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Evaluation of thiamethoxam 70% WS as seed treatment against early sucking pests of tomato

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Abstract: The present investigation was carried out at Vegetable Research Centre, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand during the 2013 and 2014 to evaluate the effectiveness of thiamethoxam, used as seed treatment against the sucking insects of tomato. The seed treatment with thiamethoxam protected tomato seedlings from aphids and thrips at the early season from the onset of seed planting. There was a fast initial effect against the pests then gradually decreased to reach a moderate effect. Data revealed that Thiamethoxam 70% WS @ 4.2 g a.i./kg of seed showed the significant pest reduction followed by Thiamethoxam 70% WS @ 3.85 g a.i./kg of seed. Highest yield was recorded by Thiamethoxam 70% WS @ 4.2 g a.i./kg of seed (28.25 t/ha) closely followed by Thiamethoxam 70% WS @ 3.85 g a.i./kg of seed (25.00 t/ha) as compared to untreated check (20.91t/ha). Percent increase in yield over control was highest (35.10%) in Thiamethoxam 70% WS @ 4.2 g a.i./kg of seed followed by Thiamethoxam 70% WS @ 3.85 g a.i./kg of seed (19.56%). The percent reductions of predators by Thiamethoxam, used as seed treatment, in both the seasons ranged from 1.65- 2.58% which was very minimum. Hence, it was concluded that the seed treatment of tomato with Thiamethoxam 70% WS @ 4.20 g a.i/kg of seed reduced the early season insect-pests (aphid and thrips) and had very less effect of natural enemies population as compared to control and also increased the fruit yield significantly than other treatments.

Keywords: Seed treatment, Sucking insects, Thiamethoxam, Tomato

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is one of the most popular and widely grown vegetable crop of both tropics and subtropics of the world, belonging to the family Solanaceae. It is grown for its edible fruit and is an esteemed source of vitamin A and C. In the world, tomato is cultivated over an area of 46.15 lakh hectares with an annual production of 1279.9 lakh tones with the productivity of 27.73 tons/ha. In India, it occupies an area of about 5.35 lakh hectares producing over 93.62 lakh tonnes with the productivity of 17.5 tons/ha (Anonymous, 2006). Its productivity could even be higher if this crop would not be susceptible to the attack of a large number of insects and microorganisms (Franca and Branco, 1987). Sap sucking pests are the most damaging at early developing stage of the tomato crop. The aphid, *Myzus persicae* and thrips, *Frankliniella sp.* are worldwide distributed insect pests causing both direct and indirect damage to tomato at early stage (Blackman and Eastop, 2000). Besides direct damage, they are the major source of transmission of viral infection in tomato crop (Namba and Sylvester, 1981).

The indiscriminate uses of insecticides lead to development of resurgence and resistance in insects. So these days, there is a need to search for newer chemicals that are selective and eco-friendly which can replace older spurious chemicals on tomato. New chemistries that can be rotated with existing chemistries to delay development of resistance, or that are effective against a broader range of vectors would be a valuable addition to existing management tools (Siebert *et al.*, 2012). Newer, low-dose, efficient synthetic agrochemicals such as neonicotinoids have been introduced for use in integration with other management practices. These have established themselves worldwide as key components in insect control programmes because of their unique properties, such as broad-spectrum activity, low use rates, systemic activity and flexible application methods. 2,3 Thiamethoxam is presently one of the most effective chemicals for the control of sucking pests such as aphids, whiteflies, thrips, some micro lepidoptera and a number of coleopteran species. The compound shows contact as well as exceptional systemic activity and is recommended for soil, foliar and seed treatments in most agricultural crops all over the world (Moser and Obrycki, 2009; Uneme, 2011).

However, seed treatment with insecticides to control crop pest has several advantages over soil and foliar application of insecticides because of its low cost, less pollution, selectivity and least interference in the natural equilibrium. Therefore, keeping the above information in view, present investigation was carried out to study the effect of seed treatment with Thiamethoxam 70% WS on the early sucking pests i.e. thrips and aphids of tomato under field conditions.

