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STUDIES ON THE EFFECT OF BIO-PESTICIDES 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 5% concentration (w/w) 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 Biodynamic culture, VAM, *Penicillium* and *Aspergillus,* respectively. All the treatments were found significantly superior over control. Precisely, muskmelon wilt can be effectively controlled through soil application of *Trichoderma* fungus @ 5% concentration.

Keywords : *Muskmelon, wilt, biopesticides, Trichoderma, Aspergillus .*

Muskmelon is a vine crop generally grown on land without any support. Therefore, there are more possibilities to infect with soil borne pathogens. Little congenial conditions for wilt pathogen may damage entire crop. Eco-friendly management of this pathogen is essential as its fruits are consumed raw. If chemicals are used may enter in food chain and become hazardous to health. 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 very serious disease in the riverbed side. The leaves of infected plants loose turgidity, turn greenish yellow, become flaccid, droop and finely wilt and then die. The infected portions contain mycelia and spores of fungus especially in the Xylem bundles or cortex area (Singh, 9). The wilt syndrome includes several complicated symptoms such as vein-clearing, epinasty, chlorosis, vascular discolouration, 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 efficiency and wilting (Agrawal, 1). 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 very 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 effective to control fusarium wilts (Singh, 10, Singh and Sachan, 11). Recently, Biodynamic culture have been tried to reduce guava wilt. Therefore it was also taken to know the effect on muskmelon wilt. Vesicular Arbuscular Mycorrrhiza (VAM) represented by genus *Glomus*, is a endo-parasitic fungal bio-agent.

Keeping above aspects view the experiment was conducted to find out the influence of bio-pesticides on muskmelon wilt, so that bio-agents may be applied in wilt prone areas to control wilt effectively in Allahabad region and like other places.

MATERIALS AND METHODS

Pot experiment was conducted at the Department of Horticulture, Kulbhaskar Ashram Post Graduate College, Allahabad (U.P.) during 2010-2011. Sixty three pots of 30 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*

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on sand-maize-meal medium in the ratio of 1 : 5 (inoculum: soil). The Bio pesticides were incorporated in to soil @ 3.0, 4.0 and 5.0% (w/w) in the upper 10 cm of the infested and un-infested soil, and left for action for 35 days. Subsequently, ten muskmelon seeds of var. Allahabadi Kajala were sown in each pot and symptoms were observed during development of disease. The per cent disease incidence (PDI) was calculated using the following formula:

Per cent disease incidence (PDI)

$$= \frac{\text{No. of wilted plants/pot}}{\text{Total plants population/pot}} \times 100$$

RESULTS AND DISCUSSION

Data indicated that bio-pesticides considerably reduced the disease incidence of muskmelon wilt. Soil applied *Trichoderma* was most effective in reducing the incidence of muskmelon wilt. Minimum hypogeal mortality (17.33%) was observed in *Trichoderma* treatment followed by Biodynamic culture, Aspergillus, VAM and *Penicillium* respectively. Maximum hypogeal mortality (39.00%) 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 23.66% plant wilting was observed up to harvesting while in case of control the value was 49.33%. It clearly 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 (Table 1, 2 3 and 4).

Data regarding flower set, fruit set, number of economic fruits per plant and yield per plant were recorded (Table 5, 6, 7 and 8). Flower set was maximum (42.00) in *Trichoderma* treatment followed by *Penicillium*, VAM, *Aspergillus* and Biodynamic culture, respectively. The lowest number of flowers set per plant (20.33) was recorded in control. All the treatments yielded significant superior results over control. Number of fruits set per plant was also observed maximum (20.33) with *Trichoderma* treatment. The lowest fruits set (9.33) was recorded in control. Number of economic fruits per plant were highest (17.67) with *Trichoderma* treatment, followed by *Penicillium*, VAM, *Aspergillus* and Biodynamic culture. The lowest number of economic fruits per plant (7.67) was observed in control. Fruit yield per plant was also showed same pattern and maximum (8.16 kg) was recorded with *Trichoderma* treatment. Other better treatments were *Penicillium,* VAM, *Aspergillus* and Biodynamic culture. The lowest yield per plant (3.33 kg) was recorded in control.

Trichoderma was found to proliferate better in fusarium inoculated environment. Awakened embryo gets 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 findings of Bhagawati et al. (2), Devi *et al.* (3), Goswami *et al.* (4), Jalali *et al.* (5), Mishra (6), Nagarajan (7), Pandey (8), Singh (10), Singh *et al.* (12) and Thangavelu (13).

Table 1: Effect of bio-pesticides on hypogeal mortality (before emergence) in muskmelon (Pooled Data 2010-11).

