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Effect of different organic amendment on population dynamics and incidence of *Fusarium* Wilt in chick pea

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Abstract
Chickpea (*Cicer arietinum* L.) is one of the most important pulse crops in India. The crop is grown in Western Maharashtra mainly in *Rabbi* Season. The chickpea is severely attacked by *Fusaruim oxysporium* f. sp. *ciceri (F. oxysporum* f.sp. *ciceri*). Organic amendments such as neem, soybean, castor, safflower, groundnut cakes and vermicompost, compost, FYM, gypsum, poultry manure were applied to chickpea, which was reduce the survival and incidence of *F. oxysporum* f.sp. *ciceri*. Among above amendments reduced pathogen population. The population of *F. oxysporium* f. sp. *ciceri* was least in neem cake (4 x 10^{-3} /g) followed by cotton and castor cakes and the highest in control followed by groundnut (22 x 10^{-3} /g), safflower (21 x 10^{-3} /g) cakes. Chickpea wilt disease were the lowest observed in neem cake treatment (0-10%) and the highest in control (70%) followed by groundnut (25-35%) and soybean (25%) cakes.

Keywords: Chickpea, *Fusarium* wilt, Organic amendment, Neem cake

Introduction
Fusarium species cause significant yield losses in main crops especially chickpea, potato, pea, bean, wheat, corn and rice in several parts of the country. The diseases resulted in yield losses to the extent of 30 to 70 per cent in the fields and made economic problems for growers. At national level the yield losses encountered due to wilt may vary between 5 to 10 per cent. The pathogen is both seed and soil borne; facultative saprophyte and can survive in soil up to six years in the absence of susceptible. The symptoms of these diseases include wilting of the foliage losses from the roots to the aerial parts of the plant, yellowing and wilting of the foliage occur, and finally there is necrosis. Discolouration of the pith and xylem occurs in the roots and can be seen when they are cut longitudinally. The incorporation of crop residues into the soil, organic wastes, composts and peats, have been proposed to control diseases caused by soil borne pathogens. Many of these amendments reduced pathogen populations (George *et al*., 2001). [1] The organic amendments viz., saw dust, ground nut cake, FYM, soybean cake, cotton cake were used in three concentrations 0.1%, 0.2%, 0.3%. The highest per cent growth of inhibition was observed in soybean cake 0.3% (32.96%), followed by groundnut cake 0.3% (29.63%). The lowest per cent growth inhibition was observed in saw dust 0.1% (06.47%). (Rani and Mane, 2014). [5] The organic amendments *viz*., neem cake, ground nut cake, FYM, soybean cake, cotton cake were used in different concentrations. The highest per cent growth of inhibition was observed in neem cake and the lowest per cent growth inhibition was observed in groundnut cake (Pandey *et al*, 2014). [4] Fusarium wilt of tomato controlled by soil amendments with composts (Harender and Kapoor., 1997). [2] Organic soil amendments neem cake, FYM, Soybean cake, Cotton cake. Stimulate the activities of microorganisms that are antagonistic to plant-parasitic nematodes (Muhammad *et al*., 2010). [3]Soil borne pathogen are causes considerable losses in chickpea. Therefore, it is decided to see the effect of organic amendment on population dynamics of soil borne plant pathogen on chickpea (*Cicer arietinum L*.) *var*. JG-62.

Material and Methods
Various oilseed cakes were obtained from the local market, Rahuri *viz.*, neem cake, ground nut cake, soybean cake, cotton cake, vermicompost, castor cake, compost, poultry manure, gypsum, safflower cake and FYM etc.

Fungal culture: *Fusarium oxysporium* f. sp. *ciceri.*

Potting mixture: Earthen pot filled with potting mixture (soil + sand) and organic matter was added as per treatment @ 5, 10 and 15 gm/kg soil. The pot was inoculated with test pathogen multiplied on sand:maize media @ 10gm/kg mixture.

Seed: The pure seeds of chickpea var. JG-62 were used for raising chickpea for experimental investigation.

Assessment of microbial population by serial dilution method

Microbial population of different fungus from organic matter and sick soil by serial dilution method. Microbial count of collected sample were assessed at 10^{-3}, 10^{-4}, 10^{-5} dilution at different growth stages of plant.