MATERIALS AND METHODS

Field experiment was laid out at Vegetable Research Centre, G .B. Pant University of Agriculture & Technology, Pantnagar, U.S. Nagar, Uttarakhand during 2013-2014 in a randomized block design to assess the bio efficacy of Thiamethoxam 70% Water Soluble (WS) against early season sucking pest complex *viz.* Aphids and Thrips of Tomato. The plot size was 50 m^2 in which spacing was maintained at 50 × 50 cm and the treatments were replicated three times. There was an untreated check without seed treatment. Insecticide Thiamethoxam 70% WS used for seed treatment at different doses; however Imidacloprid 70%WS used @ 3.5g ai/kg of seed. Seeds of tomato were treated with WS formulations. In the WS formulation, 1 part of material mixed thoroughly with 2 parts of water to provide uniform seed coating. Azadiractin 5% Neem extract concentrate was applied as spray on 21 days after sowing (DAS) and second one at ten days interval using 400 L water/ha/spay. Treatment details are as given below:

Trial No.	Product	Dose (g a.i./ kg of seed)	Product dose (ml/g per kg of seed)
1.	Thiamethoxam 70%WS (Seed treatment)	3.15	4.50
2.	Thiamethoxam 70%WS (Seed treatment)	3.50	5.00
3.	Thiamethoxam 70%WS (Seed treatment)	3.85	5.50
4.	Thiamethoxam 70%WS (Seed treatment)	4.20	6.00
5.	Thiamethoxam 70%WS (Seed treatment)	8.40	12.00
6.	Imidacloprid 70% WS (Seed treatment)	3.50	5.00
7.	Azadiractin 5% Neem extract concentrate	-	200 ml/ha
8.	Untreated Control	-	-

Data on pest population were recorded at 21st, 28th, 35th, 42th and 49th day after sowing of treated seeds. The observations were recorded on 10 randomly selected plants which were tagged in each plot leaving the border rows. The thrips and aphid population of both nymphs and adults were counted during early morning hrs on 5 leaves of top, middle & bottom canopy from each tagged plant and data on numbers of insects were subjected to following rating scale:

For aphid: 0= Nil; 1= 1-5; 2 = 6-20; 3 = 21-50, 4 =51-100 and 5 => 100.

For thrips: 0 = nil; 1= 1-5; 2 = 6-20; 3 = 21-100 and 4 => 100

The data on sucking pests and natural enemies were complied and averages were worked out in different treatments. Cumulative yield leaving aside border rows were also recorded. The data thus obtained and yields were subjected to analysis of variance after making necessary transformation (square root transformation) except in case of yield (Gomez and Gomez, 1984). Percent yield increased over control was calculated by using following formula:

Yield increase over control = [T – C/ C]× 100

Where, T = Yield of respective treatment; C = Yield of control

RESULTS AND DISCUSSION

Effect of seed treatment of Thiamethoxam 70% WS on sucking pests viz., aphids and thrips is given in tables 1 and 2, respectively. In the first season, it was observed that all the treated plots showed significant reduction of the pest population. But Thiamethoxam 70% WS @ 4.20 g a.i./kg of seed as seed dressing gave the best result followed by Thiamethoxam 70% WS @ 3.85 g a.i./kg of seed when entire pest complex was considered and significant difference was recorded in between these two treatments both in efficacy and yield increase. However, these two treatments gave significantly better performances to check for controlling the aphid and thrips population, the yield increase is also correlated with the performance of the treatments and the highest yield was obtained in the treated plots with Thiamethoxam 70% WS applied @ 4.20 g a.i./kg of seed. This treatment was found significant with standard chemical in terms of insect-pest control as well as in increasing the yield. Azadiractin 5% Neem gave lowest protection against aphid and thrips in tomato. More or less similar trend was observed during the second season. Again, the best result was obtained with the plots treated with Thiamethoxam 70% WS @ 4.20 g a.i./kg as seed as seed dressing and it was significantly superior over all other treatments The highest yield was also obtained with this treatment. Again Azadiractin 5% Neem gave lowest performance. Gore *et al.* (2010) also reported that the lowest incidence of aphids per 5 cm shoot length was recorded for thiamethoxam (0.005%).

Thiamethoxam 70% WS was found to be very soft to predators found in association with pests like aphid and thrips of tomato (Table 3). The % reductions of predatory population were vary from 1.65- 2.58% which was very minimum in both the seasons. Dhaka *et al.* (2009) was also found Thiamethoxam as the safer insecticide to the predators like coccinellids.

Yield data presented in table 4 revealed that during the

Table 1. Effect of different treatment schedules of Thiamethoxam 70% WS against aphids of tomato during 2013-14.

