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Bio-efficacy of imidacloprid 600FS as seed treatment against aphid and thrips in cumin

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Abstract

Field trials were conducted at the Seed Spices Research Station, Jagudan for two consecutive seasons, *rabi* 2016-17 and 2017-18, to evaluate the bio-efficacy of different seed treatments against cumin aphid, *Myzus persicae* and thrips, *Scirtothrips dorsalis*. A total of five treatments comprised of imidacloprid 600FS (3g a.i. kg^{-1} seed, 3.6g a.i. kg^{-1} seed and 4.2g a.i. kg^{-1} seed), thiamethoxam 30FS (2.1g a.i. kg^{-1} seed) and untreated control. Imidacloprid 600FS (4.2g a.i. kg^{-1} seed) had recorded to the tune of 26.10, 15.75, 10.46 and 5.95 per cent umbels aphid infestation at 30,40,50 and 60DAS (Days After Sowing), respectively. Imidacloprid 600FS (4.2g a.i. kg^{-1} seed) had recorded the least population of thrips 3.96, 3.65, 2.89 and 2.38 per plant at 30, 40, 50 and 60DAS (Days After Sowing), respectively. Seed treatment with imidacloprid 600FS (4.2g a.i. ha^{-1}) had obtained the highest seed yield of cumin (295 kg ha^{-1}**)** as compared to untreated plots of cumin (160 kg ha^{-1}).

Key words: Bio-efficacy, cumin , *Myzus persicae*, *Scirtothrips dorsalis*, seed treatment.

Introduction

Cumin (*Cuminum cyminum* L.), an important spice crop, is mostly cultivated in the arid regions of Gujarat and Rajasthan states of India. It is frequently affected by diseases and insect pests, which are highly detrimental to its growth and yield. Among them, aphid (*Myzus persicae*), thrips (*Scirtothrips dorsalis*) as well as mites (*Petrobia latens*) are major sucking insect pests which cause serious economic losses in cumin (Kant *et al*., 2010). Among them, cumin aphid is an important sucking pest in cumin growing areas. Both nymphs and adults cause serious damage at flowering stage of the crop due to loss of cell sap, as a result of which yellowing and curling of the leaves is exhibited at the initial stage, later the plants showed stunted growth and the inflorescence set few seeds which are shriveled. In case of severe attack, seed yield of cumin is reduced drastically. Similarly, thrips cause considerable damage and the yield is affected quantitatively and qualitatively.

In order to manage these sucking pests, farmers rely on foliar application of insecticides after their occurrence or pest population crossing economic threshold level in cumin. Under such situation, insecticides of a new group seed treatment chemical emerged most promising, low cost and selective; less polluting with least interference in the natural equilibrium can be used for managing the sucking insect pests. Among them, imidacloprid is a neonicotinoid compound belonging to the chloronicotinyl insecticide which has gut and contact activity against insects (Maienfisch *et al*., 2001). After seed treatment, imidacloprid shows systemic and residual toxicity in several crop plants and interferes with transmission of stimuli or impulses in the nervous system of insect herbivores and gives an excellent control against a wide range of sucking insect pests (Zhang *et al*., 2011). The information on bio-efficacy of seed dresser against cumin aphid and thrips is scattered and scanty in general and particularly from North Gujarat Agro-climatic condition. Hence, the present field experiment on bio-efficacy of various doses of imidacloprid 600FS on cumin as seed treatment for the management of aphid and thrips in cumin was taken up during two consecutive seasons *i.e*., *Rabi* 2016-17 and 2017-18.

Materials and methods

Field experiments were conducted at Seed Spices Research Station, Jagudan, Gujarat for two consecutive seasons during *Rabi* 2016-17 and 2017-18 in a randomized block design to assess the bio-efficacy of imidacloprid 600FS on cumin aphid and thrips. Chemical was supplied by Bayer Crop Science Limited, Mumbai under the trade name of Gaucho 600FS. A total of five treatments comprised of imidacloprid 600FS (3g a.i. kg^{-1} seed, 3.6g a.i. kg^{-1} seed and 4.2g a.i. kg^{-1} seed), thiamethoxam 30FS (2.1g a.i. kg^{-1} seed) and untreated control (Table 1).

