Research Paper :

Effect of different soil amendments on wilt complexd disease incidence and growth parameters of chickpea (*Cicer arietinum* L.)

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SUMMARY

Chickpea (*Cicer arietinum* L.) is most important pulse crop grown in India, which suffers economic losses due to wilt complex. *Fusarium oxysporium* f.sp. *ceceri*, *Rhizoctonia bataticola* and *Sclerotium rolfsii* were isolated from wilted chickpea plant. These isolated pathogens were mass multiplied on the jawar grain. Four oilseed cakes *viz.*, linseed cake, groundnut cake, neem seed cake and cotton seed cake were studied@ 100, 50, 25 and 10% conc. on the germination of chickpea seeds. Application of neem seed cake at 2.5% showed 90% emergence, followed by 5% dose, which gave 71.57% emergence, while shoot and root length was highest with neem seed cake at 5%. Also the effect of amendment of above mentioned oilseed cake before and after inoculation with respective pathogen@2.5%, 5% and 10% w/w with sterilized soil to evaluate mortality of chickpea at 30, 60, 90 and 120. The neem seed cake at 5% dose in pre-amended and post-amended soil showed maximum disease reduction, 83.34 % and 81.25 %, respectively.

Key words : Chickpea, Wilt, Disease incidence

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Chickpea (*Cicer arietinum* L.) is most important pulse crop in India, grown for dal making, culinary and for table purposes. It constitutes the main source of protein and several amino acids. It is a very cheap pulse and hence it is also referred as 'Poor man's meat'. The yield of chickpea can be reduced considerably due to many diseases. Chickpea is grown in diversified area and hence it succumbs to many fungal, bacterial and viral diseases in different geographical regions. Among all these diseases, wilt, collar rot, root rot are important diseases and causes 10-12% grain yield losses. Among organisms, Fusarium wilt and Rhizoctonia root rot together cause yield losses up to 70% in the field. Padwick (1948) stated that wilt is the worst disease in chickpea crop. Similarly, Jani *et al.* (1999) reported that wilt is the most destructive disease, resulting in considerable crop loss in Gujarat.

There is much said about the role of organic amendments in modification of physical, chemical and biological environment of soil through addition of decomposable organic matter. It improves the structure, texture, aeration and water holding capacity of soil and improves the development of root system. The biological environment also changes, due to intense microbial activities in the soil which is helpful for developing more antagonistic micro-organisms. The disease incidence is affected by various mechanisms operative in soil, host and pathogen. Considering the importance of these factors, the studies were carried out at the Department of Plant Pathology, College of Agriculture Nagpur (2006-07) with a view to clarify the role of some oilseed cakes as a source of organic amendments, in reducing the severity and ultimately the losses caused by wilt causing organisms. With this present study also aimed to study the effect of different oil seed cakes on germination, mortality and some growth parameters of chickpea.

MATERIALS AND METHODS

Isolation, identification and preparation of mass culture of wilt causing pathogen:

The diseased samples were collected showing wilting symptoms *i.e.* drooping leaves, yellow coloured etc. from 13 different fields of Nagpur district, M.S. India. The individual diseased samples were brought to the laboratory for disease diagnosis. The collected disease samples of wilted chickpea plant were used for isolation of *Fusarium oxysporum* f.sp. *cicer, Rhizoctonia bataticola* and *Sclerotium rolfsii.* The wilted portion of diseased sample from individual sample was surface sterilized with 0.1% $HgCl_2$ followed by 2-3 times washing

with sterile water. These sterilized bits were transferred on PDA (Potato dextrose agar) medium and kept for incubation at 28 ± 2°C for fungus growth. After 3-4 days of inoculation, the fungus was purified by hyphal tip method and identified as *Fusarium oxysporum* f.sp. *cicer, Rhizoctonia bataticola* and *Sclerotium rolfsii* on basis of morphological growth pattern and microscopic observations. Mass inoculum of *Fusarium oxysporum* f. sp. *cicer, Rhizoctonia bataticola* and *Sclerotium rolfsii* was prepared by adding their pure culture on hot water-soaked, steam sterilized at 15 lbs pressure, 300 g fresh jowar seeds. These seeds were kept in 1000 ml conical flasks with inoculated pure culture of individual pathogen for incubation at 28 ± 2°C temperature to facilitate good growth of fungus. These grains turned whitish (*Fusarium*), brown to blackish (*Rhizoctonia*) and cottony white with mustard like fruiting bodies (*Sclerotia*) confirming pathogen growth. This mass inoculum was utilized for soil application for testing germination and other growth parameters of chickpea.

Seed germination in oilseed cake extracts in laboratory condition:

The effect of oilseed cakes *viz.,* linseed cake, groundnut cake, neem seed cake and cotton seed cake was studied on the germination of chickpea seeds. These cakes were used in concentration of each of 100, 50, 25 and 10%. For making extracts, oilseed cakes were soaked in sterile distilled water for 12 hours. It was filtered through 4 folds of muslin cloth and then volume was adjusted. These extracts in the above mentioned desired concentrations were poured in each steam sterilized Petri plate and soaked 10 seeds of chickpea in each concentration including check in distilled water for the period of 6-8 hours to check the germination percentage in controlled condition.

