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Compatibility of thiamethoxam with *Trichoderma harzianum*

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ABSTRACT: **Laboratory experiment was conducted to study the compatibility of Thiamethoxam 70WS with growth and sporulation of *Trichoderma harzianum*. There was no inhibition of mycelial growth of *T. harzianum* in all the concentrations except at 1.25 percent. The spore count was 1x10^4 spores/ ml at seven days after inoculation of *Trichoderma*. The reduction in the radial growth of *Rhizactonia solani* was 40.2 percent in presence of *T. harzianum* whereas no inhibition was observed in thiamethoxam at 10g/kg seed. In combination with thiamethoxam at 2.85g/kg seed+*Trichoderma*, 4.28g/kg seed+*Trichoderma* and 10g/kg seed+*Trichoderma*, the reduction in radial growth of *R. solani* was 37.3, 35.95 and 32.4 percent, respectively. The study indicated that it is possible to use *Trichoderma* @ 4g/kg seed and thiamethoxam 10g/kg seed as seed treatment, which find a place in the integrated insect pest and disease management.**

KEY WORDS: Bioefficacy, compatibility, *Rhizoctonia solani*, seed treatment, thiamethoxam, *Trichoderma*

Potential species of *Trichoderma* have been extensively used by the plant pathologists due to their high efficacy, broad-spectrum activity and ease in isolation and mass multiplication. The abundance of *Trichoderma* in various soils, coupled with their ability to degrade various organic substrates in soil, their metabolic versatility and their resistance to microbial inhibitors, suggests that they possess the ability to survive in many ecological niches depending on prevailing conditions and the strain involved (Papavizas, 1985; Sundarababu, 1998).

Combined application of fungus biocontrol agent with insecticide may result either in synergism/antagonism between the two, an approach considered promising but little studied. With this view, a laboratory study was conducted on effect of new chemical Thiamethoxam 70WS, similar to imidacloprid belonging to Chloronicotinyl group, on growth and sporulation of *Trichoderma harzianum*, which could in future be recommended as a possible combination in IPM programme for the management of insect pests and root rot disease in cotton.

MATERIAL AND METHODS

a. Effect of thiamethoxam on growth and sporulation of *T. harzianum*

The poisoned food technique was followed in this experiment. 100 ml of sterilized Potato

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Dextrose Agar (PDA) medium was amended with thiamethoxam 70 WS to get 0.10, 0.25, 0.50, 0.75, 1.00 and 1.25 percent concentration and mixed thoroughly under aseptic condition. PDA medium without thiamethoxam served as control. The media was poured in to the sterilized Petri-dishes and after solidification, a 10mm disc of five days old *T. harzianum* was transferred to the center of the plate and the plates were incubated at 27±1° C in an incubator. The radial growth of *T. harzianum* was measured at every 12 hours interval from 36 hours after inoculation. Percent inhibition of growth over control was calculated using the formula given by Vincent (1927). Angular transformation was carried out and data were analyzed statistically.

$$I = \frac{100(C-T)}{C}$$ where,

I = Percent inhibition

C = Growth of *Trichoderma* in unamended medium
T = Growth of *Trichoderma* in amended medium

The spore count was recorded using haemocytometer on 7, 14, 21 and 28 days after inoculation and the results were expressed in number of spores per ml.

b. Effect of thiamethoxam and *T. harzianum* on *Rhizoctonia solani*

Seeds treated with thiamethoxam at 2.85, 4.28 and 10g/kg seed in combination with *T. harzianum* at 4g/kg seed and thiamethoxam at 10g/kg seed alone and *T. harzianum* at 4g/kg seed alone were tested for their efficacy on *Rhizoctonia solani*.

PDA supplemented with streptomycin sulphate (100 ppm) was poured to the sterile Petri-plates and allowed to solidify. The treated cotton seeds were placed on PDA at four places near the periphery of the Petri-dishes. At the centre of the plate, a 10mm disc of root rot causing organism, *R. solani* was placed in all the treatments *and* plates were kept for incubation at 27±1°C. The untreated cotton seeds served as control. The growth of *R. solani* was measured after 72 hours. Percent inhibition of growth of pathogen was calculated by using the formula given by Vincent (1927). Angular transformation was carried out and data were analyzed statistically. Critical difference values were calculated at one percent probability level and the treatment mean values of experiment were compared using Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

a. Effect on growth

It is clear from the Table1 that there was a significant difference among the different concentrations of thiamethoxam. Inhibitory effect of thiamethoxam showed decreasing trend from 36 to 72 hours after treatment. Thiamethoxam (1.25%) inhibited the growth of *Trichoderma* to the maximum extent (42.80%) and remained superior to other treatments. However, thiamethoxam at 0.1 to 0.75 percent were found on par with each other and the least inhibition (14.2) was recorded at 0.1 percent concentration. At 36 hours of inoculation, there was inhibition of mycelial growth of *T. harzianum* in all the treatments except 1.25 percent concentration, which recorded 23.3 percent inhibition after 72hours of inoculation and differed statistically with rest of the treatments. So, it is observed that Thiamethoxam 70WS had no inhibitory effect on the growth of *T. harzianum* after 72 hours and up to 1 percent concentration. This indicated that there was no drastic reduction of radial growth at 1.25 percent concentration, which is more than the recommended dose for field application (Table 1).

