



ISSN (E): 2277- 7695
 ISSN (P): 2349-8242
 NAAS Rating: 5.23
 TPI 2021; 10(12): 2474-2478
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www.thepharmajournal.com
 Received: 05-10-2021
 Accepted: 17-11-2021

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Efficacy evaluation of different dosages of imidacloprid 600FS (Gaucho) against aphid in cumin (*Cuminum cyminum* L.) under field conditions

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Abstract

Field trials were conducted at two locations, the Research Farm of ICAR-National Research Centre on Seed Spices, Ajmer and Budhwara, Pisanagan (Ajmer) for two consecutive seasons, rabi 2016-17 and 2017-18, to evaluate the efficacy of different dosages of imidacloprid 600 FS (Gaucho) as seed treatments against aphids mixed population in cumin. A total of five treatments comprised of imidacloprid 600FS @ 3g a.i./kg seed, 3.6g a.i./kg seed and 4.2g a.i./kg seed, thiamethoxam 30FS @ 2.1g a.i./kg seed and untreated control. The trials result showed that all the treatments were found significantly superior over untreated control in management of aphid in cumin. Imidacloprid 600FS @ 4.2g a.i./kg seed, received zero aphid infestation up to 40 days after seed germination during both the years and locations and also exhibited statistically at par to imidacloprid 600 FS @ 3.6g a.i./kg seed with negligible population 0.04 aphids/plant at 40 days after seed germination in rabi 2016-17 in both the locations. Similarly, imidacloprid 600FS @ 4.2g a.i./kg seed had obtained the highest seed yield of cumin i.e. 1180, 1050 and 1305 and 1148 kg/ha at institute's research farm and Budhwara in 2016-17 and 2017-18, respectively but statistically at par with imidacloprid 600 FS@ 3.6 g a.i./kg seed. Imidacloprid 600FS @ 4.2g a.i./kg seed did not recorded phytotoxic symptoms till 35 days after sowing.

Keywords: *Cuminum cyminum*, aphid, imidacloprid 600 FS, seed treatment, field efficacy

Introduction

Cumin (*Cuminum cyminum* L.) is an annual herbaceous plant (chromosome 2n=14), belongs to the family Apiaceae. It is originated from Mediterranean region and now growing in many countries like India, Syria, Pakistan, Iran, Iraq, Turkey, China, Egypt, Italy and Israel (Meena *et al.*, 2018) [9]. In India, cumin is considered as most important and valuable crop among all seed spices, largely cultivating in Gujarat and Rajasthan. In the country, it is growing in 12.76 lakh hectare area produced 9.12 lakh tonnes seed in 2019-20 (Anonymous 2021) [1] also exported 2.14 lakh tonnes cumin seed, valued for 3328 crore, play a vital role in Indian's agricultural economy. Cumin seed is largely used for giving *Tadka* in most of the vegetable cuisines to create unique aroma and flavour. It is also used for flavouring, seasoning and imparting aroma in variety of food items and beverages. Cumin has adequacy in nutritional profile, like protein, carbohydrate, fat along with vitamins like thiamine, niacin and riboflavin. It is also a rich source of iron and minerals. Besides food and nutritional significance, it has several medicinal properties used as antioxidant (De *et al.*, 2009) [4], antidiabetic (Lee, 2005) [8], stimulant, carminative, stomachic, astringent, cholesterol level reducer (Nalini *et al.* 1998) [11] and also constructive in diarrhoea and dyspepsia. The active principles in the cumin may improve gut motility and help in digestion. Dried cumin seeds contain 2.5 to 4.5% volatile oil. Due to oleoresin and cuminaldehyde content, it has more demand in the international market. Cumin plants receive a number of insect pests right from germination to harvesting of the crops. Among them, aphid's *Myzus persicae* (Sulzer), *Aphis gossypii* Glover and *Hyadaphis coriandri* (Das) species cause significant loss in cumin yield and quality (Meena *et al.* 2018; Kant *et al.* 2010) [9,7]. Aphid infestation emerges on cumin in mid December when crops are in seedling stage and continued up to crop's seed formation stage. Severe infestations of aphid were reported from February to March (Gupta and Yadav 1990, Italiya and Sisodiya 2017) [5,6], when crop attains flowering to seed formation stages. The rapid multiplication of aphid makes this pest more dangerous for crop plants. The aphids may also be acts as a vector of viral diseases like yellowing in coriander and cumin (Meena *et al.*, 2016) [10]. Farmers generally neglect initial crop protection from sucking pests including aphids in cumin, as resulted crop attains aphid infestation and due to the sap sucking in newly germinated plants, leaves curling symptoms appeared and growth stunted that adversely impact on yield.

