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RESEARCH ARTICLE :

Influence of organic amendments and bioagents on development of wilt and collar rot of chickpea (*Cicer arietinum* L.)

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SUMMARY : The present study was carried out on wilt (*Fusarium oxysporum.* f.sp. *ciceri)* and collar rot (*Sclerotium rolfsii)* in chickpea in the field for their management using organic amendments such as karanj cake, vermi-compost, neem cake and a bio-agent *i.e. T. viride*. Among the different treatments combination of Neem cake + *Trichoderma viride* was found to be most effective in reducing wilt and collar rot. Higher yield was obtained in soil amendment with neem cake and seed treated with *Trichoderma viride.* Population of *Trichoderma viride* was evaluated and maximum cfu developed in the treatment of neem cake + *Trichoderma viride.*

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KEY WORDS :
Bioagents, Chickpea, Management, Organic amendment, Treatment

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BACKGROUND AND OBJECTIVES

Chickpea (*Cicer arietinum* L.) is a member of sub family, papilionaceae (family - *leguminaceae*) originated from middle East, subsequently spread to 45 countries having arid/semi arid and sub tropical environment. There are two main types of chickpea recognized as desi small size brown colour seed which accounts nearly for 90 per cent and kabuli with bold creamy seeds is grown in about 10% of the total area. The crop suffers from a number of soil borne diseases like dry root rot (*Rhizoctonia solani*), wet root rot (*Rhizoctonia bataticola*), collar rot (*Sclerotium rolfsii*) and wilt (*Fusarium oxysporum* f. sp. *ciceri*). *Fusarium* wilt and collar rot are serious diseases of the crop and cause considerable damage to the crop. Nema and Khare (1973) observed damage to be upto 61% at seedling stage and 43% at flowering stage. Similarly, early wilting reduced the seed number/plant and caused more yield losses than late wilting (Haware and Nene, 1980). Chand and Singh (2005) conducted experiments to find out the most effective bio agents for eco-friendly management of wilt in chickpea incited by *F.o* f. sp. *ciceri*. Among 3 bio agents (*Trichoderma viride*, *Gliocladium virens* and *T. harzianum*) evaluated, seed treatment with *T. viride* was found highly effective and giving 77.8 per cent

control. Due to soil born nature of pathogens its not easy to manage the disease by applying a single practice. Therefore, in the present investigation management of both the soil borne diseases was undertaken by applying organic amendments along with native strain of *Trichoderma*.

RESOURCES AND METHODS

Studies were carried out on the biological management of soil borne diseases of chickpea (*Cicer arietinum* L.) in the field. The influence of organic amendments and bioagents was studied on development of wilt and collar rot in addition to population dynamics of the bioagent. The materials used included soil samples, isolates of *Trichoderma,* ingredients of culture media, diseased plant samples, glasswares, equipments, chemicals and a few miscellaneous articles. Diseased chickpea plants exhibiting typical symptoms of collar rot and wilt were collected from the field of research experiment at the site of Cropping System Research Project, The samples were placed in a clean bel jar at room temperature (22-28°C) in the laboratory. The diseased specimens were examined in the laboratory and isolations were periodically made to obtain the pure culture of *S. rolfsii* and *F.o*. f. sp. *ciceri.* Seeds of chickpea variety JG-62 were used in the present investigation, obtained from the Cropping System Research Project and Regional Pulse Project, College of Agriculture, Indore. Different types of organic amendments such as neem cake, karanj cake and vermi-compost were procured from local market. A 1:1000 solution of $HgCl_2$ was prepared and used for surface sterilization of samples during isolation of the pathogen. Two culture media, namely, potato dextrose agar and *Trichoderma* selective medium TSM were used during the course of investigation. Standard "Borosil" make glass wares like Petri dishes, beakers, funnels, pipettes, Erlenmeyer flask, culture tubes, measuring cylinder etc. were used during the course of study. Equipments used during the investigation included research microscope, refrigerator, autoclave, hot air oven, BOD incubator, laminar air flow, weighing balance, LPG gas burner, Bunsen burner, hot plate etc. Small instruments like Inoculation needle, scalpel, razor, glass cavity slides, polythene bags, desiccators, glass marking pencils, cover slips, brush, dropper, match box etc. were also used during the study.

Methods:

The glass wares were cleaned by dipping them in cleaning solution for 15 minutes and rinsed with running tap water for 30 minutes. The Petridishes were sterilized in a hot air oven at 180 ± 1^0 C for 1½ -2 hours. The inoculation needle and other metallic instruments were sterilized by dipping them in alcohol and heating red hot over the flame of the Bunsen burner or spirit lamp.