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Table1. Details of treatments evaluated against sucking pests of cumin at Jagudan

Trt. No.	Treatments	Dosage kg^{-1} seed		Application Time & Method
		g a.i.	Formulation (ml)	
1.	Untreated control	-	-	Prepare the slurry in a way that chemical + water makes a total volume of 25ml kg^{-1} of seeds. Treat cumin seeds in a polythene bag and air dry in shade before sowing.
2.	Imidacloprid 600FS	3	5	
3.	Imidacloprid 600FS	3.6	6	
4.	Imidacloprid 600FS	4.2	7	
5.	Thiamethoxam 30FS	2.1	7	

The trial was laid out in a randomized block design (RBD) with four replications following all the agronomic practices and fertilizer application as per the package of practices. The row to row distance was 30cm. was maintained during both the seasons. Seed treatment of different dosage of imidacloprid 600FS and thiamethoxam 30FS was applied as per treatments except untreated control. Observations on germination percentage were recorded at 20DAS (Days After Sowing) during both the seasons. Observations on cumin plants in 1 metre row length were recorded at 30DAS (Days After Sowing) during both the seasons. Observations on pest incidence were recorded from five randomly selected plants plot^{-1}. The number of sucking pests *viz*., aphids (*Myzus persicae*) and thrips (*Scirtothrips dorsalis*) were recorded on five plants at 20, 30, 40, 50 and 60 DAS (Days After Sowing). Plot-wise yield of cumin was recorded at harvest and these plot yield data were converted per hectare basis. These data were analyzed for its statistical interpretation with necessary data transformation so as to compare the bio-efficacy of different treatments.

Result and discussion

% Germination at 20DAS

The germination of cumin seed was recorded at 20DAS (Days After Sowing). Perusal of the pooled data presented in Table 2 revealed that there were non - significant differences among different treatments . However, it was varied from 98.00[(thiamethoxam 30FS (2.1g a.i. kg^{-1} seed)] to 98.56[(untreated control; imidacloprid 600FS (3g a.i. kg^{-1} seed)] per cent.

Table 2. Per cent germination in different seed treatments

Trt. No.	Treatments	Dose (g a.i. kg^{-1}seed)	% germination at 20DAS		
			2016-17	2017-18	Pooled
1.	Untreated control	-	98.81	98.31	98.56
2.	Imidacloprid 600FS	3	98.69	98.44	98.56
3.	Imidacloprid 600FS	3.6	98.50	98.06	98.28
4.	Imidacloprid 600FS	4.2	98.75	98.00	98.38
5.	Thiamethoxam 30FS	2.1	98.44	97.56	98.00
	S.Em. ±		0.38	0.34	0.26
	C.D. at 5%		NS	NS	NS
	C.V.%		0.77	0.70	0.73
	YxT				NS

DAS – Days After Sowing; also mention the abbreviation of YxT

Plant count in 1 metre row length

Plant count in 1 metre row length was recorded at 30DAS (Days After Sowing). There were non- significant differences among the different treatments (Table 3). However, it was varied from 16.65 [(imidacloprid 600FS (3.6g a.i. kg^{-1} seed)] to 17.23[(thiamethoxam 30FS (2.1g a.i. kg^{-1} seed)].

Table 3. Plant count in one meter row length in different seed treatments.

Treatments	Dose (g a.i. Kg^{-1} seed)	Plant count in 1 meter row length at 30DAS		
		2016-17	2017-18	Pooled
Untreated control	-	17.10	16.95	17.03
Imidacloprid 600FS	3	16.55	16.85	16.70
Imidacloprid 600FS	3.6	16.60	16.70	16.65
Imidacloprid 600FS	4.2	16.80	16.70	16.75
Thiamethoxam 30FS	2.1	17.20	17.25	17.23
S.Em.±		0.34	0.19	0.20
C.D. at 5%		NS	NS	NS
C.V.%		4.07	2.30	3.30
YxT		—	—	NS

DAS – Days After Sowing; also mention the abbreviation of YxT

Umbels aphid infestation (%)

Two years' data individually as well as the pooled data on per cent umbels aphid infestation were recorded at 20, 30, 40, 50 and 60 DAS presented in table 4. Perusal of the pooled results revealed that all the seed treatments of imidacloprid 600FS were found significantly superior over untreated control. There were non-significant differences in per cent umbels aphid infestation at 20 DAS.Imidacloprid 600FS (4.2g a.i. kg^{-1} seed) had recorded to the tune of 26.10, 15.75, 10.46 and 5.95 per cent umbels aphid infestation at 30, 40, 50 and 60DAS, respectively.

Cumin thrips, Scirtothris dorsalis

Two years' data individually as well as the pooled data on population of thrips per plant were recorded at 20, 30, 40, 50 and 60 DAS presented in table 5. It can be explicated from the pooled data presented in table 5 that all the doses of imidacloprid 600FS were found significantly superior over untreated control against thrips of cumin except 20DAS. Imidacloprid 600FS (4.2g a.i. kg^{-1} seed) had recorded the least population of thrips 3.96, 3.65, 2.89 and 2.38 per plant at 30, 40, 50 and 60DAS, respectively.