Later on farmers apply 4 to 5 sprays of chemical pesticides with heavy doses, as resulted, aphid develops resistance to insecticide and harvested cumin seeds retains heavy pesticide residue. Keeping these in view, an insecticidal product imidacloprid 600 FS (Gaucho) Supplied by Bayer Crop Science Limited were evaluated in different doses at two different locations, Research Farm, NRCSS, Ajmer and Budhwara, Pisangan (Ajmer), Rajasthan for two consecutive years to find out their relative efficacy against aphid on cumin under field conditions.

Materials and methods

Field experiments on evaluation of different doses of imidacloprid 600FS (Gaucho) against aphids in cumin (*Cuminum cyminum* L.) were carried out in *rabi* season of two consecutive years 2016-17 and 2017-18. The experimental locations were research farm of ICAR-National Research Centre on Seed Spices, Ajmer, Rajasthan (longitude 74° 35' 39" E and latitude 26° 22' 31" N) as well as Budhwara, Pisangan, Ajmer, Rajasthan (longitude 74°38'77" E and latitude 26° 36' 76" N). Experimental trials were laid out in randomized block design with five replications. Seeds of cumin variety GC-4 were sown in well prepared plots sized of 25 m² (5m x 5m length and width). The crop geometry of 25 cm x 10 cm (row to row and plant to plant distance) was kept and all recommended standard crop husbandry practices and other POP were used as adopted by ICAR-NRCSS in cumin crop for luxurious growth and development. Five treatments *viz.*, T-1 untreated control; T-2 imidacloprid 600 FS (Gaucho) @ 3.0 g a.i./kg seed; T-3 imidacloprid 600 FS (Gaucho) @ 3.6 g a.i./kg seed; T-4 imidacloprid 600 FS (Gaucho) @ 4.2 g a.i./kg seed and T-5 thiamethoxam 30% FS @ 2.1 g a.i./kg seed were applied as seed treatment at the time of sowing for their efficacy against aphid and T-1, T-4 and one additional treatment T-6 imidacloprid 600 FS (Gaucho) @ 8.4 g a.i./kg seed were tested for phytotoxicity. The method of seed treatment was adopted by making of slurry in a way that chemical + water makes a total volume of 25 ml/kg of seed. Seeds were treated in polythene bag and air dry in shade before sowing.

Observations on various parameters were recorded *i.e.* seed germination percentage was recorded at 20 days after seed sowing, plant counts per one meter row length at different crop growth stages was recorded for plant stand and growth, and number of aphids (nymphs and adults) was recorded from 5 randomly selected and tagged plants per plot at 20, 30, 40,

50 and 60 days after sowing for efficacy evaluation. For phytotoxicity, 1-10 rating was recorded individually for yellowing, stunting, necrosis, epinasty, hyponasty etc. Phytotoxicity observations were taken at 20, 25, 30 and 35 days after sowing. The data on seed germination percentage, plant stand per one meter row and seed yield in kg per hectare were obtained and statistically analyzed and compared treatment effect using ANOVA. Simultaneously, the data on number of aphids per plant so obtained, and calculated to mean aphid population per plant were converted into SQRT (X+1) transformed value and tabulated to statistically analyzed using OPSTAT statistical software developed by HAU, Hisar.