The pathogen *Fusarium oxysporum* f. sp. *ciceri* and *S. rolfsii* were isolated from vascular tissues of diseased plants by time segment method and later purified by hyphal tip method and maintained on potato dextrose agar slants. The affected portions of diseased plants were collected and cut with the help of a sharp razor and rinsed with sterile water to remove traces of dirt. These were pretreated by dipping in 1:1000 mercuric chloride solution for one minute and then washed twice with sterile water. These pieces were transferred aseptically on to the sterilized Petri dishes containing solidified PDA in a laminar air flow. The petri dishes were incubated at 25 ± 1^oC. The appearing fungus was observed after 72 hours and isolations were made form developing colonies for further studies.

Experimental design : Randomized Block Design (RBD)

No. of treatments : 8

T_1 - *Trichoderma* sp.(@ 10^{-7} cfu ml^{-1})

T_2 – Neem cake (@ 2.50 q/ha)+ *Trichoderma* sp. (@ 10^{-7} cfu ml^{-1})

T_3 - Neem cake (@ 2.50 q/ha)

T_4 – Vermi-compost (@ 2.50 q/ha) + *Trichoderma* sp. (@10^{-7} cfu ml^{-1})

T_5 - Vermi-compost (@ 2.50 q/ha)

T_6 – Karanj cake (@ 2.50 q/ha

T_7 – Karanj cake (@ 2.50 q/ha) + *Trichoderma* sp. (@10^{-7} cfu ml^{-1})

T_8 – Control

Replications	: 3
Total No. of plots	: 24 (8 x 3)
Plot size	: 1.8 m x 2 m
R X R spacing	: 30 cm
P X P spacing	: 10 cm
Seed rate	: 80 kg/ha
Crop	: Chickpea
Variety	: JG-62

Observations on the incidence of wilt and collar rot of chickpea were recorded by the formula :

$$\text{Disease incidence (\%)} = \frac{\text{No. of plants exhibiting wilt or collar rot}}{\text{Total number of plants observed}} \times 100$$

After sowing observations on the germination were recorded and root growth was measured on 10 random plants at flowering. At maturity the plot yield was recorded. Statistical analysis for Randomized Block Design on incidence, CRD for effect of soil dilution method, were employed and critical differences were workout at 5% probability level. The values were transformed by x "+0.5 and angular transformation wherever necessary.

OBSERVATIONS AND ANALYSIS

Studies were carried out on the biological management of soil borne diseases of chickpea (*Cicer arietinum* L.) in the field. The Influence of organic amendments and bio-agents was studied on development of wilt and collar rot and to assess the population dynamics of the bio-agent .Henis (1965) found that maximum number of sclerotia of *S. rolfsii* were produced under sub-optimal conditions for mycelial growth on an agar medium or in sterilized soil amended with wheat bran. Poddar *et al.* (2004) reported the growth of isolates of *F.o*.f.sp. *ciceri* was inhibited by the antagonists. The antagonistic potential of *Trichoderma* spp. was determined against *Fusarium oxysporum*.f.sp. *ciceri* but the three isolates (*T. harzianum, T. viride* and *T. hamalum*) exhibited variation] in their response to sensitivity as antagonist.

Wilt :

The data of Table 1 revealed that the minimum (21.33) wilt incidence recorded in Neem cake @ 2.50q/ ha+*Trichoderma viride* @10^{-7} cfu ml^{-1}seed (T_2) followed by (T_7) Karanj cake @ 2.50 q/ha+*Trichoderma viride* @10^{-7} cfu ml^{-1} (23.43), (T_4) Vermi-compost (@ 2.50q/ ha+ *Trichoderma viride* @10^{-7} cfu ml^{-1} (26.6), (T_1) *Trichoderma viride* @ 10^{-7} cfu ml^{-1} (28.36), (T_3) Neem cake @ 2.50 q/ha (29.16), (T_6) Karanj cake @ 2.50q/ha (30.43), (T_5) Vermi-compost @ 2.50 q/ha (31.3) statistically treatments T_2, T_4, T_6,and T_7 equally inhibited

Table 1 : Influence of organic amendments and bioagents on development of wilt and collar rot

