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Effect of different organic amendment on population dynamics and incidence of collar rot 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 soil born plant pathogens severely attack on the pulse crops, in which chickpea is severely attacked by *Sclerocium rolfsii* (*S. rolfsii*) of Chickpea pathogen. Organic amendments, such as neem, soybean, castor, safflower, groundnut cakes and vermicompost, compost, FYM, gypsum, poultry manure were applied to chickpea, which was reducing the survival and incidence of *S. rolfsii*. Among above amendments reduced pathogen population. The lowest *S.rolfsii* population was observed in neem cake treatment (4×10^{-3} /g) followed by cotton cake (6×10^{-3} /g) and castor cake (7.5×10^{-3} /g) as compared to control (25.5×10^{-3} /g) at 15g/kg soil application. Among organic treatments significantly least incidence of *Sclerocium* rot was observed in neem cake treatment (5-15%) followed by compost (10-15%) at different growth stages as compared to control (45%). Safflower cake (15-35%) and soybean cake (15-30%) showed least adverse effect over incidence *Sclerocium* rot of chickpea.

Keywords: Organic amendment, *Sclerocium rolfsii*, Neem cake, Coller rot

Introduction

Chickpea is the world's third most important pulse crop, after dry beans (*Phaseolus vulgaris* L.) and dry peas (*Pisum sativum* L.). The soil borne pathogen *S. rolfsii* has become a threat for its successful cultivation causing 55-95 % mortality in the seedling stage of the crop. *S. rolfsii* is polyphagous pathogen infecting crops like soybean, pigeon pea, groundnut, sunflower causes 25-30 per cent losses in yield. The diseases resulted in yield losses to the extent of 30 to 70 per cent in the fields and made economic problems for growers. Soybean root causes 30- 77 per cent loss in soybean in Vidharbh region of Maharashtra (Pawar *et al.*, 2014).^[4] 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).^[3] 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).^[2] Therefore, it is decided to see the effect of organic amendment on population dynamics of soil *S. rolfsii* on chickpea *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: *S. rolfsii*.

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

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different growth stages of plant. PDA culture medium used for fungal population and NA culture medium used for bacterial population.

Assessment of effect of organic treatment on *S. rolfisii* 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. Three soil borne fungi 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 was recorded at seedling, growth, flowering, pod, physiological maturity stages. Per cent disease incidence was 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 *S. rolfisii* under different level of organic treatment

Data pertaining to effect of different organic treatment on population of *S. rolfisii* under epiphytotic condition stages of crop at 10^{-3} dilution/g of soil is presented in table 1. The result revealed that that effect of different organic amendment treatment significantly influenced the population of *S. rolfisii* at 10^{-3} dilution/g of soil. Among organic treatments significantly lowest *S. rolfisii* population was observed in neem cake treatment (4×10^{-3} /g) followed by cotton cake (6×10^{-3} /g) and castor cake (7.5×10^{-3} /g) as compared to control (25.5×10^{-3} /g). Groundnut cake (22.5×10^{-3} /g) and vermicompost (19.5×10^{-3} /g) did not showed any adverse effect over population *S. rolfisii*. Regarding effect of level of organic matter on population of *S. rolfisii*, it was observed that population of of *S. rolfisii* decreases with increase in application dose of organic matter. Lowest population of *S. rolfisii* was observed (4×10^{-3} /g) at 15g/kg soil application of neem cake followed by cotton cake (6×10^{-3} /g). In case of interaction effect the application of neem cake @ 15g/kg soil was observed effective. Population of *S. rolfisii* was observed at four different stages of crop i.e. seedling, growth, flowering and physiological maturity stages.

Table 1: Effect of different organic treatment on population of *Scleroecium rolfisii* under epiphytotic conditions at different stages of crop (10^{-3} /g of soil)

Treatments	Level	Seedling	Growth	Flowering	Maturity
Neem cake	5g/kg	5.5	9	9	8.5
	10g/kg	4.5	5.5	6.5	7
	15g/kg	4.5	4.5	6	4
Cotton cake	5g/kg	14.5	10	9.5	15.5
	10g/kg	12	8.5	7.5	6.5
	15g/kg	8.5	7	6.5	6
FYM	5g/kg	11.5	12	13.5	14
	10g/kg	10	8	7.5	12
	15g/kg	8	7.5	6	11.5
Compost	5g/kg	17.5	16	9	15.5
	10g/kg	15.5	12	8	12
	15g/kg	12	7.5	8.5	12
Gypsum	5g/kg	11	11.5	12.5	15.5
	10g/kg	11.5	10	12	11.5
	15g/kg	8.5	5.5	10.5	9.5
Poultry	5g/kg	19	19	10.5	15.5
	10g/kg	15.5	15	8.5	14
	15g/kg	5.5	5.5	7.5	11.5
Soybean cake	5g/kg	15	15	19	16.5
	10g/kg	12	12	14	15
	15g/kg	8.5	8.5	10.5	6
Castor cake	5g/kg	10.5	10	10.5	19
	10g/kg	7.5	9	7.5	15.5
	15g/kg	5.5	5.5	7.5	13.5
Safflower cake	5g/kg	14	15	15	18
	10g/kg	13.5	14	12.5	12
	15g/kg	11.5	11.5	5.5	10
Vermicompost	5g/kg	16.5	20	19.5	16.5
	10g/kg	15	13	14	12.5
	15g/kg	13	11.5	11	11.5
G. nut cake	5g/kg	22.5	22	20	20
	10g/kg	11.5	20	18	19
	15g/kg	10	17	16	11.5
control		25.5	27	21.5	22.5
		24.5	24.5	19	27
		17	16.5	25	19.5
Treatments					
SE(±)		0.62	0.79	0.60	0.68
CD@5%		1.83	2.27	1.71	1.95