Cage house experiment:

The clay loamy soil from field and sterilized with formalin 0.5% and disposed in the sterilized earthern pot having 28 cm diameter, 25 cm depth and approximately 5 kg sterilized soil in each plot. In each set, there were 13 treatments and 3 replications were kept. In the first set of experiment, oil cakes at three different doses *viz.,* 2.5%, 5% and 10% on w/w basis were mixed and added into this pots and allowed to decompose for 17 days. On the 17th day, wilt complex pathogens were added and mixed @ 15 g/kg of soil in the pots. Then on 20th day from date of setting up of experiment, sowing was done. Ten seeds in each pot were sown in each treatment and observation on emergence up to 15 days and mortality up to maturity was recorded after every 30 days of interval. Further, the shoot and root lengths of survived plants were recorded on termination of day randomly from each plot.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been presented under following heads:

Effect of oilseed cakes on seedling emergence of chickpea:

The effect of oilseed cake was evaluated as seedling emergence of chickpea. The data regarding per cent seedling emergence at 15 DAS in pre-amended and post-amended soil are presented in Table 1. Data pertaining to Table 1 revealed that all the treatments were found to be significantly superior over the control to enhance the seedling emergence percentage at pre-amended condition. Application of neem seed cake at 2.5% showed 90% emergence, respectively followed by 5% dose which gave 71.57% emergence by neem seed cake. Also seedling emergence at post-amended soil found significantly superior over the control in chickpea. Among which neem seed cake at 2.5% and 5% application found to be superior than any other treatments. From this, it was confirmed that all oilseed extracts hampered seed germination at higher concentration except neem seed cake Afraq and Sinha (1970) reported the toxic effect of *Portulaca grandiflora* stem extract on seed germination of *Cicer arietinum* at higher concentrations.

Effect of oil seed cake on mortality of chickpea at 30, 60, 90 and 120 DAS:

Data in Table 2 revealed that the minimum mortality was 19.55% found in the treatment neem seed cake at 5% dose at 30 DAS and it was constant at all the days of observation followed by neem seed cake at 2.5% dose was 24.09% mortality in pre-amended soil. Where as per cent disease reduction in all doses of neem seed cake found high and maximum 75.20, 83.34 and 69.50%, respectively as compare to all other treatments. The neem seed cake at 5% dose found statistically significant in pre-amended soil showed maximum 83.34% wilt reduction followed by neem seed cake at 2.5% and 10% dose showed 75.20 % and 69.50% wilt reduction. Similarly, lower mortality was 20.81% and it was found in treatment of neem seed cake at 10% dose at 30DAS. Further, neem seed cake at 5% dose found lower mortality *i.e.* 22.11% at 30, 60, 90 and 120 DAS, it was constant up to maturity followed by neem seed cake at 2.5% dose had 24.94% mortality in post-amended soil. The effective treatment

Table 1 : Effect of oilseed cakes on seedling emergence of chickpea at 15 DAS in pre-amended and post-amended soil

Sr. No.	Treatments	Dose (%)	Per cent seedling emergence at 15 DAS at pre-amended condition (Avg %) Mean	Per cent seedling emergence at 15 DAS at post-amended condition (Avg %) Mean
1.	Linseed cake	2.5	50.77	50.77
2.	Linseed cake	5	52.73	48.83
3.	Linseed cake	10	50.77	50.77
4.	Groundnut cake	2.5	63.43	61.11
5.	Groundnut cake	5	56.79	54.74
6.	Groundnut cake	10	63.43	63.43
7.	Neem seed cake	2.5	90.00	75.03
8.	Neem seed cake	5	71.57	75.03
9.	Neem seed cake	10	63.43	68.59
10.	Cotton seed cake	2.5	56.79	56.79
11.	Cotton seed cake	5	50.77	56.79
12.	Cotton seed cake	10	52.73	54.74
13.	Control (Inoculated)	--	45.00	46.91
	S.E. $\pm$		5.28	4.68
	C.D. (P=0.05)		15.35	13.61

Table 2 : Effect of oil seed cake on mortality of chickpea at 30, 60, 90 and 120 DAS

