PROJECT REPORT

Project Title

Bioefficacy and Phytotoxicity of TRICHOSTAR (*TRICHODERMA VIRIDE)*

Funded by

Super Pesticides & Agro (I) Pvt. Ltd.
Kolkata

Submitted by

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Uttarakhand, India

Project: Bioefficacy and phytotoxicity of Trichostar (*Trichoderma viride*)

NAME AND ADRESS OF SPONSORER	:	M/s. Super Pesticides & Agro (I) Pvt. Ltd., 168/2 Lenin Sarani, Kolkata
Product Tested	:	*Trichoderma viride* 1% w/w Formulation (TRICHOSTAR)
BATCH NO.		06.07.10.TS 7
MANUFACTURING DATE		20.10.2006
Name of the institution	:	G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India
Study reported by		Dr. U. S. Singh, Nodal Scientist, Quality Control Biofertilizers & Biopesticides
Conducted by		Dr. Najam Waris Zaidi Senior Research Fellow (Entomology)
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EXPERIMENT 1: EFFECT OF TRICHOSTAR APPLIED AS SEED TREATMENT ON ORGANICALLY CULTIVATED CHICKPEA

MATERIALS & METHODS

Treatments:-

		Dosages:
TRICHOSTAR	:	2 g/kg seed
TRICHOSTAR	:	4 g/kg seed
TRICHOSTAR	:	6 g/kg seed
TRICHOSTAR	:	8 g/kg seed
TRICHOSTAR	:	10 g/kg seed
Untreated control	:	
Crop	:	Chickpea var. avarodhi
Design	:	RBD
Replicate	:	4
Crop season	:	*Rabi* (2006-2007)
Plot size	:	5 x 4 M^2
Date of sowing	:	09.11.06

Location: Organic Block, SPC, Pantnagar

Methodology

TRICHOSTAR (*Trichoderma viride)* @ 2, 4, 6, 8, & 10 g per kg was applied as seed treatment. Required amount of Trichostar was suspended in 50 ml water to which 1 kg chickpea seed was added and mixed thoroughly. Treated seeds were air dried and sown in field.

Observations were recorded on grain yield, phytotoxicity and effect on natural enemies.

RESULTS

There was no incidence of either root rot and wilt or foliar diseases under field condition. In spite of this seed treatment with Trichostar significantly enhanced chickpea yield as compared to control. Probably it was because of growth promotary effect of the *T. virens*. As shown in Table 1 seed treatment with Trichostar @ 6, 8, and 10 g/kg were at par with each other and significantly superior over control and lower dosages of Trichostar. In view of this observation treatment of chickpea seed with Trichostar @ 6 to 8 g per kg is recommended.

Phytotoxicity

Seed treatment with any of the dosages up to 10 g/kg or two sprays of TRICHOSTAR (*Trichoderma viride)* formulation @ 5 kg/ha, at 10 days interval, did not show any phytotoxicity.

Effect on Natural Enemies

Seed treatment with TRICHOSTAR (*Trichoderma viride),* at any dosage, did not show any adverse effect on the population of natural enemies associated with the pest of chickpea.

Table-1: Bio-efficacy of TRICHOSTAR (*T. viride)* against organically cultivated **chickpea**

Sl	Treatment	Dosage (g/kg seed)	Yield (Q/ha)*
1.	TRICHOSTAR –T1	2	8.2b
2.	TRICHOSTAR - T2	4	8.8bc
3.	TRICHOSTAR -T3	6	9 2cd
4.	TRICHOSTAR - T4	8	9.8d
5.	TRICHOSTAR - T5	10	9.7d
6.	Untreated control	0	7.4a

*Means in a column followed by same letter(s) are not significantly different from each other at *P*=0.05

Table-2 Phytotoxicity of TRICHOSTAR (*Trichoderma viride)* on **chickpea.**

Sl	Treatment	Dosage	Leaf injury on tips and surface	Vein clearing	Wil-ting	Necro-sis	Epin-asty	Hypo-nasty
Seed treatment								
1	Trichostar	2 g/kg	NIL	NIL	NIL	NIL	NIL	NIL
2	Trichostar	4 g/kg	NIL	NIL	NIL	NIL	NIL	NIL
3	Trichostar	6 g/kg	NIL	NIL	NIL	NIL	NIL	NIL
4	Trichostar	8 g/kg	NIL	NIL	NIL	NIL	NIL	NIL
5	Trichostar	10 g/kg	NIL	NIL	NIL	NIL	NIL	NIL
Foliar spray								
2.	Trichostar	1000 gha^{-1}	NIL	NIL	NIL	NIL	NIL	NIL
3.	Trichostar	1500 gha^{-1}	NIL	NIL	NIL	NIL	NIL	NIL
4.	Trichostar	2000 gha^{-1}	NIL	NIL	NIL	NIL	NIL	NIL
5.	Trichostar	2500 gha^{-1}	NIL	NIL	NIL	NIL	NIL	NIL
5.	Trichostar	5000 gha^{-1}	NIL	NIL	NIL	NIL	NIL	NIL
.	Untreated control	-	NIL	NIL	NIL	NIL	NIL	NIL