CD@1%		2.44	3.04	2.29	2.62
Levels					
SE(±)		0.33	0.41	0.31	0.35
CD@5%		0.95	1.18	0.89	1.02
CD@1%		1.34	1.66	1.25	1.43
Interactions					
SE(±)		1.10	1.37	1.03	1.18
CD@5%		3.16	NS	2.96	3.38
CD@1%		4.23	NS	3.97	4.53

Effect of organic amendment on incidence collar rot diseases of chickpea under artificial inoculation condition

Data pertaining to effect of different organic treatment on incidence of collar rot under epiphytotic condition stages of crop at 10^{-3} dilution/g of soil is presented in table 2. Among all organic treatments significantly least incidence of *Sclerocium* rot was observed in neem cake treatment (5-15%) followed by compost (10-15%) at different growth stages as compared to control (45%). Safflower cake (15-35%) and soybean cake (15-30%) showed least adverse effect over incidence *Sclerocium* rot of chickpea. Regarding effect of level of organic matter on incidence *Sclerocium* rot of chickpea, it was observed that incidence *Sclerocium* rot of chickpea decreases with increase in application dose of organic matter. Lowest incidence of *Sclerocium* rot was observed in neem cake treatment was 5% at 5g/kg soil application of neem cake followed by compost at 15g/kg soil

application was 10%. In case of interaction effect the application of neem cake @ 5g/kg soil was observed effective. Incidence of *Sclerocium* rot was observed at five different stages of crop i.e. seedling, growth, flowering, pod development and physiological maturity stages. Similar result were observed by (Luiz and Rodrigo, 2003),^[1] observed the adverse effect organic amendments i.e. neem cake and compost on Sclerotial germination, mycelial growth of *S. rolfisii* induced disease in pulse crop. The addition of neem cake is the best control of soil-borne disease *Sclerocium* rot in pulses. The effect of organic amendment and fungicide on survival of collar rot fungus of soybean incited by *Sclerocium rolfisii*. He reported that organic amendment reduce the pre-emergence and post-emergence mortality of soybean. He observed that neem cake highly effective against *S. rolfisii* reported by Pawar *et al.* (2014).^[4]

Table 2: Effect of different organic treatment on incidence of *Sclerocium rolfisii* under epiphytotic conditions at different stages of crop (%)

Treatments	Level	Seedling	Growth	Flowering	Pod	Maturity	Total
Neem cake	5g/kg	0	0	0	0	5	5
	10g/kg	0	0	5	0	5	10
	15g/kg	0	0	5	5	5	15
Cotton cake	5g/kg	0	5	10	5	5	25
	10g/kg	0	0	5	5	0	10
	15g/kg	0	0	5	0	5	10
FYM	5g/kg	0	5	10	5	5	25
	10g/kg	0	0	0	5	0	5
	15g/kg	0	0	5	10	0	15
Compost	5g/kg	0	5	0	5	5	15
	10g/kg	0	0	5	0	5	10
	15g/kg	0	0	5	5	0	10
Gypsum	5g/kg	0	5	10	10	5	30
	10g/kg	0	5	10	5	5	25
	15g/kg	0	5	5	5	5	20
Poultry	5g/kg	0	5	0	5	5	15
	10g/kg	0	5	5	5	5	20
	15g/kg	0	0	10	10	0	20
Soybean cake	5g/kg	0	5	10	10	5	30
	10g/kg	0	5	5	5	0	15
	15g/kg	0	0	5	5	5	15
Castor cake	5g/kg	0	5	10	10	5	30
	10g/kg	0	5	10	0	5	20
	15g/kg	0	0	10	10	5	25
Safflower cake	5g/kg	0	5	10	10	10	35
	10g/kg	0	5	5	0	5	15
	15g/kg	0	5	10	10	10	35
Vermicompost	5g/kg	0	5	0	5	5	15
	10g/kg	0	5	10	0	0	15
	15g/kg	0	0	5	10	0	15
G.nut cake	5g/kg	0	5	10	5	5	25
	10g/kg	0	5	5	5	5	20
	15g/kg	0	5	5	0	5	15
control		0	10	10	10	10	40
		0	10	10	15	10	45
		0	10	10	10	10	40
Treatments							

SE(\pm)		0	3.66	3.31	3.40	3.79	3.59
CD@5%		0	5.91	5.38	5.73	6.20	NS
CD@1%		0	8.02	7.21	7.69	8.33	NS
Levels							
SE(\pm)		0	1.91	1.73	1.77	1.98	1.88
CD@5%		0	2.49	2.69	2.86	3.10	5.38
CD@1%		0	4.01	3.61	3.84	4.16	NS
Interactions							
SE(\pm)		0	6.35	5.74	5.88	6.57	6.23
CD@5%		0	10.35	9.31	9.93	10.75	NS
CD@1%		0	13.89	12.50	13.32	14.42	NS

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