Treatment	% Hypogeal Mortality			Mean
	Biopesticides Concentration (%)			
	3.0	4.0	5.0	
Trichoderma	25.0 (29.94)	20.0 (26.47)	10.0 (18.39)	18.33 (24.93)
Aspergillus	30.0 (34.55)	24.0 (28.48)	14.0 (22.65)	22.67 (28.56)
Penicillium	34.0 (38.22)	28.0 (32.26)	18.0 (26.35)	26.67 (32.27)
VAM	32.0 (36.65)	26.0 (30.55)	16.0 (24.44)	24.67 (30.54)
Biodynamic culture	28.0 (32.55)	22.0 (28.56)	12.0 (20.65)	20.67 (27.25)
Control	35.0 (36.24)	40.0 (39.21)	45.0 (42.12)	40.00 (39.19)

CD (P = 0.05) : Bio-pesticides (2.25); Concentration (1.75); Bio-pesticides × Conc. (3.90)

*Figures in parentheses are transformed *'Arc sine'* value, (Avg. of 4 replicates)

Table 2: Effect of bio-pesticides seedling morality (up to 15days after emergence) in muskmelon (Pooled Data 2010-11).

Treatment	% Wilt incidence up to a week			Mean
	Concentration (%)			
	3.0	4.0	5.0	
Trichoderma	7.0 (30.94)	22.0 (28.47)	12.0 (20.39)	20.33 (26.60)
Aspergillus	32.0 (36.55)	28.0 (30.48)	15.0 (24.65)	25.00 (30.56)
Penicillium	35.0 (40.22)	31.0 (34.26)	20.0 (28.35)	28.67 (34.27)
Biodynamic culture	38.0 (38.65)	28.0 (32.55)	18.0 (26.44)	28.00 (32.54)
VAM	30.0 (34.55)	24.0 (30.56)	14.0 (22.65)	22.67 (29.25)
Control	37.0 (38.24)	42.0 (40.21)	47.0 (44.12)	42.00 (40.85)

CD (P = 0.05) : Bio-pesticides (2.10); Concentration (1.60); Bio-pesticides × Conc. (3.75)
Figures in parentheses are transformed 'Arc sine' values. (Avg. of 4 replicates)

Table 3 : Effect of bio-pesticides on plant wilting (up to flowering stage) in muskmelon (Pooled Data 2010-11).

Treatment	% Wilt incidence up to flowering stage			Mean
	Concentration (%)			
	3.0	4.0	5.0	
Trichoderma	28.0 (31.94)	23.0 (29.47)	13.0 (21.39)	21.33 (27.60)
Aspergillus	33.0 (37.55)	29.0 (31.48)	16.0 (25.65)	26.00 (31.56)
Penicillium	36.0 (41.22)	32.0 (35.26)	21.0 (29.35)	29.67 (35.27)
VAM	40.0 (39.65)	29.0 (33.55)	19.0 (27.44)	29.33 (33.54)
Biodynamic culture	31.0 (35.55)	25.0 (31.56)	15.0 (24.65)	24.67 (30.25)
Control	38.0 (39.24)	43.0 (41.21)	48.0 (45.12)	41.67 (41.85)

CD (P = 0.05) : Bio-pesticides (2.20); Concentration (1.71); Bio-pesticides × Conc. (3.87)
Figures in parentheses are transformed 'Arc sine' values. (Avg. of 4 replicates)

Table 4: Effect of bio-pesticides on wilt incidence (up to harvesting) in muskmelon (Pooled Data 2010-11).

Treatment	% Wilt incidence up to harvesting			Mean
	Concentration (%)			
	3.0	4.0	5.0	
Trichoderma	31.00 (32.94)	25.00 (31.47)	15.00 (19.98)	23.66 (28.13)
Aspergillus	37.00 (38.55)	31.00 (32.48)	19.00 (27.65)	29.00 (32.89)
Penicillium	40.00 (41.22)	34.00 (37.26)	27.00 (31.35)	33.66 (36.61)
VAM	43.00 (40.65)	37.00 (34.55)	21.00 (28.44)	33.66 (34.54)
Biodynamic culture	34.00 (37.55)	29.00 (32.56)	17.00 (24.63)	26.66 (31.58)
Control	47.00 (40.89)	49.00 (43.29)	52.00 (49.11)	49.33 (44.

CD (P = 0.05) : Bio-pesticides (2.24); Concentration (1.74); Bio-pesticides × Conc. (3.89)
Figures in parentheses are transformed 'Arc sine' (Avg. of 4 replicates)

Conclusion

All the microbial inoculants were significantly superior over control. Wilt pathogen was suppressed much effectively with *Trichoderma* followed by *Penicillium,* VAM, BD Pesticide and *Aspergillus* respectively. Interactions may be tried for further improvement in wilt disease management. Farmers may apply Trichoderma powder for soil, seed and seedling treatment. Pit application during seed sowing will prove more effective. Farmers may prepare this inoculums in large quantity by inoculating moist, well

Table 5: Effect of bio-pesticides on flower set in infested muskmelon (Pooled Data 2010-11).