Results and discussion

The data on various parameters *i.e.* germination percentage, plant stand and growth, aphid infestation, seed yield and phytotoxicity are presented in Tables 1-6 revealed that, the applied insecticides in different dosages were found effective in the management of aphids in initial growth stage of cumin crop over untreated control. Simultaneously, it also brought from the study that the insecticide imidacloprid 600 FS did not cause any phytotoxic effect on new germinated cumin plant, if applied under appropriate dose, which find out in the finding of the experiments, and the head wise results are giving as under:

Germination percentage

The data on effect of different dosages of imidacloprid 600FS on germination percentage of cumin presented in Table 1, revealed that the maximum germination (98.00 and 93.80%) was recorded in plots treated with imidacloprid 600FS @ 4.2 g a.i./kg seed at Ajmer (1) and Budhwara (2), respectively during 2016-17 followed by imidacloprid 600FS @ 3.6 g a.i./kg seed (97.00 and 92.20%) in both the locations. Both the treatments were found statistically at par for germination. During 2017-18, similar trend in germination percentage was observed *i.e.* highest germination 98.00 and 95.94 per cent was recorded under the treatment of imidacloprid 600FS @ 4.2 g a.i./kg seed but also observed statistically at par with the treatments of imidacloprid 600FS @ 3.6 g a.i./kg seed. The similar result was found by Prajapati *et al.*, (2018) are accordance to the present findings. The remaining treatments were also found as significantly effective in germination of cumin in comparison to untreated control.

Table 1: Evaluation of different dosages of imidacloprid 600FS (Gaucho) on germination percentage of cumin at 20 days after sowing (DAS) in two different locations

Treatment	Dosage/kg of seed a.i. (g)	Seed germination (%)			
		2016-17		2017-18	
		Ajmer (Location-1)	Budhwara (Location-2)	Ajmer (Location-1)	Budhwara (Location-2)
T1 Untreated Control	-	80.30	76.42	82.22	78.58
T2 Imidacloprid 600 FS(Gaucho)	3	89.53	87.80	94.40	88.85
T3 Imidacloprid 600 FS(Gaucho)	3.6	97.00	92.20	97.60	95.13
T4 Imidacloprid 600 FS(Gaucho)	4.2	98.00	93.80	98.00	95.94
T5 Thiamethoxam 30% FS	2.1	96.34	90.00	97.40	92.59
T6 Imidacloprid 600 FS(Gaucho)	8.4	94.60	92.20	97.00	94.01
S.Em±	-	0.65	1.35	0.36	0.78
CD (p=0.05)	-	1.92	4.01	1.08	2.32

Plant Stand

The data on plant counts in 1 meter row length at 30 days after sowing are presented in Table 2, showed that the maximum plant counts/meter row was recorded in plots

treated with imidacloprid 600 FS @ 4.2 g a.i./kg seed (10 plants/meter row) followed by 9.60 to 9.80 plants/meter row in plots treated with imidacloprid 600FS @ 3.6 g a.i./kg seed and imidacloprid 600FS @ 8.4 g a.i./kg seed (9.00 to 9.8

plants/meter row length). The minimum plant counts per meter row were recorded in untreated control plots i.e. 7.20 to

7.80 plants/ meter row length during both the years at both the locations.

Table 2: Evaluation of different dosages of imidacloprid 600FS (Gaucho) on plant stand in 1 meter row at 30 days after sowing (DAS) in two different locations

Treatment	Dosage/ kg of seed a.i. (g)	Plants counts in 1 meter row length			
		2016-17		2017-18	
		Ajmer (Location-1)	Budhwara (Location-2)	Ajmer (Location-1)	Budhwara (Location-2)
T1 Untreated Control	-	7.60	7.8	7.6	7.20
T2 Imidacloprid 600 FS(Gaucho)	3	8.60	8.0	8.2	8.40
T3 Imidacloprid 600 FS(Gaucho)	3.6	9.60	9.8	9.8	9.60
T4 Imidacloprid 600 FS(Gaucho)	4.2	10.00	10	10	10.00
T5 Thiamethoxam 30% FS	2.1	8.60	9.2	9.2	8.40
T6 Imidacloprid 600 FS(Gaucho)	8.4	9.40	9.6	9.8	9.00
SEm±	-	0.31	0.29	0.33	0.32
CD (p=0.05)	-	0.93	0.87	0.97	0.97

Field efficacy against aphids

The effectiveness of different doses of imidacloprid 600FS were evaluated and data on aphid infestation recorded in each plot in both the locations (Ajmer and Budhwara) under specified interval (at 20, 30, 40, 50 and 60 days after sowing) and presented in Tables 3 and 4. Results showed that the infestation of aphid was initiated on cumin crop at 20 days after sowing in both years.

