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RESEARCH ARTICLE

Evaluation of some soil amendments and fungicides on wilt incidence and yield of chilli

■ A.G. NAJAR, MUSHTAQ AHMAD, S.A. GANIE* AND QAISAR ANJUM

Division of Plant Pathology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, SRINAGAR (J&K) INDIA

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*Corresponding author:
lucky.shabeer@rediffmail.com

ABSTRACT

Five soil amendments *viz.,* sand, saw-dust, dal weed, cow dung and lime and two fungicides *viz.,* carbendazim 50 WP and mancozeb 75 WP were evaluated *in vivo* for their effects on wilt incidence and fruit yields. Soil amendment with cow dung @ 2 kg m^{-2} proved superior to other amendments exhibiting minimum wilt incidence of 40.28 per cent compared to 66.33 per cent observed in unamended check with corresponding increase in yield to 65.05 q ha^{-1} as compared to check 35.67 q ha^{-1}. However, of the two fungicides, carbendazim 50 WP@ 40 g m^{-2} proved most effective exhibiting wilt incidence of 29.17 per cent and per hectare fruit yield of 68.87 q. Soil amendments with dal weed and saw dust also showed some degree of decrease in wilt incidence and a corresponding increase in fruit yields.

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INTRODUCTION

Chilli (*Capsicum annuum* L.) is an important Salanaceous vegetable crop grown for its unripe green and ripe red fruit which, in whole or powder form, is an indispensable condiment, digestive stimulant as well as flavouring and colouring agent in sauces, chetnius, pickles and other forms of food. Its economic importance lies in pungency of its fruit believed to be due to an alkaloid, "capsaicin". Inspite of quite favourable edaphic and environmental conditions for chilli cultivation available in Kashmir valley, the yields have not been so encouraging owing to occurrence of many diseases, of which wilt has become an important major disease in the valley during the last few years causing about 30 to 40 per cent yield losses. Various attempts to manage the disease through the use of fungicides has been made with little or sometimes considerable success.Composts have been used in agriculture with beneficial effects for years (Kelman and Cook, 1977). Several reports have discussed suppressive effects of composts on a variety of soil borne plant pathogens (Baker and Cook, 1974; Singh, 1983; Lumesden *et al*., 1983). The present studies were, therefore, undertaken with a view to assess the suppressive effects of soil amendments on chilli wilt pathogen, *Fusarium pallidoroseum*.

MATERIALS AND METHODS

Three well decomposed organic manures *viz.,* saw dust (decomposed by admixing 1 per cent each of mule dung and urea), Dal weed and cow dung at 80 per cent moisture level, two inorganics *viz.,* sand and hydrated lime [$Ca(OH)_2$]and two fungicides *viz.,* carbendazim 50 WP and mancozeb 75 WP were incorporated at three different concentrations into the disease sick soil 10 days before transplanting of 45 days old seedlings of chilli cv. Local long in 3m x 2 m plots in RBD with three replications maintaining an unamended check. Observations on wilt incidence were recorded by counting the plants showing wilting out of the total number of plants examined.

$$\text{Wilt incidence (\%)} = \frac{\text{Number of plants wilted}}{\text{Number of plant examined}} \text{x100}$$

Data on fruit yield were recoded for each treatment by pooling the fresh ripe fruit weight of each picking and computed in quintals ha^{-1}. The border row plants were excluded for recording observations.

RESULTS AND DISCUSSION

All the five amendments significantly reduced development of wilt in the crop at all the test concentrations (Table 1) and at all three stages. At pre-flowering stage of

Table 1 : Effect of different soil amendments and fungicides on wilt incidence (*Fusarium pallidoroseum*) and fresh fruit yield of chilli cv. Local long

Treatments	Quantity ($g\ m^{-2}$)	Wilt incidence (%)* at growth stage			
		Pre-flowering	50 % flowering	Final fruit picking	Fruit yield ($q\ ha^{-1}$)
Amendment					
Sand	2000	8.33 (16.70)	36.81 (37.35)	66.67 (54.74)	36.94
	4000	7.64 (15.93)	38.19 (38.17)	67.36 (55.16)	35.58
	8000	7.64 (16.01)	40.28 (39.39)	68.06 (55.59)	34.24
	Mean	7.86 (16.24)	38.43 (38.30)	67.36 (55.16)	35.59
Saw dust	500	8.33 (16.70)	37.50 (37.76)	64.58 (53.48)	39.50
	1000	8.33 (16.70)	33.33 (35.24)	61.80 (51.84)	42.50
	2000	10.42 (18.77)	31.94 (34.41)	59.03 (50.20)	46.29
	Mean	9.03 (17.39)	34.26 (35.80)	61.80 (51.84)	59.26
Dal weed	500	6.25 (14.35)	27.08 (31.32)	58.33 (49.80)	47.39
	1000	4.17 (11.78)	25.00 (29.95)	54.17 (47.39)	51.42
	2000	4.17 (11.78)	18.65 (25.56)	47.92 (43.81)	57.15
	Mean	4.86 (12.63)	23.58 (28.94)	53.47 (47.00)	51.99
Cow dung	500	4.17 (11.78)	25.00 (29.99)	52.08 (46.19)	50.83
	1000	2.08 (8.29)	18.06 (25.14)	45.83 (42.61)	62.02
	2000	2.08 (8.29)	15.97 (23.55)	40.28 (39.39)	65.05
	Mean	2.78 (9.45)	19.68 (26.23)	46.06 (42.73)	59.30
Lime	220	6.25 (14.35)	26.39 (31.04)	48.61 (44.21)	54.28
	440	4.17 (11.78)	26.39 (30.91)	50.69 (45.40)	62.78
	880	4.17 (11.78)	17.36 (24.57)	42.36 (40.61)	55.01
Mean		4.86 (12.64)	23.38 (28.64)	47.22 (43.41)	57.36
Control		8.33 (16.70)	37.50 (37.76)	66.33 (54.53)	35.67
Over all mean		6.28 (14.03)	29.47 (32.61)	57.04 (49.12)	49.86
Fungicides					
Carbendazim 50 WP	10	0.00 (4.05)	12.50 (20.66)	35.42 (36.45)	65.08
	20	0.00 (4.05)	8.33 (16.70)	31.25 (33.98)	67.28
	40	0.00 (4.05)	9.58 (14.35)	29.17 (32.68)	68.87
Mancozeb 75 WP	Mean	0.00 (4.05)	10.14 (17.24)	31.95 (34.37)	67.08
	30	2.08 (8.29)	18.75 (25.54)	40.28 (39.39)	58.96
	60	0.00 (4.05)	14.58 (22.41)	33.33 (35.26)	65.20
	90	0.00 (4.05)	10.42 (18.77)	33.33 (35.26)	67.42
Mean		0.69 (5.46)	14.58 (22.24)	35.65 (36.64)	63.86
Control		8.33 (16.70)	37.50 (37.76)	66.33 (54.33)	35.67
Over all mean		3.01(8.74)	20.74 (25.75)	44.64 (41.85)	55.54
S.E.±		(1.05)	(1.05)	(1.05)	1.05
C.D. (P = 0.05)		(2.20)	(2.20)	(2.20)	2.21

