

# Evaluation of botanicals and bioagents to record the root, shoot length and vigour index of chickpea

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## ABSTRACT

Effect of six botanicals plants extract, one fungicide and three bio-agents were studied on seed germination and seedling vigour index in chickpea (var. chaffa-816). A pot culture experiment was conducted to record the pre and post-emergence seedling mortality caused by three pathogens *Fusarium oxysporum* f. sp. *ciceri*, *Rhizoctonia bataticola*, *Sclerotium rolfsii*, in *in vitro*. Maximum germination, shoot length, root length and seedling vigour index recorded in carbendazim followed by *Trichoderma viride* and *Azadirachta indica*. Lowest pre and post-emergence seedling mortality recorded in Carbendazim followed by *Trichoderma viride*, *Azadirachta indica*, *Eucalyptus spp.*

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## INTRODUCTION

Chickpea [*Cicer arietinum* (L.)] is leguminous pulse crop which belongs to leguminaceae family. It was first domesticated in Middle East and is widely cultivated in world. It is third most important legume crop in world after beans and peas. It is first important pulse crop in India being grown on largest area in *Rabi* season.

The major fungal diseases are wilt complex caused due to *Fusarium oxysporum* f. sp. *ciceri*, *Rhizoctonia bataticola*, *Sclerotium rolfsii*, *Colletotrichum blight*, *Alternaria blight*, *Aschochyta blight*, Botrytis, gray mold and stunt etc.

Chickpea wilt, root rot and collar rot caused by *Fusarium oxysporum* f.sp. *ciceri*, *Rhizoctonia*

*bataticola*, *Sclerotium rolfsii* (Nene, 1985) is the most serious and challenging diseases, which causes severe yield loss *i.e.* 60-70 per cent under favourable conditions. It was, therefore, the present study was conducted to study the soil borne fungi of chickpea.

## MATERIAL AND METHODS

### Isolation of pathogen:

Wilt complex pathogen *Fusarium oxysporum* f.sp. *ciceri*, *Rhizoctonia bataticola*, *sclerotium rolfsii* (Dastur, 1935) were isolated by plating the infected cut piece of roots and stem of chickpea plant on potato dextrose agar (PDA) medium after surface sterilization with 0.1 per cent, mercuric chloride (HgCl<sub>2</sub>) solution.

After seven days pathogens were isolated and transferred on PDA for growth. Pathogenicity test were confirmed by inoculating the respective pathogens mass multiplied on sand sorghum medium in soil.

### Plant extract preparation :

The procedure for preparation of aqueous plant extract (w/v basis) was as followed by (Sarvamangala *et al.*, 1993) required quantity of selected plant leaves were placed in mercuric chloride (HgCl<sub>2</sub> 0.1%) solution for 2 min. and thoroughly washed with sterilized distilled water by three washing, equal weight of plant leaves and volume of water was grinded in mortar and pestle, then filtered through double layered muslin cloth to remove fibrous and suspended material, thus filtrate prepared were treated as 100 per cent concentration from this extracts required concentration of botanicals were made by adding sterilized water.

### Paper towel method :

Seeds of chaffa-816 treated with different botanicals at different concentration such as 5 per cent, 10 per cent, 20 per cent and bioagents at 5 per cent filtrate as per-treatment detail and root, shoot length, vigour index and germination percentage recorded and analysed statistically.

The vigour index analysed by using the following formula.

$$\text{SVI} = \frac{\text{Per cent seed germination (shoot length in cm + root length in cm)}}{100}$$

SVI = Seedling vigour index.

### Pot culture experiments :

Inoculum of test pathogens *viz.*, *Fusarium*

*oxysporum* f. sp. *ciceri*, *Rhizoctonia bataticola* and *Sclerotium rolfsii* multiplied separately on sorghum grain medium and mixed in upper 15 cm soil at the rate of 10 gram per kg of soil per pot. seeds soaked in different concentration (5%, 10%, 20%) of leaf extract of Ghaneri, Tulus, Nilgiri, Sadafuli, *Neem*, Korphad and seed treated with bioagents such as *Trichoderma viride*, *Trichoderma harzianum*, *Pseudomonas fluorescence* and chemical carbendazim as per the treatment were sown.

### Details of experiments :

Duration of experiments	:	Oct 2010 – Feb. 2011
Design	:	CRD
Treatment	:	Eleven
Replication	:	Three
Season	:	Rabi
Variety	:	Chaffa-816.

## RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

### Botanicals :

The result on germination, shoot and root length, seedling vigour index, seedling mortality when seed treated with plant extract, bioagents at different concentration are tabulated in Table 1(A), Table 1(B), Table 1(C) and significant were noticed on all the parameter over control .

It is evident from the Table 1(A), Table 1(B), Table 1(C) that all the treatment significantly affected germination and shoot and root length seedling vigour

Treatment details		
Treatments	Common name	Chickpea seed soaked in concentration %
<i>Lantana camera</i>	<i>Ghaneri</i>	5%, 10%, 20% leaf extract
<i>Ocimum sanctum</i>	<i>Tulsi</i>	5%, 10%, 20% leaf extract
<i>Eucalyptus</i> spp.	<i>Nilgiri</i>	5%, 10%, 20% leaf extract
<i>Vinca rosea</i>	<i>Sadafuli</i>	5%, 10%, 20% leaf extract
<i>Azadirachta indica</i>	<i>Neem</i>	5%, 10%, 20% leaf extract
<i>Alove vera</i>	<i>Korphad</i>	5%, 10%, 20% leaf extract
<i>Trichoderma viride</i>		5% culture filtrate
<i>Trichoderma harzianum</i>		5% culture filtrate
<i>Pseudomonas fluorescens</i>		5% culture filtrate
Carbendazim		0.1%
Control		

**Table 1(A) : Effect of seed treatment with botanicals and bioagents on var. chaffa- 816**

Sr. No.	Treatment (Concentration %.)	% Germination	Per cent seedling mortality						Shoot length	Root length	Seedling vigour index
			<i>F. oxysporum</i> f.sp.ciceri		<i>Rhizoctonia bataticola</i>		<i>Sclerotium rolfsii</i>				
			Pre-emer.	Post-emer.	Pre-emer.	Post-emer.	Pre-emer.	Post-emer.			
1.	<i>Lantana camara</i> (5%)	86.00 (68.12)*	13.95 (3.73)**	6.75 (2.59)**	12.79 (3.57)**	5.33 (2.30)**	10.46 (3.23)**	2.59 (1.60)**	4.60	8.20	1100.8
2.	<i>Ocimum sanctum</i> (5%)	85.00 (67.21)*	15.29 (3.91)**	8.33 (2.88)**	14.11 (3.75)**	6.84 (2.61)**	11.76 (3.42)**	4.00 (2.00)**	4.40	8.15	1066.75
3.	<i>Eucalyptus</i> spp. (5%)	87.00 (68.87)*	12.64 (3.55)**	7.89 (2.80)**	11.49 (3.38)**	6.49 (2.54)**	9.19 (3.03)**	3.79 (1.94)**	4.70	8.25	1126.65
4.	<i>Vinca rosea</i> (5%)	85.00 (67.21)*	16.47 (4.05)**	9.85 (3.13)**	15.29 (3.91)**	8.33 (2.88)**	12.94 (3.59)**	5.40 (2.32)**	4.50	8.20	1088.00
5.	<i>Azadirachta indica</i> (5%)	88.00 (69.73)*	10.22 (3.19)**	5.06 (2.24)**	9.09 (3.01)**	3.75 (1.93)**	7.95 (2.81)**	2.46 (1.56)**	4.80	8.60	1179.20
6.	<i>Aloea vera</i> (5%)	83.00 (65.65)*	18.07 (4.25)**	10.29 (3.20)**	16.86 (4.10)**	8.69 (2.94)**	14.45 (3.80)**	5.63 (2.37)**	4.20	8.10	1020.90
7.	<i>Trichoderma viride</i> (5% filtrate)	92.00 (73.57)*	7.60 (2.75)**	2.35 (1.53)**	6.52 (2.55)**	2.32 (1.52)**	5.43 (2.33)**	2.29 (1.51)**	5.30	9.10	1324.80
8.	<i>Trichoderma harzianum</i> (5% filtrate)	90.00 (71.56)*	11.11 (3.33)**	6.25 (2.5)**	10.00 (3.16)**	4.93 (2.22)**	8.88 (2.97)**	3.65 (1.91)**	4.80	8.30	1179.00
9.	<i>Pseudomonas fluorescens</i> (5% filtrate)	91.00 (72.54)*	8.79 (2.96)**	7.22 (2.68)**	7.69 (2.77)**	4.76 (2.18)**	6.59 (2.56)**	3.52 (1.87)**	5.10	8.90	1274.00
10.	Carbendazim (0.1%)	94.00 (75.82)*	6.38 (2.52)**	3.40 (1.84)**	5.31 (2.30)**	2.24 (1.49)**	4.25 (2.06)**	2.22 (1.48)**	5.50	9.70	1428.80
11.	Control	80.00 (63.44)*	20.00 (4.47)**	12.50 (3.53)**	18.75 (4.33)**	10.70 (3.27)**	17.50 (4.18)**	10.60 (3.25)**	3.30	8.00	904.00
	F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.			Sig.
	S.E.±	0.57	0.17	0.04	0.17	0.03	0.05	0.02			7.62
	C.D.(P= 0.01)	1.69	0.69	0.11	0.69	0.08	0.15	0.07			30.87