a. Effect on sporulation

On 7th day of inoculation, highest number of spores of 17.25 X 10^3 was recorded in untreated control and found significantly superior over thiamethoxam treatments. Thiamethoxam at 0.10 percent recorded 13.75 X 10^3 spores followed by 0.25 percent dosage treatment (12.1 X 10^3) that was on par with 0.5 percent dosage treatment (10.95 X 10^3). Lowest number of spores of 10 X 10^3 was observed in higher dosage of 1.25 percent, which

Table 1. Effect of Thiamethoxam 70 WS on the growth and sporulation of *Trichoderma harzianum*

Tr. No.	Treatment (%)	Percent inhibition of growth				Spore yield (X 10^3/ml) DAI			
		36h	48h	60h	72h	7	14	21	28
1	Thiamethoxam (0.1)	14.2(22.14)^c	2.2 (8.43)^d	0.0 (0.0)^c	0.0 (0.0)^b	13.8b	11.8^b	24.0^b	19.0^b
2	Thiamethoxam (0.25)	14.7(22.55)^c	16.4 (23.89)^c	0.0 (0.0)^c	0.0 (0.0)^b	12.1^c	11.1^b	22.8^c	16.9^c
3	Thiamethoxam (0.50)	15.2(22.95)^c	17.4 (24.65)^c	0.0 (0.0)^c	0.0 (0.0)^b	10.9^{cd}	9.8^c	21.2^d	15.5^{cd}
4	Thiamethoxam (0.75)	16.2(23.75)^c	25.9 (30.62)^b	0.0 (0.0)^c	0.0 (0.0)^b	10.8^d	9.7^c	19.9e	14.3^{de}
5	Thiamethoxam (1.0)	29.1(32.61)^b	28.9 (32.48)^b	18.1 (25.1)^b	0.0 (0.0)^b	10.3^d	9.1^{cd}	17.4^f	13.2^e
6	Thiamethoxam (1.25)	42.8(40.86)^a	39.0 (38.65)^a	29.8 (33.1)^a	23.3 (28.9)^a	10.0^d	8.6^d	17.0^f	13.3^e
7	Untreated Control	–	–	–	–	17.3^a	46.5^a	54.2^a	76.2^a

DAI= Days After Inoculation

Means denoted by the same letter on each column are not statistically different by (P=0.01) DMRT.

* Figures in the parentheses are angular transformed values.

remained on par with the treatments T_3 (10.95 X 10^3), T_4 (10.8 X 10^3) and T_5 (10.3 X 10^3).

After 21 days of treatment, highly significant difference was observed between treatments with respect to number of spores. Highest spores of 54.20 X 10^3 were observed in untreated control and least was observed in higher dosage treatment (T_6), which recorded 17X 10^3 spores. It is observed that chemical did not inhibit completely the sporulation of *T. harzianum* (Table 1).

h Effect on *R. solani*

The reduction in the radial growth of the *R. solani was* 40.2 percent in *T. harzianum* alone treatment while there was no inhibition of pathogen in Thiamethoxam at 10 g/kg per seed alone (Table 2). In combination with Thiamethoxam at 2.85 g/kg seed + *Trichoderma,* 4.28 g/kg seed + *Trichoderma* and 10 g/kg seed + *Trichoderma,* the reduction in the radial growth of the *R. solani* was 37.30, 35.95 and 32.40 percent, respectively. The reduction in the radial growth of the pathogen was less in insecticide plus *Trichoderma* combinations as compared to *Trichoderma* alone treatment. This effect may be because of thiamethoxam treatment at one percent dosage, which affected the growth of

T. harzianum to an extent of 10 percent after 60 hours and no effect after 72 hours of inoculation. Thiamethoxam showed inhibition only for short time (72h) up to one percent concentration and its compatibility with *Trichoderma* suggest to use the chemical with antagonistic fungi for the management of sucking pests and seedling diseases. Kumar (1998) reported that there was significant reduction of radial growth and sporulation of *T. viride* when tested at 7000 ppm of imidacloprid. Further imidacloprid and *Trichoderma* combination was effective against *Macrophomina phaseolina* (Tassi), a root rot causing pathogen in cotton.

Table 2. Effect of Thiamethoxam 70 WS on the bioefficacy of *Trichoderma harzianum*

Tr. No.	Treatment	Percent inhibition of pathogen
1	Thiamethoxam @ 2.85 g/kg +*Trichoderma viride* @ 4g/kg	37.30 (37.64)[b]
2	Thiamethoxam @ 4.28 g/kg +*Trichoderma viride* @ 4g/kg	35.95 (36.84)[b]
3	Thiamethoxam @ 10 g/kg +*Trichoderma viride* @ 4g/kg	32.40 (34.69)[c]
4	*Trichoderma viride* @ 4g/kg alone	40.20 (39.24)[a]
5	Thiamethoxam @ 10 g/kg alone	0.00 (0.00)[d]
6	Untreated Control	0.00 (0.00)[d]

Means denoted by the same letter on each column are not statistically different by (P=0.01) DMRT.
* Figures in the parentheses are angular transformed values.

The laboratory studies conducted have clearly indicated that Thiamethoxam showed lesser effect on *T. harzianum*. Hence, it is possible that *T. harzianum* can be used along with thiamethoxam as seed treatment as one of the tools for the management in integrated insect pest and disease management.

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