S. N.	Treatments	Dose in ga.i./ kg of seed (ml/mg / kg of seed)	Scoring of aphid (0-5 scale) at different days after sowing (DAS)					Mean score
			21 DAS	28 DAS	35 DAS	42 DAS	49 DAS	
1.	Untreated check	-	2.22 (1.54)*	2.78 (1.72)	3.59 (1.95)	3.98 (2.05)	4.15 (2.09)	3.34
2.	Thiamethoxam 70%WS	3.15 (4.50)	0.59 (0.78)	0.80 (0.91)	1.31 (1.16)	1.77 (1.32)	2.07 (1.44)	1.30
3.	Thiamethoxam 70%WS	3.50 (5.00)	0.48 (0.70)	0.69 (0.84)	1.19 (1.11)	1.58 (1.25)	1.89 (1.37)	1.17
4.	Thiamethoxam 70%WS	3.85 (5.50)	0.36 (0.61)	0.47 (0.70)	0.67 (0.83)	0.94 (0.96)	1.17 (1.08)	0.72
5.	Thiamethoxam 70%WS	4.20 (6.00)	0.27 (0.53)	0.37 (0.60)	0.47 (0.69)	0.63 (0.78)	0.78 (0.88)	0.50
6.	Imidacloprid 70% WS	3.50 (5.00)	0.53 (0.53)	0.72 (0.86)	1.25 (1.13)	1.64 (1.28)	1.97 (1.40)	1.22
7.	Azadiractin 5% Neem extract concentrate	(200 ml/ha)	0.73 (0.87)	1.32 (1.17)	1.89 (1.25)	2.37 (1.54)	2.96 (1.71)	1.85
	C.D at 5 %		0.05	0.06	0.06	0.05	0.06	-

*All the values in parentheses are square root transformed values.

Table 2. Effect of different treatment schedules of Thiamethoxam 70% WS against thrips of tomato during 2013-14.

S. N.	Treatments	Dose in g a.i./kg of seed (ml/mg / kg of seed)	Scoring of Thrips (0-4 scale) at different days after sowing (DAS)					Mean score
			21 DAS	28 DAS	35DAS	42 DAS	49 DAS	
1.	Untreated check	-	1.62 (1.47)*	2.30 (1.58)	2.50 (1.64)	2.62 (1.67)	2.75 (1.70)	2.36
2.	Thiamethoxam 70%WS	3.15 (4.50)	0.76 (0.83)	1.35 (1.17)	1.78 (1.35)	2.00 (1.41)	2.34 (1.53)	1.65
3.	Thiamethoxam 70%WS	3.50 (5.00)	0.57 (0.76)	0.79 (0.90)	1.29 (1.15)	1.68 (1.29)	2.09 (1.44)	1.29
4.	Thiamethoxam 70%WS	3.85 (5.50)	0.47 (0.69)	0.65 (0.81)	0.88 (0.95)	1.01 (1.00)	1.27 (1.12)	0.86
5.	Thiamethoxam 70%WS	4.20 (6.00)	0.32 (0.57)	0.50 (0.71)	0.67 (0.82)	0.83 (0.90)	0.99 (0.99)	0.66
6.	Imidacloprid70% WS	3.50 (5.00)	0.62 (0.80)	0.87 (0.94)	1.51 (1.25)	1.79 (1.33)	2.10 (1.45)	1.38
7.	Azadiractin 5% Neem extract concentrate	(200 ml/ha)	0.82 (0.92)	1.37 (1.18)	1.62 (1.29)	1.92 (1.38)	2.29 (1.51)	1.60
	C.D at 5 % level		0.07	0.07	0.05	0.05	0.06	-

*All the values in parentheses are square root transformed values.

Table 3. Effect of different treatment schedules of Thiamethoxam 70% WS on some important natural enemies associated with tomato ecosystem during 2013-14.

S. N.	Treatment	Dose in g a.i./ kg of seed (ml/g / kg of seed)	Average % reduction / increase (+) of natural enemies population on different days after sowing			
			First season (2013)		Second season (2014)	
			Menochilus sp.	*Chrysoperla* sp.	*Menochilus* sp.	*Chrysoperla* sp .
1.	Untreated check	-	+20.33 (0.00)*	+19.54 (0.00)	+22.35 (0.00)	+19.63 (0.00)
2.	Thiamethoxam 70%WS	3.15 (4.50)	2.09 (8.27)	1.72 (7.58)	1.85 (8.01)	1.62 (7.35)
3.	Thiamethoxam 70%WS	3.50 (5.00)	2.36 (8.86)	1.96 (8.09)	2.10 (8.45)	1.82 (7.74)
4.	Thiamethoxam 70%WS	3.85 (5.50)	2.44 (9.02)	2.17 (8.45)	2.29 (8.66)	1.93 (7.98)
5.	Thiamethoxam 70%WS	4.20 (6.00)	2.53 (9.24)	2.29 (8.68)	2.37 (8.83)	2.03 (8.20)
6.	Imidacloprid70% WS	3.50 (5.00)	2.12 (8.39)	1.76 (7.64)	1.90 (8.06)	1.71 (7.53)
7.	Azadiractin 5% Neem extract concentrate	(200 ml/ha)	1.42 (6.89)	1.15 (6.21)	1.36 (6.64)	1.04 (5.86)
	C.D at 5% level		0.20	0.19	0.16	0.18

*All the values in parentheses are angular transformed values; no. of *Menochilus* sp. and *Chrysoperla* sp. varied between 3-6 and 3-4/ten leaves, respectively.

