 and 750 ppm (weight /volume) and they were tested on the mycelial growth of *Fusarium oxysporum* f. sp. *cubense* using by poisoned food technique following the procedure of Schmitz, (1930) the suitable control was also maintained without mixing any fungicides.

The PDA medium was mixed with carbendazim at four different concentrations viz., 100, 250, 500 and 750 ppm. The amended medium was poured into sterilized Petri plate @ 20 ml/plate. The fungicides are mixed in PDA media before pouring in the 90 mm Petri-plates. The 5 mm bits of pathogen are cut with a cork borer and put in the center of the plates after solidifying the medium. The percent inhibition growth was calculated using below-mentioned formula (Vincent, 1947) [6].

$$I = C - T / C \times 100$$

Where

I = Inhibition percentage;

C = Colony diameter in control (mm)

T = Colony diameter in treatment

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Results and Discussion

The experiment was conducted to find out the effect of different concentration of micronutrients on the mycelial growth of *Fusarium oxysporum* f. sp. *cubense* causing panama wilt of banana (Table 1). Among the three fungicides tested, (carbendazim, azoxystrobin and propiconazole), carbendazim @ 500 ppm and 750 ppm completely inhibited (Fig.-3, 4, 5) the growth of *Fusarium oxysporum* f. sp. *cubense* followed by azoxystrobin (32.96, 11.30, 8.12 and 7.16 mm in 100, 250, 500 and 750 ppm, respectively). (Fig-1, 2) The maximum mycelial growth was recorded in propiconazole. Ram and Pandey (2011) [5] reported that

systemic fungicide viz., carbendazim, difenconazole and its combination items captan + hexaconazole and carbendazim + mancozeb at concentration of 100 and 200 g ml⁻¹ and hexaconazole at 200 g ml⁻¹ totally suppressed the mycelial growth of *Fusarium oxysporum* f. sp. *udum* and found the carbendazim 100 ppm was very effective. The carbendazim are systemic fungicide and it suppresses the growth *Fusarium oxysporum* f. sp. *cubense* by interfering with spindle fiber formation and stop meiosis. But in case of azoxystrobin are acts on cell wall of fungi and propiconazole are also acts on Electron Transport System. The carbendazim are found very effective with increasing concentration.

Table 1: *In vitro* effect of fungicides on the mycelial growth of *Fusarium oxysporum* f. sp. *Cubense*

Treatments		Colony diameter (mm)*			Per cent inhibition of colony growth over control		
		3 rd day	5 th day	7 th day	3 rd day	5 th day	7 th day
T ₁	Carbendazim 100 ppm	12.00	21.80	31.20	59.60	62.54	64.98
T ₂	Carbendazim 250 ppm	10.00	17.10	21.80	66.33	70.62	75.53
T ₃	Carbendazim 500 ppm	5.00	5.00	5.00	83.16	91.41	94.39
T ₄	Carbendazim 750 ppm	5.00	5.00	5.00	83.16	91.41	94.39
T ₅	Azoxystrobin 100ppm	15.50	28.20	32.80	47.81	51.55	63.19
T ₆	Azoxystrobin 250ppm	14.10	25.30	11.30	52.53	56.53	87.32
T ₇	Azoxystrobin 500ppm	7.26	8.40	8.10	75.54	85.57	90.91
T ₈	Azoxystrobin 750ppm	6.80	7.40	7.10	77.10	87.29	92.03
T ₉	Propiconazole 100ppm	17.10	29.60	41.90	42.42	49.14	52.97
T ₁₀	Propiconazole 250ppm	15.50	26.00	39.30	47.81	55.33	55.89
T ₁₁	Propiconazole 500ppm	7.50	8.70	9.10	74.75	85.05	89.79
T ₁₂	Propiconazole 750ppm	7.00	7.60	7.80	76.43	86.94	91.25
T ₁₃	Control	29.70	58.20	89.10	-	-	-
	SE(m)±	0.12	0.13	0.12	-	-	-
	CD (p=0.01)	0.48	0.52	0.45	-	-	-

*Means of five replications

Fig 1: Mycelial growth (mm) of *Fusarium oxysporum* f. sp. *cubense* against different Fungicides

Fig 2: Percent inhibition of the *Fusarium oxysporum* f. sp. *cubense*

Fig 3: *In vitro* effect of carbendazim against Foc

Fig 4: *In vitro* effect of Azoxystrobin against Foc

Fig 5: *In vitro* effect of Propiconazole against FOC

The mycelial growth of *Fusarium oxysporum* f.sp. *cubense* was found against different micronutrients and finally, we concluded that borax has completely inhibited the growth of *Fusarium oxysporum* f.sp. *cubense* *in-vitro* that's why carbendazim will be used for the management of the Panama wilt disease of Banana (Fig-2).

Soma *et al.* (2008) [4] found that carbendazim and Vitavax were exceedingly fungitoxic and demonstrated 100 percent inhibition in the event of *Fusarium oxysporum* f. sp. *cubense* at 100ppm and 200ppm concentrations. The above findings lend support to the present investigation and the addition of fungicides particularly carbendazim suppresses the growth of Foc. Hence, this investigation suggests that carbendazim could be effectively used as a viable control strategy for agriculturally important soil-borne diseases.

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