Experiment 2: Bioefficacy of TRICHOSTAR Against Organically cultivated vegetable pea

Materials & Methods

Crop: Vegetable pea cv. Arkel

Date of Sowing : 7.11.06

Plot size : 10 x 4 m^2

Seed treatment (ST) : @ 6 g/kg seed

Foliar sprays (FS): 2 at 10 days interval

Location: Organic Block, SPC, Pantnagar

Treatments:-

		Dosages:
T1 - Trichostar	:	6 g/kg ST
T2 – Trichostar	:	6 g/kg ST + 500 gha^{-1} FS
T3 - Trichostar	:	6 g/kg ST + 1000 gha^{-1} FS
T4 - Trichostar	:	6 g/kg ST + 1500 gha^{-1} FS
T5 - Trichostar	:	6 g/kg ST + 2000 gha^{-1} FS
T6- Trichostar	:	6 g/kg ST + 2500 gha^{-1} FS
T7 - Untreated control		

Replication	:	3
Design	:	RBD
Crop season	:	Rabi (2006-07)
Spray volume	:	500 l/ha.

Methodology :-

TRICHOSTAR (*Trichoderma viride)* was applied as seed treatment @ 6 g/kg seed. Pea crop raised from treated seeds or untreated seeds (control) were given two sprays, at 10 days interval, with different dosages of Trichostar (i.e.@ 500, 1000, 1500, 2000, 2500 g per ha).

Observation were recorded on rust severity & grain yield (kg per ha). Effect of Trichostar on natural enemies and phytotoxicity was also recorded 10 days after second spray.

Results:-

All plots treated with TRICHOSTAR resulted in significantly lower rust incidence and higher grain yield as compared to control. Seed treatment with Trichostar @ 6 g/kg followed by two foliar sprays @ 1500 g/ha was superior over lower dosages of the bioagents and was at par with higher dosages of foliar spray (Table 3). Therefore, use of Trichostar @ 6 g/kg seed treatment plus two foliar sprays @ 1500 g/ha may be recommended for organically cultivated vegetable pea.

Phytotoxicity:

Two sprays of TRICHOSTAR (*Trichoderma viride)* formulation, at 10 days interval, did not show any phytotoxicity even up to 5 kg per ha dose on pea (Table 4).

TRICHOSTAR (*Trichoderma viride)* formulation @ 6 g/kg seed treatment + two foliar sprays 1.5 kg/ha, beginning with the appearance of the disease, can be recommended for the control of rust in pea.

Effect on Natural enemies

Any of the above treatments with TRICHOSTAR (*Trichoderma viride)* did not show any adverse effect on the population of natural enemies associated with the pest of pea.

Table 3: Effect of seed treatment along with foliar application of Trichostar on rust incidence and yield of organically cultivated pea (var. Arkel)

SN	Treatments	Rust Severity	Yield (kg/ha)
1	T1 (6 g/kg ST)	18.5 (4.3)*	290.4
2	T2 (6 g/kg ST + 500 gha^{-1} FS)	14.8 (3.8)	310.0
3	T3 (6 g/kg ST + 1000 gha^{-1} FS)	11.5 (3.4)	340.6
4	T4 (6 g/kg ST + 1500 gha^{-1} FS)	9.1 (3.0)	360.5
5	T5 (6 g/kg ST + 2000 gha^{-1} FS)	6.8 (2.6)	358.9
6	T6 (6 g/kg ST + 2500 gha^{-1} FS)	7.3 (2.7)	378.5
7	T7 (Control)	26.0 (5.1)	156.8
CD (p≤0.05)		(0.4)	25.4
CV		5.2	6.6

*Values in parenthesis or square root transformed.

Table-4 Phytotoxicity of TRICHOSTAR (*Trichoderma viride)* on pea**.**

Sl	Treatment	Trichostar Dosage	Leaf injury on tips and surface	Vein clearing	Wil-ting	Necro-sis	Epin-asty	Hypo-nasty
1.	T1	500 g/ha.	NIL	NIL	NIL	NIL	NIL	NIL
2.	T2	1000 g/ha	NIL	NIL	NIL	NIL	NIL	NIL
3.	T3	1500 g/ha	NIL	NIL	NIL	NIL	NIL	NIL
4.	T4	2000 g/ha	NIL	NIL	NIL	NIL	NIL	NIL
5.	T5	2500 g/ha	NIL	NIL	NIL	NIL	NIL	NIL
6	T6	5000 g/ha	NIL	NIL	NIL	NIL	NIL	NIL
7.	Untreated control	-	NIL	NIL	NIL	NIL	NIL	NIL