Assessment of effect of organic treatment on *Fusarium oxysporium* f.sp. *ciceri* by pot culture method with sick soil

Assessment of effect of organic treatment on soil borne pathogens by pot culture method with sick soil. Organic amendment *viz*., neem cake, ground nut cake, soybean cake, cotton cake, vermicompost, castor cake, compost, poultry manure, gypsum, safflower cake and FYM were applied at three different levels *i.e*., @ 5, 10 and 15 g/kg soil in per pot. *Fusarium oxysporium* f.sp. *ciceri* was assessed against organic amendments. Seed of chickpea var., JG-62 used for assessment. Seeds were sown in separate pot containing sick soil. The disease incidence calculated.

Statistical analysis: Observations of per cent disease incidence and population counts of fungi recorded in the present investigations were however, suitably transformed using arc-sine transformation and FCRD respectively.

Results and Discussion

Population of *Fusarium oxysporium* f.sp. *ciceri* under different level of organic treatment.

Data pertaining in table 1. Among all organic treatments significanty lowest *Fusarium oxysporium* f.sp. *ciceri* population was observed in neem cake treatment (4×10^{-3} /g) followed by cotton cake (5×10^{-3} /g) and castor cake (6×10^{-3} /g) as compared to control (27.5×10^{-3} /g). Regarding effect of level of organic matter on population it was observed that population of *Fusarium oxysporium* f.sp. *ciceri* decreases with increase in application dose of organic matter. The lowest population of *Fusarium oxysporium* f.sp. *ciceri* was observed (4×10^{-3} /g) at 15g/kg soil application of neem cake followed by cotton cake (5×10^{-3} /g).In case of interaction effect the application of neem cake @ 15g/kg soil was observed effective.

Table 1: Effect of different organic treatment on population of *Fusarium oxysporium* f.sp. *ciceri under* epiphytotic conditions at different stages of crop (10^{-3} /g of soil)

Treatments	Level	Seedling	Growth	Flowering	Maturity
Neem cake	5g/kg	14.5	6.5	9	7.5
	10g/kg	9	5.5	7.5	6.5
	15g/kg	7.5	4	4.5	6.5
Cotton cake	5g/kg	9.5	7	9.5	11
	10g/kg	6.5	6	8.5	11
	15g/kg	8.5	5	6.5	8.5
FYM	5g/kg	13	8.5	11.5	12.5
	10g/kg	11	7.5	8	11
	15g/kg	8.5	6	5.5	9.5
Compost	5g/kg	12.5	9	12	13.5
	10g/kg	11.5	9	10.5	12.5
	15g/kg	9	6.5	8	11
Gypsum	5g/kg	15	11	9.5	12.5
	10g/kg	10	9.5	8.5	11.5
	15g/kg	12	5.5	6	8.5
Poultry	5g/kg	11	8.5	19	14
	10g/kg	9.5	6	15	13
	15g/kg	8.5	5.5	12.5	11
Soybean cake	5g/kg	16	18	12	14.5
	10g/kg	13	12.5	8.5	12
	15g/kg	12	12	6	9.5
Castor cake	5g/kg	12	15	16.5	15.5
	10g/kg	6	7.5	15.5	14.5
	15g/kg	8.5	6.5	10.5	10.5
Safflower cake	5g/kg	15.5	14	12	21
	10g/kg	13.5	11.5	11.5	19.5
	15g/kg	10.5	11	11.5	18
Vermicompost	5g/kg	14.5	11.5	20	14.5
	10g/kg	12	10	18.5	13.5
	15g/kg	10	8.5	16.5	12.5
G. nut cake	5g/kg	20	17	20	22
	10g/kg	17.5	13.5	19	20.5
	15g/kg	17	10.5	17.5	19
Control		19.5	16.5	25.5	27.5
		20	19	22.5	25.5
		24	23	27	23.5
Treatments					
SE(±)		0.86	0.82	0.64	0.64

CD@5%		2.44	2.35	1.85	1.83
CD@1%		3.29	3.15	2.48	2.45
Levels					
SE(±)		0.44	0.42	0.34	0.33
CD@5%		1.28	1.23	0.96	0.95
CD@1%		1.80	1.72	1.35	1.34
Interactions					
SE(±)		1.48	1.42	1.12	1.11
CD@5%		NS	NS	NS	NS
CD@1%		NS	NS	NS	NS

Effect of organic amendment on incidence of wilt diseases of chickpea under artificial inoculation condition.

