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Effect of Bio-Control Agents on Muskmelon Wilt (*Fusarium oxysporum* f. sp. *melonis*)

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Abstract

Five bio-pesticides viz., *Trichoderma, Aspergillus, Penicillium*, VAM and biodynamic culture were tried to find out their lethal effects on muskmelon wilt caused by *Fusarium oxysporum* f.sp. *melonis* when applied through soil. Trichoderma and biodynamic culture at 3% concentration of soil (wt/wt) were effective as these significantly reduced the wilt incidence with improved clinical aspects. Least plumule decay was observed with *Trichoderma* treatment. Similarly, seedling and plant mortality, flower and fruit set and fruit yield parameters were significantly better with *Trichoderma* treatment. Other better results were observed in bio-dynamic culture, VAM, *Penicillium* and *Aspergillus* respectively. All the treatments were found to be significantly superior to control. Precisely, muskmelon wilt can be effectively controlled through soil application of *Trichoderma* fungus at 3% concentration.
Key words : Muskmelon, Wilt, Biopesticides, *Fusarium oxysporum* f. *sp. melonis, Trichoderma.*

Wilt of muskmelon (*Cucumis melo* L.) caused by *Fusarium oxysporum* f. sp. *melonis* is a destructive disease in most muskmelon growing areas. Muskmelon wilt is serious disease in the riverbed side. The leaves of infected plants loose tugidity, turn greenish yellow, become flaccid, droop and finely wilt and then die. The infected portions contain mycelia and spores of fungus specially in the xylem bundles or cortex area. The wilt syndrome includes several complicated symptoms such as vein-clearing, epinasty, chlorosis and vascular discoloration, stunting and temporary or permanent losses of turgidity. The fungus produce fusaric toxin which increased the permeability of parenchymatous cells in the leaf tissues leading to loss of osmotic effciency and wilting. It also plugged the water route through xylem and caused wilting. It is saprophytic, soil borne and survived on stubbles of diseased plants. This pathogen spread over to short distant through surface run-off, irrigation water and contaminated farm equipments. Mycelia enter host root directly or through wounds or at the point of formation of lateral roots. Mycelia advances through root cortex intercellularly and reaches xylem vessels. Due to saprophytically survival in the soil it is difficult to control. Cultural practices such as deep ploughing, crop rotation, fallowing and flooding may help in reducing pathogen population in soil but do not completely eliminate it. Fungus like *Trichoderma Asperigillus,* VAM and *Penicillium* were found to be effective to control fusarium wilts (1). Recently, biodynamic culture have been tried to reduce guava wilt. Therefore it was also taken to know the effect on muskmelon wilt. Pathogen Vesicular Arbucular Mycorrhiza (VAM) respresented by genus *Glomus,* is a endo-parasitic fungal bio-agent. Keeping these aspects in view the experiment was conducted to find out the influence of bio-pesticides on muskmelon wilt so that bio-agents may be applied in river-bed area to control wilt effectively in Allahabad region and like other places.

Methods

Pot experiment was conducted, at the Department of Horticulture K. A. P. G. College, Allahabad, affiliated to C.S. J. M. University Kanpur (UP) during 2004-2005. Sixty three pots 25 cm size were taken for experimental purpose. All pots were washed with formalin (4%) and filled with sterilized soil.

The sterilized soil was infested with the vigorously growing culture of *Fusarium oxysporum* f. sp. melonis on sand -maize meal medium in the ratio of 1

Table 1. Effect of bio-control agents on hypogeal, seedling and plant mortality in muskmelon (pooled data 2004-05). Figures in parentheses are transformed Arc sine values.