Sr. No.	Treatments	Dose (%)	Per cent wilt incidence Pre amended condition					Per cent wilt incidence post amended condition				
			30 DAS	60 DAS	90 DAS	120 DAS	% disease reduction	30 DAS	60 DAS	90 DAS	120 DAS	% disease reduction
1.	Linseed cake	2.5	27.80	35.65	41.72	41.72	34.11	31.50	38.49	41.72	41.72	41.38
2.	Linseed cake	5	27.02	40.43	40.43	40.43	37.43	28.56	42.52	42.52	42.52	39.56
3.	Linseed cake	10	30.72	37.43	37.43	37.43	45.05	31.50	38.49	41.72	41.72	41.38
4.	Groundnut cake	2.5	23.84	26.92	33.31	33.31	55.13	24.56	27.58	33.44	33.44	59.82
5.	Groundnut cake	5	26.45	32.56	32.56	32.56	56.90	27.02	33.31	36.22	36.22	53.79
6.	Groundnut cake	10	24.19	34.17	37.99	37.99	43.62	27.49	35.14	40.16	40.16	44.94
7.	Neem seed cake	2.5	21.41	24.09	24.09	24.09	75.20	22.33	24.94	24.94	24.94	76.47
8.	Neem seed cake	5	19.55	19.55	19.55	19.55	83.34	22.11	22.11	22.11	22.11	81.25
9.	Neem seed cake	10	20.81	23.84	26.92	26.92	69.50	19.89	25.83	25.83	25.83	74.88
10.	Cotton seed cake	2.5	25.49	35.26	35.26	35.26	50.42	26.02	38.00	40.43	40.43	44.34
11.	Cotton seed cake	5	28.25	34.93	37.16	37.16	45.73	28.94	35.14	43.64	43.64	36.98
12.	Cotton seed cake	10	20.96	34.93	37.43	37.43	45.05	29.63	36.60	42.02	42.02	40.70
13.	Control (Inoculated)	--	34.93	55.07	55.07	55.07	--	37.93	56.09	60.37	60.37	--
	S.E. $\pm$		2.24	2.12	2.19	2.19	--	2.46	2.26	2.32	2.32	--
	C.D. (P=0.05)		6.53	6.16	6.37	6.37	--	7.83	6.56	6.74	6.74	--

Table 3 : Effect of oil seed cakes on shoot length and root length of chickpea

Sr. No.	Treatments	Dose (%)	Pre-amended soil		Post-amended soil	
			Shoot length (cm)	Root length (cm)	Shoot length (cm)	Root length (cm)
1.	Linseed cake	2.5	28.00	36.00	24.00	32.00
2.	Linseed cake	5	28.50	38.00	26.00	36.00
3.	Linseed cake	10	26.00	34.00	24.00	30.00
4.	Groundnut cake	2.5	32.00	43.00	30.00	41.00
5.	Groundnut cake	5	30.00	45.00	31.00	38.00
6.	Groundnut cake	10	28.00	43.00	27.00	40.00
7.	Neem seed cake	2.5	36.00	48.00	34.00	48.00
8.	Neem seed cake	5	38.00	54.00	36.00	51.00
9.	Neem seed cake	10	32.00	44.00	30.00	42.00
10.	Cotton seed cake	2.5	27.50	38.00	26.00	36.00
11.	Cotton seed cake	5	28.00	40.00	28.00	40.00
12.	Cotton seed cake	10	29.00	41.00	28.00	40.00
13.	Control (Inoculated)	--	26.50	34.00	22.00	28.00

in the post amended experiment was at 5% dose of neem seed cake which was statistically significant over the control in per cent wilt reduction (81.25) followed by neem seed cake at 2.5 and 10% doses which reduced the diseases by 76.47 and 74.88%, respectively as compared to control. In present study, seedling emergence was affected due to pre-emergence mortality in all the treatments except neem seed cake at all doses. It might be due to toxic substance produced by oilseed cakes during decomposition. Similar results were also obtained by Dubey (2002) and Jayrarajan *et al.* (1987). In an initial stage of decomposition of soil seed cakes enhanced the population of wilt complex pathogens due to which mortality was higher. Mortality declined and inhibitory effect increased as the decomposition period of oilseed cake in soil progressed. Padmodaya (1999) obtained similar results.

Effect of oil seed cakes on shoot length and root length of chickpea in pre and post amended soil:

Data in Table 3 revealed that neem seed cake at 5% dose showed highest shoot length (38.00 cm) and root length (54.00 cm) than rest of all the treatments. Next best treatment was neem seed cake at 2.5% dose showed shoot length of 36.00 cm and root length of 48.00 cm. Similarly, all treatments in post amended soil were effective for increasing the shoot and root length as compared to control. Neem seed cake at 5% dose showed higher shoot length (36.00 cm) and root length (54.00 cm), followed by neem seed cake at 2.5 % dose showed shoot length 34.00 cm and root length 48.00 cm.

The shoot length and root length in all the treatments of pre-amended of oilseed cakes observed quite higher than post amended application of oilseed cakes. These variations might be due to with different methodology and condition of the experiment. The experimental findings of Khan and Hussain (1988) and Haque *et al.* (1995) confirmed the amendment of neem seed cake which induced the best growth of plants.

There are various factors affecting directly or indirectly on the effect of oilseed cakes such as temperature, time of incorporation, incubation period, level of doses and substance released at the time of decomposition. The suppression of fungal activity in organically amended soil has been attributed to one or more reasons. The amendments may also changes the physical and chemical condition / nature of the soil leading to increase host resistance, favorable condition for rapid root development, replacement of diseased roots with new ones and better prolonged utilization of nutrients by enhanced root system.

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