Treatment	Flower Set in infested Plant (No.)			Mean
	Concentration (%)			
	3.0	4.0	5.0	
Trichoderma	37.0 (38.24)	42.0 (40.21)	47.0 (44.12)	42.00 (40.85)
Aspergillus	15.0 (24.65)	29.0 (30.48)	32.0 (36.55)	25.00 (30.56)
Penicillium	20.0 (29.35)	31.0 (34.26)	35.0 (40.22)	28.67 (34.27)
VAM	18.0 (26.44)	28.0 (32.55)	38.0 (38.65)	28.00 (32.54)
Biodynamic culture	14.0 (22.65)	24.0 (30.56)	30.0 (34.55)	22.67 (29.25)
Control	12.0 (30.94)	22.0 (28.47)	27.0 (31.39)	20.33 (29.93)

CD (P = 0.05) : Bio-pesticides (2.21); Concentration (1.71); Bio-pesticides × Conc. (3.88)
Figures in parentheses are transformed 'Arc sine' values. (Avg. of4 replicates)

Table 6 : Effect of bio-pesticides on fruit set in infested muskmelon (Pooled Data 2010-11).

Treatment	Fruit Set per Infested Plant (No.)			Mean
	Concentration (%)			
	3.0	4.0	5.0	
Trichoderma	18.00 (28.24)	20.00 (29.50)	23.00 (29.50)	20.33 (29.08)
Aspergillus	7.00 (29.65)	13.00 (37.48)	15.00 (40.55)	11.67 (35.89)
Penicillium	9.00 (28.35)	15.00 (28.26)	17.00 (31.22)	13.67 (28.61)
VAM	8.00 (15.44)	13.00 (23.55)	18.00 (28.65)	13.00 (22.54)
Biodynamic culture	7.00 (12.65)	11.00 (20.56)	14.00 (33.55)	10.67 (22.58)
Control	5.00 (10.94)	10.00 (22.47)	13.00 (28.39)	9.33 (20.60)

CD (P = 0.05) : Bio-pesticides (1.97); Concentration (1.55); Bio-pesticides × Conc. (3.53)
Figures in parentheses are transformed 'Arc sine' values.(Avg. of 4 replicates)

Table 7: Effect of bio-pesticides on number of economic fruit per plant in infested muskmelon (Pooled Data 2010-11).

Treatment	Number of Economic Fruits per plant			Mean
	Concentration (%)			
	3.0	4.0	5.0	
Trichoderma	16.00 (19.24)	17.00 (20.21)	20.00 (30.12)	17.67 (23.19)
Aspergillus	6.00 (9.65)	11.00 (10.48)	23.00 (16.55)	10.00 (12.22)
Penicillium	8.00 (10.35)	13.00 (13.26)	15.00 (19.22)	12.00 (15.94)
VAM	7.00 (9.44)	11.00 (13.55)	16.00 (26.65)	11.33 (16.54)
Biodynamic culture	6.00 (9.65)	9.00 (10.56)	12.00 (14.55)	9.00 (11.58)
Control	4.00 (8.94)	8.00 (10.47)	11.00 (13.39)	7.67 (10.60)

CD (P = 0.05) : Bio-pesticides (1.95); Concentration (1.44); Bio-pesticides × Conc. (3.57)
*Figures in parentheses are transformed 'Arc sine' values. (Avg. of 4 replicates)

Table 8 : Effect of bio-pesticides on yield per plant in infested muskmelon (Pooled Data 2010-11)

Treatment	Yield per plant (Kg.)			Mean
	Concentration (%)			
	3.0	4.0	5.0	
Trichoderma	7.5 (8.24)	8.00 (20.21)	9.00 (24.12)	8.16 (20.85)
Aspergillus	2.5 (4.65)	5.00 (10.48)	6.00 (22.55)	4.50 (12.56)
Penicillium	3.5 (8.35)	6.00 (24.26)	7.00 (22.22)	5.50 (17.94)
VAM	3.0 (6.44)	5.00 (10.55)	7.50 (18.65)	5.16 (11.88)
BD Pesticide	2.5 (5.65)	4.00 (20.56)	5.50 (14.55)	4.00 (13.58)
Control	1.5 (3.94)	3.50 (8.47)	5.00 (10.39)	3.33 (7.60)

CD (P = 0.05) : Bio-pesticides (1.77); Concentration (0.97); Bio-pesticides × Conc. (3.05)
*Figures in parentheses are transformed 'Arc sine' values.' (Avg. of 4 replicates)

decayed FYM with *Trichoderma* culture. It is clear that experiment was conducted in pot which was moist properly and sufficient organic matter was added as these two things are essential for proper multiplication of bio-inoculants. Water stagnation may reduce the potential of pathogen killing.

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