			Treatments			
Hypogeal mortality	*Trichoderma*	*Aspergillus*	*Penicillium*	VAM	Biodynamic culture	Control
Concentration (%)						
1.0	25.0 (29.94)	30.0 (34.55)	34.0 (38.22)	32.0 (36.65)	28.0 (32.55)	35.0 (36.24)
2.0	20.0 (26.47)	24.0 (28.48)	28.0 (32.26)	26.0 (30.55)	22.0 (28.56)	40.0 (39.21)
3.0	10.0 (18.39)	14.0 (22.65)	18.0 (26.35)	16.0 (24.44)	12.0 (20.60)	45.0 (42.12)
Mean	18.33 (24.93)	22.67 (28.56)	(26.67 (32.27)	24.67 (30.54)	20.67 (27.25)	40.00 (39.19)
Wilt Incidence up to a week			Treatments			
Concentration (%)	*Trichoderma*	*Aspergillus*	*Penicillium*	VAM	Biodynamic culture	Control
1.0	28.0 (31.94)	33.0 (37.55)	36.0 (41.22)	39.0 (39.65)	31.0 (35.55)	38.0 (39.24)
2.0	23.0 (29.47)	29.0 (31.48)	32.0 (35.26)	29.0 (33.55)	25.0 (31.56)	43.0 (41.21)
3.0	13.0 (21.39)	16.0 (25.65)	21.0 (29.35)	19.0 (27.44)	15.0 (23.65)	48.0 (45.12)
Mean	21.33 (27.60)	26.00 (31.56)	29.67 (35.27)	29.00 (33.54)	23.67(30.25)	43.00 (41.85)
Wilt incidence up to flowering stage						
Concentration (%)	*Trichoderma*	*Aspergillus*	*Penicillium*	VAM	Biodynamic culture	Control
1.0	29.0 (32.94)	34.0 (38.55)	37.0 (42.22)	41.0 (40.65)	32.0 (36.55)	39.0 (40.24)
2.0	24.0 (30.47)	30.0 (32.48)	33.0 (36.26)	30.0 (34.55)	26.0 (32.56)	44.0 (42.21)
3.0	14.0 (22.39)	17.0 (26.65)	22.0 (30.35)	20.0 (28.44)	16.0 (24.65)	49.0 (46.12)
Mean	22.33 (28.60)	27.00(32.56)	30.67 (36.27)	30.33 (34.54)	24.67 (31.25)	42.67 (42.85)
Wilt incidence up to flowering			Treatment			
Concentration (%)	*Trichoderma*	*Aspergillus*	*Penicillium*	VAM	Biodynamic culture	Control
1.0	32.00 (33.94)	38.00 (39.55)	41.00 (42.22)	44.00 (41.65)	35.00 (38.55)	48.00 (40.89)
2.0	26.00 (32.47)	32.00 (33.48)	35.00 (38.26)	38.00 (35.55)	30.00 (33.56)	50.00 (44.29)
3.0	16.00 (20.98)	20.00 (28.65)	28.00 (32.35)	22.00 (29.44)	18.00 (25.63)	53.00 (50.11)
Mean	24.66 (29.13)	30.00(33.89)	34.66 (37.61)	34.66 (35.54)	27.66 (32.58)	50.33 (45.09)

Source	SE	CD (*P* = 0.05)	SE	CD (*P*= 0.05)	SE	CD (*P* =0.05)	SE (d)	CD (*P*=0.05)
Bio-control Agents	(1.12)	(2.25)	(1.10)	(2.20)	(1.11)	(2.22)	(1.12)	(2.25)
Concentration	(0.86)	(1.75)	(0.84)	(1.70)	(0.84)	(1.72)	(0.86)	(1.75)
Bio-control Agents × conc	(1.94)	(3.90)	(1.90)	(3.85)	(1.91)	(3.88)	(1.94)	(3.90)

: 4 (inoculum : soil). The Bio-pesticides were incorporated into soil at of 1.0, 2.0 and 3.0% (wt/ wt)in the upper 15 cm of the infested and un-infested soil, and left for action for 45 days. Subsequently, ten muskmelon seeds of var Pusa Sharabati were sown in each pot and symptoms were observed during development of disease. The percent disease incidence (PDI) was calculated using the following formula :

$$\text{Percent disease incidence (PDI)} = 100 \times \frac{\text{Number of wilted plants/pot}}{\text{Total plant population/pot}}$$

Table 2. Effect of bio-control agents on flower set, fruit set, economic fruit per plant and yield per plant in infested muskmelon (pooled data 2004—05). Figures in parentheses are transformed Arc sine values.

Flower set no.			Treatments			
Concentration (%)	*Trichoderma*	*Aspergillus*	*Pencillium*	VAM	Biodynamic culture	Control
1.0	38.0 (39.24)	16.0 (25.65)	21.0 (29.35)	19.0 (27.44)	15.0 (23.65)	13.0 (31.94)
2.0	43.0 (41.21)	29.0 (31.48)	32.0 (35.26)	29.0 (33.55)	25.0 (31.56)	23.0 (29.47)
3.0	48.0 (45.12)	33.0 (37.55)	36.0 (41.22)	39.0 (39.65)	31.0 (35.55)	28.0 (31.39)
Mean	43.00 (41.85)	26.00(31.56)	29.67(35.27)	29.00 (33.54)	23.67 (30.25)	21.33 (30.93)

Fruit set (no.)			Treatments			
Concentration (%)	*Trichoderma*	*Aspergillus*	*Pencillium*	VAM	Biodynamic culture	Control
1.0	19.00 (29.24)	8.00 (30.65)	10.00 (27.35)	9.00 (17.44)	8.00 (13.65)	6.00 (11.94)
2.0	21.00 (30.50)	14.00 (38.48)	16.00 (29.26)	14.00 (23.55)	12.00 (21.56)	11.00 (23.47)
3.0	24.00 (30.50)	16.00 (41.55)	18.00 (32.22)	19.00 (29.65)	15.00 (35.55)	14.00 (29.39)
Mean	21.33 (30.08)	12.67 (36.89)	14.67 (29.61)	14.00 (23.54)	11.67 (23.58)	10.33 (21.60)