Table 4. Per cent umbels aphid infestation in different seed dressing insecticides (Pooled)

Treatments	Dose (g a.i.$^{-1}$ kg seed)	% umbels aphid infestation				
		20DAS	30DAS	40DAS	50DAS	60DAS
Untreated control	-	36.11* (34.72)	36.02* (34.59)	36.12* (34.75)	36.58* (33.85)	36.49* (35.37)
Imidacloprid 600FS	3	35.68 (34.01)	33.11 (29.82)	29.72 (24.59)	24.03 (16.59)	21.07 (12.92)
Imidacloprid 600FS	3.6	36.23 (34.92)	31.83 (27.81)	26.91 (20.49)	22.17 (14.23)	17.39 (8.93)
Imidacloprid 600FS	4.2	35.78 (34.19)	30.72 (26.10)	23.38 (15.75)	18.87 (10.46)	14.12 (5.95)
Thiamethoxam 30FS	2.1	35.98 (34.51)	32.21 (28.41)	27.33 (21.07)	21.42 (13.34)	16.38 (7.96)
S.Em.±		0.45	0.49	0.94	1.16	0.63
C.D. at 5%		NS	1.43	2.75	4.56	1.84
C.V.%		3.55	4.24	9.30	5.94	8.47
YxT		NS	NS	NS	2.13	NS

DAS – Days After Sowing; *Arcsin transformed values; Figures in parenthesis are original values

Table 5. Mean population of thrips in different seed dressing insecticides (Pooled)

Treatments	Dose (g a.i.$^{-1}$ kg seed)	Thrips plant^{-1}				
		20DAS	30DAS	40DAS	50DAS	60DAS
Untreated control	-	3.87*	4.05*	4.22*	4.35*	4.28*
		(14.51)	(15.93)	(17.29)	(18.39)	(17.78)
Imidacloprid 600FS	3	3.77	3.06	2.95	2.92	2.38
		(13.71)	(8.83)	(8.22)	(8.00)	(5.18)
Imidacloprid 600FS	3.6	3.76	2.96	2.68	2.38	2.20
		(13.60)	(8.28)	(6.67)	(5.15)	(4.35)
Imidacloprid 600FS	4.2	3.66	2.11	2.04	1.84	1.70
		(12.90)	(3.96)	(3.65)	(2.89)	(2.38)
Thiamethoxam 30FS	2.1	3.82	2.30	2.22	1.99	1.90
		(14.05)	(4.79)	(4.45)	(3.47)	(3.12)
S.Em. ±		0.06	0.07	0.08	0.09	0.06
C.D. at 5%		NS	0.20	0.24	0.26	0.18
C.V.%		4.19	6.83	8.30	9.18	6.95
YxT		NS	NS	NS	NS	NS

DAS- Days After Sowing; *$\sqrt{X + 0.5}$ transformed values; Figures in parenthesis are original values

Seed yield of cumin (kgha^{-1})

Two years' data individually as well as the pooled data on seed yield of cumin presented in table 6 revealed that the seed yield of cumin differed significantly in two individual years as well as in pooled analysis. Looking to the different seed treatments, the plots treated with imidacloprid 600FS (4.2g a.i. ha^{-1}) had obtained the highest seed yield of cumin (295 kg ha^{-1}**)**. Imidacloprid 600FS (3.6g a.i. ha^{-1}) had exhibited 250 kg ha^{-1} seed yield of cumin. Untreated control plots of cumin gave significantly the lowest seed yield (160 kg ha^{-1}) among all the treatments under testing.

Table 6. Seed yield of cumin in different seed treatments

Treatments	Dose (g a.i. $^{-1}$ kg seed)	Seed yield (kg ha^{-1})		
		2016-17	2017-18	Pooled
Untreated control	-	146	175	160
Imidacloprid 600FS	3	219	250	234
Imidacloprid 600FS	3.6	234	265	250
Imidacloprid 600FS	4.2	280	310	295
Thiamethoxam 30FS	2.1	214	244	229
S.Em. ±		16	23	14
C.D. at 5%		49	72	41
C.V.%		14.65	18.73	17.11
YxT				NS

The present findings confirm the findings of Patel *et al*., (2002) observed that carbosulfan 25EC (0.05%) was found effective in controlling cumin aphid under north Gujarat conditions. More or less similar observations on superiority of carbosulfan 25EC against aphid were also reported by Patil and Patel (2013) on Isabgol crop. Besides these, various research workers reported imidacloprid had been evaluated as seed dressing chemical on different crops *viz*., cotton (Mote *et al*., 1995; Gill *et al*., 1996; Udikeri *et al*., 2007; Zhang *et al*., 2011), blackgram (Shobharani *et al*., 2017), bhendi (Sharma and Karela,1996 ; Sreenivas and Nargund, 2006).Thus, the present findings corroborate the earlier reports. In past,Vadodaria *et al*., 2001 and Zhang *et al*.,

2011 who reported thiamethoxam 70WS–a new seed dresser against sucking insect pests of cotton.

On the basis of two years' experimentation, it can been concluded that imidacloprid 600FS @ 4.2g a.i. kg^{-1} seed was found effective against cumin aphid (*Myzus persicae*) and cumin thrips (*Scirtothrips dorsalis*) with increase in seed yield of cumin.

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