Data pertaining in table 2. Among organic treatments significanty least incidence of *Fusarium* wilt was observed in neem cake treatment (0-10%) followed by vermicompost (0-15%) at different growth stages as compared to control (70%). Groundnut cake (25-35%) and soybean cake (25%). Regarding effect of level of organic matter on incidence *Fusarium* wilt of chickpea, it was observed that incidence *Fusarium* wilt of chickpea decreases with increase in application dose of organic matter. Lowest incidence of *Fusarium* wilt was observed in neem cake treatment was 0% at 10g/kg soil application of neem cake followed by vermicompost (0-15%).

Similar results were observed by S. Ranjitha Rani *et al.* (2014) [5] observed that Chickpea (*Cicer arietinum L.)* wilt caused by *Fusarium oxysporum f.sp. ciceri* was controlled by application of different organic matter *viz.*, saw dust, ground nut cake, FYM, soybean cake, cotton cake were used in three concentrations 0.1%, 0.2%, 0.3%. The highest per cent growth of inhibition was observed in soybean cake 0.3% (32.96%), followed by groundnut cake 0.3% (29.63%). The lowest per cent growth inhibition was observed in saw dust 0.1% (06.47%). Pandey *et al.*, (2014) [4] studied that the effect of organic soil amendment (FYM, Vermi-compost, Green manure, Neem cake) against *Fusarium* wilt of chickpea. He got similar result that among all the treatments with Neem cake were more effective in controlling wilt disease of chickpea (46.7%), as compared to Farm Yard Manure (39.9%), Vermi-compost (39.3%) and Green manure (26.2%).

Table 2: Effect of different organic treatment on incidence of *Fusarium* wilt of chickpea under artificial inoculation condition at different stages (%)

Treatments	Level	seedling	Growth	Flowering	Pod	Maturity	Total
Neem cake	5g/kg	0	5	0	0	0	5
	10g/kg	0	0	0	0	0	0
	15g/kg	0	5	0	5	0	10
Cotton cake	5g/kg	5	10	0	0	5	20
	10g/kg	5	5	0	0	0	10
	15g/kg	0	0	5	5	5	15
FYM	5g/kg	5	0	5	5	0	15
	10g/kg	5	5	0	5	5	20
	15g/kg	0	0	0	0	0	0
Compost	5g/kg	5	5	5	5	0	20
	10g/kg	5	0	0	0	0	5
	15g/kg	0	0	5	5	0	10
Gypsum	5g/kg	5	5	0	0	0	10
	10g/kg	0	5	5	5	5	20
	15g/kg	0	0	5	0	0	5
Poultry	5g/kg	5	5	0	5	5	20
	10g/kg	0	0	0	5	0	5
	15g/kg	0	5	0	5	5	15
Soybean cake	5g/kg	5	5	0	10	5	25
	10g/kg	0	5	5	5	5	20
	15g/kg	0	0	5	5	10	20
Castor cake	5g/kg	0	0	0	0	5	5
	10g/kg	0	5	10	5	0	20
	15g/kg	0	5	0	5	5	15
Safflower cake	5g/kg	5	5	0	5	5	20
	10g/kg	5	10	10	10	10	45
	15g/kg	0	0	0	5	5	10
Vermicompost	5g/kg	0	0	0	0	0	0
	10g/kg	0	5	0	5	0	10
	15g/kg	0	0	5	5	5	15
G.nut cake	5g/kg	5	5	0	10	5	25
	10g/kg	5	5	10	5	10	35
	15g/kg	0	0	5	10	10	25
control		10	15	10	15	20	70
		10	10	10	15	20	65
		10	10	5	10	10	45

Treatments							
SE(±)		3.03	3.64	3.17	3.26	2.58	3.66
CD@5%		4.90	6.29	4.40	6.20	5.92	NS
CD@1%		6.50	8.45	5.91	8.33	7.95	NS
Levels							
SE(±)		1.58	1.90	1.65	1.71	1.35	1.91
CD@5%		2.40	3.15	2.20	3.10	2.96	5.47
CD@1%		3.20	4.22	2.95	4.16	3.97	7.68
Interactions							
SE(±)		5.53	6.32	5.49	5.64	4.48	6.34
CD@5%		8.52	10.97	7.63	10.75	10.26	18.14
CD@1%		12.4	14.64	10.23	14.4	13.77	NS

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