Treatments	Wilt incidence (%)	Collar rot incidence (%)
T_1-*Trichoderma viride* (@ 10^{-7} cfu ml^{-1})	22.6(28.36)*	7.32(15.73)
T_2-Neem cake (@ 2.50q/ha)+*Trichoderma viride*(@ 10^{-7} cfu ml^{-1})	13.33(21.33)	5.51(13.50)
T_3-Neem cake(@2.50 q/ha)	23.71(29.16)	13.41(21.46)
T_4-Vermi-compost (@ 2.50q/ha)+ *Trichoderma viride* (@10^{-7} cfu ml^{-1})	20.00(26.60)	7.10(15.40)
T_5-Vermi-compost (@ 2.50 q/ha)	27.00(31.30)	14.10(22.50)
T_6- Karanj cake (@ 2.50 q/ha)	25.78(30.43)	14.06(22.00)
T_7-Karanj cake (@ 2.50 q/ha)+*Trichoderma viride* (@10^{-7} cfu ml^{-1})	15.8(23.43)	6.15(14.33)
T_8- Control	38.76(38.50)	22.81(28.53)
S.E. ±	1.04	0.95
C.D. (P=0.05)	5.40	4.94

*Values given in parenthesis are angular transformed

Analysis of variance of Table 1 (Column 1)

S.V.	D.F.	S.S.	M.S.S.	F cal.	F tab.
Replication	2	1.3258333	0.6629167	0.3628042	3.74
Treatment	7	580.82667	82.975238	45.411083	2.77
Error	14	25.58	1.8272024		
Total	23				

Analysis of variance of Table 1 (Column 2)

S.V.	D.F.	S.S.	M.S.S.	F cal.	F tab.
Replication	2	0.4058333	0.2029167	0.0931192	3.74
Treatment	7	577.565	82.509286	37.863804	2.77
Error	14	30.51	2.1791071		
Total	23				

the wilt incidence. The maximum disease incidence of wilt was recorded in control *i.e.* 38.5 per cent exhibiting significant differences with other treatments. Thus, growing chickpea with neem cake + *T. viride* or karanj cake + *T. viride* resulted in significant reduction of wilt incidence.

Collar rot :

The data of Table 1 revealed that the minimum (13.50) collar rot incidence recorded in (T_2) neem cake (@ 2.50q/ha+*Trichoderma viride* @10 $^{-7}$ cfu ml^{-1}seed followed by (T_7) karanj cake (@ 2.50 q/ha+*Trichoderma viride* @10^{-7} cfu ml $^{-1}$ (14.33), (T_4) vermi-compost (@ 2.50q/ha+ *Trichoderma viride* @10 $^{-7}$ cfu ml $^{-1}$ (15.40), (T_1) *Trichoderma viride*.@ 10 $^{-7}$ cfu ml $^{-1}$ (15.73), (T_3) neem cake @2.50 q/ha (21.46), (T_6) karanj cake @ 2.50q/ ha (22.00), (T_5) vermi-compost @ 2.50 q/ha (22.50) furrow application of neem cake, karanj cake and vermi-compost simultaneously. Seed priming with *Trichoderma viride*, equally inhibited the collar rot incidence.

The maximum incidence of collar rot was recorded in control *i.e.* 28.53 exhibiting significant differences with other treatments Thus, growing chickpea with furrow application of neem cake or karanj cake followed by seed priming with *T. viride* resulted in reduction of collar rot incidence.

Among the different treatments the integration of *T. viride* with neem cake proved to be most effective in reducing the disease incidence followed by karanj cake+*T. viride*. This suggested that *T. viride* was most effective in controlling wilt and collar rot as compared to the other treatments in combinations. Mandhare and Suryawanshi (2003) also reported that soil application of *T. harzianum* one week before sowing followed by seed treatment was found to be most effective in reducing wilt and collar rot of chickpea. Christopher *et al.* (2008) suggested the management of dry root rot of chickpea by the integration of antagonists (*Trichoderma virens*) and organic amendments. The antagonistic potential of *T. viride* was presently studied against *Fusarium oxysporum* f. sp. *ciceri* and *Sclerotium rolfsii* and it was found to be more potent against *F*usarium *oxysporum* .f.sp. *ciceri*. Sonawane and Pawar (2001) studied antagonism between F.o.f.sp. ciceri and *T. viride*, *T. harzianum* and *Aspergillus awamori in vitro* in dual culture. The present findings are on the basis of one year experimentation and need further confirmation through field and laboratory studies on organic amendments and Extensive work is needed on selection of more potent strains of bio-agents against wilt and collar rot.

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