\* Arc sine values, \*\* square root values

index over control. Maximum germination was recorded with carbendazim 94.00 per cent present results corroborates with the investigation of Sarkar and Saxena (2007) who found that seed treatment with thiram reduced seed mycoflora, retaining viability, germination and improved seedling vigour index significantly. Among bioagents *Trichoderma viride* recorded germination as 92.00 per cent followed by *Pseudomonas fluorescens* 91.00 per cent. Among botanicals *Azadirachta indica* superior over all the treatments recorded maximum germination per cent at 5 per cent, 10 per cent, 20 per cent concentration such as 88.00 per cent, 90.00 per cent 92.00 per cent, respectively followed by *Eucalyptus* spp. It recorded germination per cent at 5 per cent, 10 per cent, 20 per cent such as 87.00 per cent, 89.00 per cent, 92.00 per cent, respectively.

Maximum shoot and root length was measured in carbendazim shoot length 5.50 cm and root length 9.70 cm. followed by *Trichoderma viride* shoot length 5.30

cm and root length 9.10 cm, *Azadirachta indica* at 20 per cent concentration shoot length 5.28 cm and root length 9.09 cm as regards seedling vigour index carbendazim proved best 1428.80 was found significantly superior to other treatments *Trichoderma viride* has 1324.8 seedling vigour index and among botanicals *Azadirachta indica* @ 20 per cent concentration has 1322.04 seedling vigour index followed by *Eucalyptus* spp. 1318.36. Singh and Agarwal (1986) reported beneficial effects of fungicides in improving germination of soybean and Patil (1987) in gram. There was significant increase in shoot and root length in fungicidal treatment over untreated control. These observation are conformity with reports of Srivastava and Tripathi (1998) in sugarbeet, Solanke *et al.* (2001) in chilli and Prajapati *et al.* (2003) in chickpea.

Pot experiment was performed for pre and post-seedling mortality in soil inoculated three pathogen viz., *Fusarium oxysporum* f. sp. *ciceri*, *Rhizoctonia*