* Means of three replications; Figures in parenthesis are angular transformed values;
A highly negative correlation (r = 0.9134) existed between wilt incidence and fruit yield

crop growth, cow dung applied @ 1 to 2 kg m^{-2} soil exhibited only 2.08 per cent wilt incidence. The same compost applied at 0.5 kg m^{-2} soil, dal weed applied @ 1 to 2 kg m^{-2} soil and lime @ 0.44 and 0.88 kg were the next best amendments reducing the wilt incidence to 4.17 per cent from 8.33 per cent observed in unamended control plots. The observations recorded at 50 per cent flowering stage of crop growth again revealed that cow dung applied @ 1 to 2 kg m^{-2} soil or lime applied @0.88 kg m^{-2} exhibited least wilt incidence of 15.97-17.36 per cent as compared to 37.50 per cent observed in unamended check. Dal weed applied @ 0.5 to 1.0 kg or cow dung applied @ 0.5 kg or lime @ 0.22 to 0.44 kg m^{-2} soil were the next best amendments, reducing the wilt incidence to 25 to 27per cent. At final fruit picking stage of crop growth, cow dung applied @ 2 kg m^{-2} soil or lime @0.88 kg m^{-2} soil, showed minimum disease incidence of 40.28 to 42.36 per cent followed by dal weed @ 2 kg m^{-2} soil or cow dung @ 1.0 kg m^{-2} soil as compared to 66.33 per cent observed in unamended check. However, both the fungicides caused a significant reduction in wilt incidence at all the three crop growth stages. In carbendazim applied soil no wilted plant was observed at pre-flowering stage, whereas 10.14 per cent wilt incidence was recorded at 50 per cent flowering which gradually increased to 31.95 per cent at final fruit picking stage of crop growth. The disease in mancozeb applied soils was noticed at pre-flowering stage as well, exhibiting a wilt incidence of 0.69 per cent which gradually increased to 14.58 and 35.65 per cent at 50 per cent flowering and final fruit picking stages, respectively.

The data on the yields obtained (Table 1) indicated that amendments with cow dung @ 2 kg m^{-2} was the best treatment providing a fruit yield of 65.05 q ha^{-1} as compared to 35.67 q ha^{-1} obtained in unamended check plots. The maximum fruit yield of 68.87 q ha^{-1} were, however, obtained with carbendazim 50 WP (40 g m^{-2} soil) followed by 65.08 to 67.42 q ha^{-1} obtained by amendments with the same fungicide applied at 10 to 20 g m^{-2} soil or mancozeb 75 WP @ 60 to 90 g m^{-2} soil. The suppressive effects of these organic amendments against *F. pallidoroseum* could be partly due to reduction in pathogen population in soil and partly due to enhanced activity of saprophytic fungi and bacteria (Ramakrishnan and Jeyarrajan, 1996; Najar, 2001), a condition not achieved in amendments with sand, which therefore, failed to express suppressive effect. The amendments with lime, however seem to operate by affecting, change in pH level of the soil. During the present study, the soil pH increased from 6.5 to 8.1 after soil amendment with 880 g lime m^{-2} soil. Fisher (1935) also reported that lime restricted the growth and development of *Fusarium* spp. in soil by increasing the pH level of soil. However, none of the soil amendments was as effective as carbendazim 50 WP or mancozeb 75 WP applied into soil @ 10 to 40 g m^{-2} and 90 g m^{-2}, respectively. The better efficacy of carbendazim compared to mancozeb might be because of its systematicity which enables it to eradicate the established infection, a feature lacking in mancozeb and other dithiocarbamates.

Other plant diseases controlled by soil amendments with saw dust and other plant composts as reported by other researchers are Fusarium wilt of tomato (Kato and Tamita (1981) and wilt (*F. solani*) of muskmelon (Chakrabarti and Sen' 1991). Khanna and Singh (1974) also reported reduced population density of *Fusarium* spp. in the rhizosphere of pigeonpea following soil amendments with saw dust. Sen and Kapoor (1974) also reported reduced wilt and increased yield in tomato following the chemical application.

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