EXPERIMENT 3: EFFECT OF TRICHOSTAR APPLIED AS SEED TREATMENT AND FOLIAR SPRAY ON LENTIL

MATERIALS & METHODS

Treatments:-

		Dosages:
TRICHOSTAR	:	4 g/kg seed
TRICHOSTAR	:	6 g/kg seed
TRICHOSTAR	:	8 g/kg seed
TRICHOSTAR	:	8 g/kg seed + 2 Foliar spray @ 1 kg/ha
TRICHOSTAR	:	8 g/kg seed + 2 Foliar spray @ 1.5 kg/ha
TRICHOSTAR	:	8 g/kg seed + 2 Foliar spray @ 2.0 kg/ha
TRICHOSTAR	:	10 g/kg seed
Untreated control	:	
Crop	:	Lentil var. PL-5
Design	:	RBD
Replicate	:	4
Crop season	:	Rabi, (2006-2007)
Plot size	:	10 x 4 M^2

Location: Pantnagar Rural Bioresource Center, Bhagwanpur, Udham Singh Nagar, Uttarakhand

METHODOLOGY

TRICHOSTAR (*Trichoderma viride)* @ 4, 6, 8, & 10 g per kg was applied as seed treatment. Two foliar applications of TRICHOSTAR @ 1.0, 1.5 and 2.0 kg/ha, at 10 days interval beginning with the appearance of rust, were applied on crop raised from 8.0 g/kg treated seeds. For seed treatment required amount of Trichostar was suspended in 50 ml water to which 1 kg lentil seed was added and mixed thoroughly. Treated seeds were air dried and sown in field.

Observations were recorded on grain yield. Phyto-toxicity was recorded periodically.

RESULTS

As shown in Table 5 number of lentil plants per unit area was significantly higher at all dosages of seed treatment with Trichostar as compared to control. However, there was no significant difference in 6, 8 and 10 g/kg seed treatment dosages. All the dosages of seed treatment significantly reduced rust incidence and increased yield of lentil as compared to control. However, seed treatment with foliar spray was more effective. Seed treatment @ 8 g/kg followed by two sprays of Trichostar @ 1.5 kg/ha was most effective in reducing rust incidence and increasing lentil yield.

Phytotoxicity

Seed treatment with any of the dosages up to 10 g/kg or two sprays of TRICHOSTAR (*Trichoderma viride)* formulation @ 5 kg/ha, at 10 days interval, did not show any phytotoxicity (Table 6)

Effect on Natural Enemies

Seed treatment with TRICHOSTAR (*Trichoderma viride)* or its foliar application, at any dosage, did not show any adverse effect on the population of natural enemies associated with the pest of lentil.

Table 5: Effect of TRICHOSTAR (*Trichoderma viride*) on seed stand and rust of lentil

Treatments (Trichostar)	Seedlings/row	Rust intensity (%)	Yield (kg/ha)
4 g/kg ST	117	49.0	575.3
6 g/kg ST	123	43.6	600.3
8 g/kg ST	128	42.5	609.8
8 g/kg ST + 1 kg/ha FS	134	34.4	678.4
8 g/kg ST + 1.5 kg/ha FS	129	21.6	701.5
8 g/kg ST + 2 kg/ha FS	136	23.0	698.2
10 g/kg ST	138	44.0	596.0
Control	90	63.0	578.8
CD (p=0.05)	22	11.0	37.4

Table-6 Phytotoxicity of TRICHOSTAR (*Trichoderma viride)* on **lentil**

Sl	Treatment	Dosage	Leaf injury on tips and surface	Vein clearing	Wil-ting	Necro-sis	Epin-asty	Hypo-nasty
Seed treatment								
1	Trichostar	4 g/kg	NIL	NIL	NIL	NIL	NIL	NIL
2	Trichostar	6 g/kg	NIL	NIL	NIL	NIL	NIL	NIL
3	Trichostar	8 g/kg	NIL	NIL	NIL	NIL	NIL	NIL
4	Trichostar	10 g/kg	NIL	NIL	NIL	NIL	NIL	NIL
ST (@ 8 g/kg) + Foliar spray								
2.	Trichostar	1000 gha^{-1}	NIL	NIL	NIL	NIL	NIL	NIL
3.	Trichostar	1500 gha^{-1}	NIL	NIL	NIL	NIL	NIL	NIL
4.	Trichostar	2000 gha^{-1}	NIL	NIL	NIL	NIL	NIL	NIL
5.	Trichostar	5000 gha^{-1}	NIL	NIL	NIL	NIL	NIL	NIL
.	Untreated control	-	NIL	NIL	NIL	NIL	NIL	NIL