**Table 1 (B) : Effect of seed treatment with botanicals and bioagents on var. chaffa- 816**

Sr. No.	Treatment. (Concentration %.)	% germination	Per cent seedling mortality						Shoot length	Root length	Seedling vigour index
			<i>F. oxysporum</i> f.sp.ciceri		<i>Rhizoctonia bataticola</i>		<i>Sclerotium rolfsii</i>				
			Pre-emer.	Post-emer.	Pre-emer.	Post-emer.	Pre-emer.	Post-emer.			
1.	<i>Lantana camara</i> (10%)	88.00 (69.73)*	12.50 (3.53)**	5.19 (2.27)**	11.36 (3.37)**	3.84 (1.95)**	9.09 (3.01)**	2.50 (1.58)**	4.70	8.25	1139.60
2.	<i>Ocimum sanctum</i> (10%)	87.00 (68.87)*	13.79 (3.71)**	6.66 (2.58)**	12.64 (3.55)**	5.26 (2.29)**	10.34 (3.21)**	2.56 (1.60)**	4.65	8.22	1119.69
3.	<i>Eucalyptus</i> spp. (10%)	89.00 (70.63)*	11.25 (3.35)**	6.32 (2.51)**	10.11 (3.17)**	5.00 (2.23)**	7.86 (2.80)**	2.43 (1.55)**	4.81	8.50	1184.59
4.	<i>Vinca rosea</i> (10%)	86.00 (68.03)*	15.11 (3.88)**	8.21 (2.86)**	13.95 (3.73)**	6.75 (2.59)**	11.62 (3.40)**	3.94 (1.98)**	4.50	8.20	1092.20
5.	<i>Azadirachta indica</i> (10%)	90.00 (71.56)*	8.88 (2.97)**	3.65 (1.91)**	7.77 (2.78)**	2.40 (1.54)**	6.66 (2.58)**	2.38 (1.54)**	5.20	8.95	1273.50
6.	<i>Aloea vera</i> (10%)	85.00 (67.21)*	16.47 (4.05)**	8.45 (2.90)**	15.29 (3.91)**	6.94 (2.63)**	12.94 (3.59)**	4.05 (2.01)**	4.48	8.18	1076.10
7.	<i>Trichoderma viride</i> (5% filtrate)	92.00 (73.57)*	7.60 (2.75)**	2.35 (1.53)**	6.52 (2.55)**	2.32 (1.52)**	5.43 (2.33)**	2.29 (1.51)**	5.30	9.10	1324.80
8.	<i>Trichoderma harzianum</i> (5% filtrate)	90.00 (71.56)*	11.11 (3.33)**	6.25 (2.5)**	10.00 (3.16)**	4.93 (2.22)**	8.88 (2.97)**	3.65 (1.91)**	4.80	8.30	1179.00
9.	<i>Pseudomonas fluorescens</i> (5% filtrate)	91.00 (72.54)*	8.79 (2.96)**	7.22 (2.68)**	7.69 (2.77)**	4.76 (2.18)**	6.59 (2.56)**	3.52 (1.87)**	5.10	8.90	1274.00
10.	Cabendazim (0.1%)	94.00 (75.82)*	6.38 (2.52)**	3.40 (1.84)**	5.31 (2.30)**	2.24 (1.49)**	4.25 (2.06)**	2.22 (1.48)**	5.50	9.70	1428.80
11.	Control	80.00 (63.44)*	20.00 (4.47)**	12.50 (3.53)**	18.75 (4.33)**	10.70 (3.27)**	17.50 (4.18)**	10.60 (3.25)**	3.30	8.00	904.00
	F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.			Sig.
	S.E.±	0.57	0.17	0.04	0.17	0.01	0.60	0.17			7.71
	C.D. (P=0.01)	1.69	0.69	0.15	0.69	0.05	2.39	0.70			30.77

\* Arc sine values, \*\* square root values

*bataticola*, *Sclerotium rolfsii* where seed treated with different concentration of botanicals as 5 per cent, 10 per cent, 20 per cent and bioagents used as 5 per cent filtrate and seedling mortality recorded after seven days (pre emergens) and seedling mortality recorded after 21 days (post-emergence) after sowing are tabulated in Table 1A, B and C. From Table 1A, B and C data revealed that lowest pre and post-emergence seedling mortality was recorded in carbendazim treatment similar results were investigated by Solanke *et al.* (2001) in chilli, Raut *et al.* (1980) in sorghum, Bharathi and Raut (2009) in rice, Shukla (1980) in triticale, Singh and Agrawal (1986) in soybean, Hedge and Hiremath (1987) in cowpea in case of soil inoculated *Fusarium oxysporum* f.sp. *ciceri*, *Rhizoctonia bataticola*, *Sclerotium rolfsii*. Carbendazim treatment recorded lowest pre and post-emergence seedling mortality such as 6.38 per cent pre and 5.31 per cent post, 5.31 per cent pre and 2.24 per cent post, 4.25 per cent pre and 2.22 per cent post,

respectively.

Carbendazim was found to be superior over all treatment (Sindhan and Katwasra, 2002.) followed by *Trichoderma viride* recorded lowest pre and post-emergence seedling mortality in *Fusarium oxysporum* f. sp. *ciceri*, *Rhizoctonia bataticola*, *Sclerotium rolfsii* such as 7.60 per cent pre and 2.35 per cent post, 6.52 per cent pre and 2.32 per cent post, 5.43 per cent pre and 2.29 per cent post, respectively. Similar results were obtained by Lokesh and Hiremath (1988) in red gram and in chilli and Ramanathan and Sivaprakasam (1992).

Among botanicals lowest pre and post emergence seedling mortality was recorded in *Azadirachta indica* at 20 per cent concentration in soil inoculated *Fusarium oxysporum* f. sp. *ciceri*, *Rhizoctonia bataticola*, *Sclerotium rolfsii*. *Azadirachta indica* at 20 per cent concentration recorded 7.60 per cent pre and 3.52 per cent post, 7.60 per cent pre and 2.35 per cent post, 6.52 per cent pre and 2.32 per cent post, respectively.