Economic fruit per plant (no.)			Treatments			
Concentratin (%)	*Trichoderma*	*Aspergillus*	*Pencillium*	VAM	Biodynamic culture	Control
1.0	17.00 (20.24)	7.00 (10.65)	9.00 (11.35)	8.00 (10.44)	7.00 (10.65)	5.00 (8.94)
2.0	18.00 (21.21)	12.00 (11.48)	14.00 (14.26)	12.00 (14.55)	10.00 (11.56)	9.00 (11.47)
3.0	21.00 (31.12)	24.00 (17.55)	16.00 (20.22)	17.00 (27.65)	13.00 (15.55)	12.00 (14.39)
Mean	18.67 (24.19)	11.00 (13.22)	13.00 (16.94)	12.33 (17.54)	10.00 (12.58)	8.67 (11.60)

Field per plant (kg)			Treatment			
Concentration (%)	*Trichoderma*	*Aspergillus*	*Penicillium*	VAM	Biodynamic culture	Control
1.0	8.5 (9.24)	3.5 (5.65)	4.5 (9.35)	4.0 (7.44)	3.5 (6.65)	2.5 (4.94)
2.0	9.00 (21.21)	6.00 (11.48)	7.00 (25.26)	6.00 (11.55)	5.00 (21.56)	4.50 (9.47)
3.0	10.00 (2512)	7.00 (23.55)	8.00 22.22)	8.50 (19.65)	6.50 (15.55)	6.00 (11.39)
Mean	9.16 (21.85)	5.50 (13.56)	6.50 (18.94)	6.16 (12.88)	5.00 (14.58)	4.33 (8.60)

Source	SE	CD (P + 0.05)	SE	CD (P = 0.05)	SE	CD (P =005)	SE (d)	CD (P=0.05)
Bio-control Agents	(1.11)	(2.22)	(0.99)	(1.98)	(0.98)	(1.96)	(0.89)	(1.78)
Concentration	(0.85)	(1.71)	(0.73)	(1.56)	(0.72)	(1.45)	(0.48)	(0.98)
Bio-Control Agents × conc	(1.91)	(3.89)	(1.71)	(3.54)	(1.75)	(3.58)	(1.53)	(3.06)

Results and Discussion

Data indicated that bio-pesticides considerably reduced the disease incidence of muskmelon wilt. Soil applied with *Trichoderma* was most effective in reducing the incidence of muskmelon wilt. Minimum hypogeal mortality (18.33%) was observed in *Trichoderma* treatment followed by biodynamic culture, *Aspergillus*, VAM and *Penicillium* respectively. Maximum hypogeal mortality (40.00%) was recorded in control. Seedling mortality, mortality of plant up to flowering stage and finally up to harvesting stage was minimum with *Trichoderma* treatment while maximum was observed in control. Only (24.66%) plant wilting was observed up to harvesting while in control the value was (50.33%). It indicates that *Trichoderma* works effectively in wilt pathogen control. Other bio-agents as VAM, *Penicillium, Aspergillius* and biodynamic culture were also produced encouraging results in plant mortality.

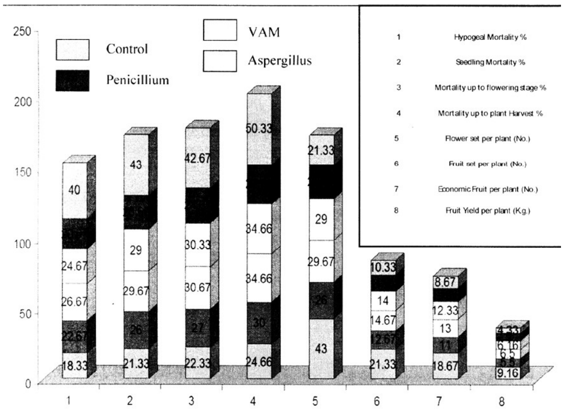

Figure 1. Effect of bio-pesticides on muskmeloon wilt (*Fusarium oxysporum* f. sp. *melonis*).

Data regarding flower set, fruit set, number of economic fruit per plant and yield per plant were recorded. Flower set was maximum (43.00) in *Trichoderma* treatment followed by *Penicillium*, VAM, *Aspergillus* and biodynamic culture respectively. The lowest number of flower set per plant (21.33) was recorded in control. All the treatments yielded significant superior results over control. Number of fruit set per plant was also observed maximum (21.33) with *Trichoderma* treatment. The lowest fruit set was recorded (10.33) in control, number of economic fruit per plant were highest (18.67) with *Trichoderma* treatment followed by *Penicillium*, VAM, *Aspergillus* and biodynamic culture. The lowest number of economic fruit per plant (8.67) was observed in control. Fruit yield per plant also showed same pattern and maximum (9.16 kg) was recorded with *Trichoderma* treatment. Other better treatments were *Penicillium,* VAM, *Aspergillus* and biodynamic culture. The lowest yield per plant (4.33 kg) was recorded in control.

Trichoderma was found to proliferate better in fusarium inoculated environment. Awakned embryo get decayed readily with fusarium infested medium and more than (40%) seeds were damaged while only 10% mortality was observed up to harvesting. Other fungi as *Aspergillus*, *Penicillium* and VAM also compete with wilt causal organism and reduced their population considerably. The effect might be antagonistic or competitive. Findings are in conformity with the earlier findings (2—10).

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