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Sustainable Management of Chickpea Wilt Caused by *Fusarium oxysporum* f.sp. *Ciceri*

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ABSTRACT

Chickpea (Cicer arietinum L.), also known as Bengal Gram is one of the major pulse cultivated and consumed in India. It is a cheap source of protein (about 17-20%) compared to animal protein. Chickpea wilt caused by fungal pathogen Fusarium oxysporum f.sp. ciceri is one of the serious diseases causing huge loss to crop throughout the world. The experiment was conducted at agricultural farm of Palli-Siksha Bhavana, Visva-Bharati, Sriniketan, during the winter season of 2013-15 on chickpea with a view to manage the disease in a sustainable manner by using eco-friendly approaches with less hazards and safer chemicals. Out of different treatments neem cake showed minimum disease incidence (11.23 %) followed by vermi-compost with 12.06 percent. Mustard cake was found to be less effective and exhibited 16.07 percent disease incidence. Maximum plant height and maxmum 1000 seed weight were observed in vermi-compost treated plot. All the treatments were differ significantly in terms of percentage decrease in disease incidence and increase in yield over control. The above findings are very useful for the farmers for making decision over the use of organic materials for management of wilt disease which is safe management practice for environment, also increased yield of chickpea.

Key words: *Chickpea, Wilt, Soil organic amendments, Management, Fusarium*

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is an important pulse crop of *rabi* season. Although, chickpea is predominantly consumed as a pulse, dry chickpea is also used in preparing a variety of snack foods. It is a cheap source of protein (about 17-20%) compared to animal protein. Low yield of chickpea attributed to its susceptibility to several biotic and abiotic stresses. Among the biotic stress, chickpea is frequently attacked by a wilt caused by *Fusarium oxysporum* f.sp. *ciceri* (Padwick) Mauto and K. Sato which is worldwide in distribution. The fungus is a primarily soil borne pathogen, however, few reports indicated that it can be transmitted through seeds[1]. Early wilting causes more loss than late wilting, but seeds from late-wilted plants are lighter, rough and dull than those from healthy plants[2]. In India annual yield loss due to *Fusarium* wilt were estimated at 10%[3,4].

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Under favourable condition, the wilt infection can damage the crop completely and cause 100% yield loss[5,6]. Organic amendments are a common practice adopted by the farmers as they are not accepted the synthetic chemical fertilizers for its hazardous effect. Organic amendments and plant residues suppress disease caused by *Fusarium oxysporum* in soil less containers mixes[7]. Organic amendment produced volatile and non volatile substances during their decomposition and also stimulate resident and introduced antagonists[8]. Organic amendments are recommended as biological means to reduce the incidence of several soil borne plant pathogen. Thus the present study was carried out to find the effect of organic amendments against *Fusarium* wilt disease of chickpea.

MATERIALS AND METHODS

Field trials were conducted during the *rabi* season of 2013-15 at Agricultural farm of Palli-Siksha Bhavana, Visva-Bharati, Sriniketan. The experiment was laid out Randomize Block Design with three replications. Various oilseed cakes viz., Sesame cake, Mustard cake, Neem cake, Groundnut cake, Vermi-compost and Spent Mushroom Substrate (SMS) were used to minimize the disease. Chickpea variety Mahamaya-2 was selected for the experiment. All oil cakes apply at the rate of 500 kg per ha and vermi-compost, FYM and SMS apply at the rate of 1000 kg per ha. All soil amendments were mixed in plot and moistened giving light irrigation at 21 days before of sowing as it could decompose properly. After mixing the soil amendments in field, the field was kept undisturbed for seven days for building up of the soil micro flora. Soil without amendments served as control. All agronomic practice was carried out as per recommendations. Observations were recorded on percent disease incidence, plant height, 1000 seed weight and yield. The percent disease incidence was recorded up to the incidence in untreated checked was maximum.

RESULTS AND DISCUSSION

Various oil seed cakes viz., Sesame cake, Mustard cake, Neem cake, Groundnut cake, Vermi-compost and Spent Mushroom Substrate (SMS) were evaluated to find out their effect on wilt disease in chickpea. The data are presented Table 1 and 2.