**Table 1 (C) : Effect of seed treatment with botanicals and bioagents on var. chaffa- 816**

Sr. No.	Treatment. (Concentration %.)	% germination	Per cent seedling mortality						Shoot length (cm)	Root length (cm)	Seedling vigour index
			<i>F. oxysporum</i> f.sp.ciceri		<i>Rhizoctonia bataticola</i>		<i>Sclerotium rolfsii</i>				
			Pre-emer.	Post-emer.	Pre-emer.	Post-emer.	Pre-emer.	Post-emer.			
1.	<i>Lantana camara</i> (20%)	90.00 (71.56)*	11.11 (3.33)**	3.70 (1.92)**	10.00 (3.16)**	2.46 (1.56)**	8.88 (2.97)**	2.43 (1.55)**	5.20	9.05	1282.50
2.	<i>Ocimum sanctum</i> (20%)	89.00 (70.63)*	12.35 (3.51)**	5.12 (2.26)**	11.23 (3.35)**	3.79 (1.94)**	10.11 (3.17)**	2.50 (1.58)**	5.15	9.00	1259.35
3.	<i>Eucalyptus</i> spp. (20%)	92.00 (73.57)*	8.69 (2.94)**	3.57 (1.88)**	8.69 (2.94)**	3.57 (1.88)**	7.60 (2.75)**	2.35 (1.53)**	5.25	9.08	1318.36
4.	<i>Vinca rosea</i> (20%)	87.00 (68.87)*	14.94 (3.86)**	8.10 (2.84)**	12.64 (3.55)**	5.26 (2.29)**	11.49 (3.38)**	3.89 (1.97)**	5.10	8.90	1218.00
5.	<i>Azadirachta indica</i> (20%)	92.00 (73.57)*	7.60 (2.75)**	3.52 (1.87)**	7.60 (2.75)**	2.35 (1.53)**	6.52 (2.55)**	2.32 (2.32)**	5.28	9.09	1322.04
6.	<i>Aloea vera</i> (20%)	87.00 (68.87)*	14.94 (3.86)**	6.75 (2.59)**	13.79 (3.71)**	5.33 (2.30)**	12.64 (3.55)**	3.94 (1.98)**	4.48	8.18	1101.42
7.	<i>Trichoderma viride</i> (5% filtrate)	92.00 (73.57)*	7.60 (2.75)**	2.35 (1.53)**	6.52 (2.55)**	2.32 (1.52)**	5.43 (2.33)**	2.29 (1.51)**	5.30	9.10	1324.80
8.	<i>Trichoderma harzianum</i> (5% filtrate)	90.00 (71.56)*	11.11 (3.33)**	6.25 (2.5)**	10.00 (3.16)**	4.93 (2.22)**	8.88 (2.97)**	3.65 (1.91)**	4.80	8.30	1179.00
9.	<i>Pseudomonas flurosecens</i> (5% filtrate)	91.00 (72.54)*	8.79 (2.96)**	7.22 (2.68)**	7.69 (2.77)**	4.76 (2.18)**	6.59 (2.56)**	3.52 (1.87)**	5.10	8.90	1274.00
10.	Cabendazin (0.1%)	94.00 (75.82)*	6.38 (2.52)**	3.40 (1.84)**	5.31 (2.30)**	2.24 (1.49)**	4.25 (2.06)**	2.22 (1.48)**	5.50	9.70	1428.80
11.	Control	80.00 (63.44)*	20.00 (4.47)**	12.50 (3.53)**	18.75 (4.33)**	10.70 (3.27)**	17.50 (4.18)**	10.60 (3.25)**	3.30	8.00	904.00
	F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.			Sig.
	S.E. ±	0.57	0.02	0.04	0.17	0.19	0.05	0.02			7.98
	C.D.(P=0.01)	1.69	0.08	0.15	0.69	0.73	0.15	0.08			31.84

\* Arcsine values, \*\* square root values

Chaudhari *et al.* (2002) reported beneficial effect of *Azadirachta indica* in soybean.

*Azadirachta indica* treatment followed by *Eucalyptus* spp. @ 20 per cent concentration it also recorded lowest pre and post-emergence mortality in *Fusarium oxysporum* f. sp. *ciceri* i.e. 8.69 per cent pre and 3.57 per cent post in *Rhizoctonia bataticola* it was 8.69 per cent pre and 3.57 per cent post and in case of *Sclerotium rolfsii* it was recorded as 7.60 pre and 2.35 per cent post.

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★ ★ ★ ★ ★ 9<sup>th</sup> Year of Excellence ★ ★ ★ ★ ★