INT. J. BIOL. BIOTECH., 12 (4): 629-632, 2015.

INTEGRATED MANAGEMENT OF VINE DECLINE, WILT AND ROOT ROT DISEASES OF MELON (*CUCUMIS MELO* L.)

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ABSTRACT

Field experiment was conducted during summer season (February –August) and winter season (December-January) to control vine decline, wilt and root rot diseases of melon. The treatments comprising seed application with Carbendazim (2g/kg seeds) before sowing, soil amendment with mustard oil cake (2 tons/ ha.) 15 day prior of seed sowing and soil drenching with either Carbendazim (2%) or mustard cake extract twice after fruit setting to maturity significantly decreased vine decline, wilt and root rot and increased yield as well as vine and root length.

Key Words: Melon, vine decline, wilt, root rot, Carbendazim, mustard oil cake.

INTRODUCTION

Melon (*Cucumis melo* L.) the most important cucurbitaceous fruit crops grown in winter and summer in Pakistan. Winter crop is cultivated on 70 % of the melon growing land which is planted during December-January and gives produce for more than three months. Summer crop mature in 60 days and planted in July-August and (Lashari and Khushk, 2007). The crop is seriously affected in lower Sindh and damage noted under field conditions was 40-50% where plant showed symptoms of wilting and death in patches. *Rhizoctonia solani* Kuhn and *Macrophomina phaseolina* (Tassi) Goid. and two species of *Fusarium* viz., *F. solani* (Mart.) Appel and Wollenw. Emend. Synd. & Hans., *F. oxysporum* Schlecht.emend. Snyd. and Hans, are responsible for this economically important disease of melon in Sindh. *Fusarium* wilt of muskmelon has been rated as one the destructive diseases capable of killing 90% or more of the crop (Leach and Currence, 1938). *Fusarium oxysporum* f.sp .*melonis* (Bhaskaran *et al.,* 1971; Waraitch *et al.,* 1976) and *F. solani* (Sen and Palodhi, 1979) caused serious wilt of muskmelon in India. *Fusarium solani* and *Rhizoctonia solani* caused root-rot and considered as the most deleterious diseases associated with great losses in Egypt (Madkour *et al*., 1983; Abdel-el-Rehim *et al.,* 1987), in Italy (Fantino *et al.,* 1989) and in Slovenia (Celar, 2000). Wilt and root infection is continuously a serious problem of melon crop especially at maturity stage in all melon growing areas of Sindh, Pakistan. Amendments in the form of plant debris, green manures, farmyard manures, compost, oil cakes and fertilizers are known to improve crop productivity by improving nutrient status of soil and might have increase microbial activities in soil to suppress diseases (Sivaprakasam, 1991). Biocontrol are alternative to the chemical pesticides for the control of plant diseases especially the soil-borne diseases (Roberts *et al*., 2005). Seed treatment and soil drenching using Bavistin (carbedazim 50 WP) provided the highest disease control compared with individual methods (Kumar *et al*., 2011). According to Ghada *et al*. (2014) microbial antagonist *Trichoderma* spp., and fungicides viz., Capritop and Topsin-M were most effective in controlling the sudden wilt of cantaloupe caused by *Rhizoctonia solani, Pythium aphanidermatum, Macrophomina phaseolina* and *Fusarium solani*. An integrated management system constitutes best management strategies and tactics for the disease complex (Brodie, 1970 and Khan and Parvatha, 1993). It is considered that integration between bio-agents and essential oil or salt is safe, applicable and cost-effective method for controlling root rot fungi viz., *Alternaria solani, Fusarium solani, F. oxysporum, Rhizoctonia solani, Sclerotium rolfsii, Macrophomina phaseolina* and *Pythium* sp., causing soil-borne diseases in different vegetables (El-*Mougy et al*., 2012). Instead of employing a single control strategy combined control treatments have greater success in combating plant diseases. Asad-uz-Zaman *et al*. (2015) emphasis on the superiority of integrated approach to control *R. solani*, the sclerotia forming pathogen as compared to the individual treatment either by an antagonist or fungicide or oil cake. Because of very high economic importance owing to its demand in fruit market, an integrated management practice was carried out with a view to control the disease and enhance yield, of melon in this paper.

MATERIALS AND METHODS

Field experiments were conducted in summer season (July –October) and winter season (December-April) in naturally infested experimental field which showed a range of mean population of *F. oxysporum, F. solani* (2800-5,700 cfu/ g) by soil dilution technique (Nash and Synder, 1962), *Macrophomina phaseolina* (3-5 sclerotia/g) by wet

sieving technique (Sheikh and Ghaffar, 1975) and *Rhizoctonia solani* (5-20%) on sorghum seeds used as baits (Wilhelm, 1955). Seeds of melon local variety Golden were sown in mid December (Winter season) and Ist week of July (Summer season) in seedbed in 4m x 4.5m plot size in Randomized Complete Block Design (RCBD) having three replications. No chemical fertilizer was used whereas cow dung was applied @5 tons per ha.. There were 8 treatments as follows:

T_1 = A+B
T_2 = A+ C
T_3 = B+ C
T_4 = A+B+C
T_5 = A+ D
T_6 = B+D
T_7 = A+B+D
T_8 = Control (Untreated)
A = Seed dressing with Carbendazim (2g/kg seeds) before sowing.
B =Soil amendment with mustard oil cake (2 tons/ hec.) 15 days prior of seed sowing.
C = Soil drenching with Carbendazim (2%) twice after fruit setting to maturity.
D = Soil drenching with mustard cake extract twice after fruit setting to maturity.