Table 1. Effect of organic amendments of soil against wilt disease of chickpea

Sl No	Treatments	% Disease incidence	% Decrease in disease incidence	Yield (Kg/Ha)	% Increase in Yield over control
1	Sesame cake	13.76 (3.76)*	38.49	1582	27.99
2	Groundnut cake	12.94 (3.65)	42.15	1603	29.69
3	Mustard cake	16.07 (4.06)	28.16	1502	21.52
4	Neem cake	11.23 (3.41)	49.80	1665	34.71
5	Spent Mushroom Substrate	14.43 (3.85)	35.49	1548	25.24
6	Vermi-compost	12.06 (3.53)	46.09	1637	32.44
7	Farm Yard Manure	15.12 (3.94)	32.41	1521	23.06
8	Control	22.37 (4.77)		1236	
S. Em. ± CD at 5%		0.15 0.46		1.79 5.43	

*Data parenthesis is Square Root Transform value

It was evident from the data (table-1) that the treatments were contributed positively towards to disease management. Among the seven treatments of soil amendments, neem cake was found to be most effective in terms of disease incidence 11.23 %. This was followed by Vermi-compost, Groundnut cake, Sesame cake, Spent Mushroom Substrate (SMS) and Farm Yard Manure (FYM) with 12.06 %, 12.94%, 13.76%, 14.43 % and 15.12 % incidence respectively. The least effective treatment was Mustard cake with 16.07 % disease incidence. The neem cake gave highest yield (1665 kg/ha) followed by vermi-compost 1637 kg/ha. The lowest yield found in mustard cake treated plot with 1502 kg/ha. All treatments significantly reduce the disease incidence and increased the yield of chickpea in comparison to control plot. Plants of vermi-compost amended plot exhibited maximum plant height (47.2 cm) at 80 DAS followed by groundnut cake, sesame cake and neem cake showed 46.8 cm, 45.7 cm, and 44.6 cm. Minimum plant height (42.3 cm) was observed in the plot treated with farm yard manure.

The test weight of 1000 seeds was maximum (192.6 g) vermi-compost treated plot followed by groundnut with 186.5g. Plants of farm yard manure treated plot gave minimum seed weight, 166.7 g (table no-2).

Table 2. Effect of organic amendments of soil against Plant height and seed weight of chickpea

Sl No	Treatments	Plant height(cm) 80 DAS	1000 seed weight (g)
1	Sesame cake	45.7	179.8
2	Groundnut cake	46.8	186.5
3	Mustard cake	44.2	174.8
4	Neem cake	44.6	175.6
5	Spent Mushroom Substrate	43.5	168.4
6	Vermi-compost	47.2	192.6
7	Farm Yard Manure	42.3	166.7
8	Control	36.4	152.4
S. Em. ± CD at 5%		1.72 5.24	2.07 6.28

The suppressive ability of neem organic amendment in inhibiting growth of soil borne pathogens has been demonstrated to be through competition, antibiosis or due to increase of soil microbial populations[10]. In the present study, the performance of soil amendments with neem cake was corroborate with the report of Goudar and Kulkarni[9] where they noticed minimum disease incidence. Significant reduction of *Fusarium solani* by neem amendment also reported by Lakashmi and Jeyarajan[11]. Baily and Lazarovits[12] reported that organic amendments, manures and composts with high nitrogen contents may suppress soil borne diseases by releasing allelochemicals during microbial decomposition. Continuous application of compost extract reduces disease incidence due to induced natural defense mechanism against *Fusarium oxysporum* in tomato was reported by Al-Dhamani *et al.,*[13]. Chattopadhyay *et al.,*[14] reported that soil application of green manure, mustard cake and farm yard manure lead to significant reduction of population of *Fusarium oxysporum* f. sp. *ciceri*, causal agent of chickpea wilt under field condition. Application of mustard or groundnut cake in soil reduced the incidence of *Fusarium* wilt in cumin (Diyora and Khandar[15]). Incorporation of SMS of paddy straw and coir pith in to the soil reduce the activity of soil borne pathogen *F. oxysporum* and improve growth of tomato plants[16].

CONCLUSION

Amendments of soil with organic materials have tremendous effect on enhancing the chickpea yield as it reduce the incidence of *Fusarium* wilt up to a considerable level. It also releases nutrients slowly and improve the soil health by increasing the beneficial soil micro-flora. This is an eco-friendly approach can be used as an alternative management strategy for combating the menace.

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