Table 4. Effect of different treatment schedules of Thiamethoxam 70% WS on average fruit yield of tomato.

S. N.	Treatment	Dose in g a.i./ kg of seed (ml/gper kg of seed)	Yield (t/ha)			Per cent increase in yield (over control)
			2013	2014	Mean	
1.	Untreated check	-	21.66	20.17	20.91	-
2.	Thiamethoxam 70%WS	3.15 (4.50)	23.33	22.17	22.75	8.89
3.	Thiamethoxam 70%WS	3.50 (5.00)	24.33	24.00	24.16	15.54
4.	Thiamethoxam 70%WS	3.85 (5.50)	25.66	24.33	25.00	19.56
5.	Thiamethoxam 70%WS	4.20 (6.00)	29.25	27.25	28.25	35.10
6.	Imidacloprid70% WS	3.50 (5.00)	23.66	23.25	23.45	12.15
7.	Azadiractin 5% Neem extract concentrate	(200 ml/ha)	22.55	21.50	22.05	5.45
	C.D at 5%		4.49	4.51	-	-

year first season, 2013 yield varied from 21.66 to 29.25t/ha. The treatment Thiamethoxam 70% WS @ 4.2 g a.i./kg of seed, was found significantly superior over other treatments and control for fruit yield. Highest yield was recorded for this treatment i.e. Thiamethoxam 70% WS @ 4.2 g a.i./kg of seed (29.50t/ha) followed by Thiamethoxam 70% WS @ 3.85 g a.i./kg of seed (25.66t/ha). Lowest yield was recorded in untreated check with 21.66t/ha. During the second season, 2014 yield varied from 20.17 to 27.25t/ha. Only one treatments i.e. Thiamethoxam 70% WS @ 4.2 g a.i./kg of seed, was found significantly superior over other treatment and control for fruit yield. Highest yield was recorded for this treatment i.e. Thiamethoxam 70% WS @ 4.2 g a.i./kg of seed (27.25t/ha). Lowest yield was recorded in untreated check with 20.17t/ha (Table 4). Pooled yield of both the years ranged from 20.91 to 28.25t/ha. Highest yield was recorded by Thiamethoxam 70% WS @ 4.2 g a.i./kg of seed (28.25 t/ha) closely followed by Thiamethoxam 70% WS @ 3.85 g a.i./kg of seed (25.00 t/ha). Lowest yield was observed in untreated check (20.91t/ha). Percent increase in yield over control calculated on the basis of pooled mean ranged from 35.10 to 8.89. It was highest in Thiamethoxam 70% WS @ 4.2 g a.i./kg of seed (35.10) followed by Thiamethoxam 70% WS @ 4.2 g a.i./kg of seed (19.56). Akashe *et al.* (2008) also reported that thiamethoxam 0.005% proved best by recording maximum per cent decline in aphid population and providing the highest yield of 1087 kg/ ha in safflower. Least increase in yield was observed in Azadiractin 5% Neem extract concentrate over control i.e. 5.45 (Table 4).

It is evident from two seasonal studies that Thiamethoxam 70% WS @ 4.20 g a.i/kg of seed reduced the early season insect-pests (aphid and thrips) as compared to control and also increased the fruit yield significantly than other treatments. This treatment was also found superior over standard chemical in terms of pest control as well as significant in increasing the fruit yield. El-Naggar (2006) reported that imidacloprid as well as thiamethoxam were effective against thrips for 7 weeks after planting. Misra (2002) found that thiamethoxam proved significantly superior in controlling aphids and jassids. Dhawan *et al*. (2008) mentioned that thiamethoxam was the most effective against cotton aphids under screen house conditions. El-Zahi and Aref (2011) also found that thiamethoxam and imidacloprid were the most effective against cotton aphids under field conditions.

Conclusion

In the present study seed treatment of tomato with thiamethoxam 70% WS @ 4.2 g a.i. or 6 gm/kg of tomato seeds were found to be most effective against the early season sucking pests i.e aphids and thrips of tomato. Seed treatment of tomato with this insecticide can be incorporated in the IPM package of tomato for the management of early sucking pests.

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