Seed germination, growth parameter (root and vine length), disease incidence (vine decline, root rot and wilt) and fruit yield were recorded after fruit setting to maturity of the crop. Samples of vine and root were collected periodically to confirm root infection by pathogens calculated as follows:

$$\text{Infection \%} = \frac{\text{Number of plants (vine or root) infected by pathogens}}{\text{Total number of plants}} \times 100$$

Statistical analysis was done to compare different treatments combinations using Duncan multiple range test and compared means by SPSS version 17.

RESULTS AND DISCUSSION

In a field study during summer and winter seasons, the effect of different combinations of treatments for controlling vine decline, wilt and root rot diseases of melon as well as populations of *Fusarium oxysporum, F. solani, Macrophomina phaseolina*, and *Rhizoctinia solani* was determined. The treatment T_7 comprising of seed dressing with Carbendazim (2g/kg seeds) before sowing and soil amendment with mustard oil cake (2 tons/ hec.) 15 days prior of seed sowing and soil drenching with mustard cake extract twice after fruit setting to maturity was found most effective in reducing the disease and in increasing fruit yield during summer (8111.5kg/ha) (Table 1) and winter (22111.9 kg/ha) (Table 2). This is followed by treatment T_4 comprising of seed dressing with Carbendazim (2g /kg seeds) before sowing and soil amendment with mustard oil cake (2 tons/ ha.) 15 days prior of seed sowing and soil drenching with Carbendazim (2%) twice after fruit setting to maturity was found most effective in reducing the disease and in increasing fruit yield during summer (8093.4kg/ha) and winter (21879.5kg /ha). Plant-growth parameters such as root and vine length were increased. Amendment improved the moisture retention capacity of soil (Lodha, 1995) and thereby increased activities of antagonist microorganisms resulting in reduction in *M. phaseolina* population (Dhingra and Sincliar, 1975). Some of the volatiles released during decomposition also increased germination of fungi and bacteria and increased the microbial activity in soil (Mitchell and Alexander, 1963). Field evaluations of fungicides by several workers have shown that carbendazim as soil drench was effective against *Fusarium* spp., and significantly managed wilt disease complex on many crops (Mishra and Ghosh, 1978; Tarabeih and Attarackehi, 1979; Pal and Chowdhary, 1983).

The population of pathogenic fungi viz., *Macrophomina phaseolina, Fusarium oxysporum, F.solani, Macrophomina phaseolina* and *Rhizoctonia solani* were significantly reduced by the amendment of mustard oil cakes whereas significant increase in population of saprophytic fungi viz., *Aspergillus niger, A. terreus, Trichoderma* spp., *Penicillium atramentosum*. Sharma *et al.* (1955) reported 100% reduction in populations of *Fusarium oxysporum* f. sp. *cumini* and *Macrophomina phaseolina* in the mustard-cake-amended soil within a period of 30 days This is because of substantial increase in the population of antagonistic actinomycetes A several-fold improvement has been reported in plant-growth parameters viz. plant weight, percent pollen fertility, pod numbers of lentil and mungbean (Tiyagi *et al.,* 2001). The management of root rot wilt and vine decline diseases of melon

could be based on integration of seed treatment with Carbendazim before sowing and amendment of soil with mustard oil cake 15 days prior of seed sowing together with soil drenching with either mustard cake extract or Carbendazim twice after fruit setting to maturity.

Table 1. Effect of different treatments on incidence, growth and yield of melon Cultivar Golden during summer.

Treatments	Emergence %	Incidence		Growth		Yield (Kg/ ha)
		Root infected %	Vine decline %	Vine length (cm)	Root length (cm)	
T_1	94_a	22.5_b	27.1_c	120.2_b	20.4_b	5858.4_e
T_2	90_b	26.7_c	15.1_b	114.1_c	23.6_a	6888.2_c
T_3	87_c	19.6_b	12.7_b	118.6_b	24.0_a	7243.6_b
T_4	96_a	14.1_a	5.1_a	123.7_a	22.9_a	8093.4_a
T_5	91_b	20.2_b	14.4_b	111.1_c	22.4_a	6555.6_d
T_6	89_c	18.8_b	13.2_b	119.8_b	22.8_a	6828.9_c
T_7	95_a	13.4_a	4.8_a	126.6_a	23.9_a	8111.5_a
T_8	81_d	68.4_d	38.4_d	83.30_d	17.2_c	4815.6_f

Mean followed by the same letter within a column are not significantly different at (P=0.05) according to Duncan's multiple range test.

Table 2. Effect of different treatments on incidence, growth and yield of melon cultivar Golden during winter.

Treatments	Emergence %	Incidence		Growth		Yield (Kg/ ha)
		Root infected %	Vine decline %	Vine length (cm)	Root length (cm)	
T_1	95_a	19.3_c	7.4_c	122.9_c	27.4_d	16553.8_d
T_2	92_b	17.8_c	5.9_c	119.1_c	33.9_b	18782.2_c
T_3	90_c	13.1_b	7.6_c	129.9_b	34.1_b	19243.5_b
T_4	95_a	8.7_a	2.1_a	143.7_a	41.2_a	21879.5_a
T_5	91_b	12.6_b	6.5_c	121.7_c	31.4_c	19585.6_b
T_6	90_c	11.9_b	3.1_b	131.8_b	30.9_c	18428.9_c
T_7	94_a	9.2_a	1.2_a	149.6_a	40.7_a	22111.9_a
T_8	90_c	48.5_d	17.6_d	97.80_d	20.2_e	13440.8_e

Mean followed by the same letter within a column are not significantly different at (P=0.05) according to Duncan's multiple range test.

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(*Accepted for publication September 2015*)