In 2016-17 at Ajmer (Location-1), all the treatments were found significantly superior over untreated control in all the durations. Imidacloprid 600FS @ 4.2 g a.i./kg seed and 3.6 g a.i./kg seed were proved as most effective treatments for aphid control wherein no aphid population was recorded till 40 days after sowing. Prajapati *et al.*, 2018 also reported that imidacloprid 600 FS @ 4.2 g a.i./kg seed was recorded lowest aphid infestation on cumin are accordance with the present study. At 60 days after sowing, the minimum aphid population (0.80 aphids/plant) was recorded in the plots treated with imidacloprid 600FS @ 4.2 g a.i./kg seed followed by imidacloprid 600FS @ 3.6 g a.i./kg seed (0.84 aphids/plant) and both the treatments were statistically at par in their relative efficacy. However, the maximum aphid population (8.16 aphids/plant) was recorded in untreated control plots. Treatment of thiamethoxam 30% FS @ 2.1 g a.i./kg seed and imidacloprid 600FS @ 3.0 g a.i./kg seed were found comparatively lower effective against aphid (Table 3). The similar result was observed by Dangi *et al.*, 2016 for thiamethoxam 25 WG against aphid on cumin are accordance to present study.

In 2016-17 at Budhwara (Location-2), all the treatments were found significantly superior over untreated control in all the durations. Imidacloprid 600FS @ 4.2 g a.i./kg seed and 3.6 g a.i./kg seed were proved as most effective treatments for aphid control wherein no aphid population was recorded till 40 days after sowing. At 60 days after sowing, the minimum aphid population (0.76 aphids/plant) was recorded in the plots treated with imidacloprid 600FS @ 4.2 g a.i./kg seed followed by imidacloprid 600FS @ 3.6 g a.i./kg seed (0.80 aphids/plant) and both the treatments were statistically at par in their relative efficacy. However, the maximum population (6.52 aphids/plant) was recorded in untreated control plots. Treatment of thiamethoxam 30% FS @ 2.1 g a.i./kg seed (0.92 aphids/plant) and imidacloprid 600FS @ 3.0 g a.i./kg seed (2.68 aphids/plant) were found comparatively lower effective against aphid.

In 2017-18 at Ajmer (Location-1), the data on aphid population is presented in Table 4, revealed that, all the treatments were found significantly superior over untreated control in all the durations. Imidacloprid 600FS @ 4.2 g a.i./kg seed and 3.6 g a.i./kg seed were found as most effective treatments for aphid control in cumin as seed treatment, wherein no aphid population was recorded till 40 days after sowing. 50 days after sowing, a meager aphids (0.56 aphids/plant) appeared on cumin plants treated with imidacloprid 600 FS @ 3.6 g a.i./kg seed which was statistically at par with higher dosage imidacloprid 600FS @ 4.2 g a.i./kg seed. At 60 days after sowing, the minimum aphid population (0.64 aphids/plant) was recorded in the plots treated with imidacloprid 600FS @ 4.2 g a.i./kg seed followed by imidacloprid 600FS @ 3.6 g a.i./kg seed (0.72 aphids/plant) and both the treatments were statistically at par in their relative efficacy. However, the maximum aphid population (8.04 aphids/plant) was recorded in untreated control plots. Treatment of thiamethoxam 30% FS @ 2.1 g a.i./kg seed (1.56 aphids/plant) and imidacloprid 600FS @ 3.0 g a.i./kg seed (3.00 aphids/plant) were found comparatively less effective against aphid. Similarly at Budhwara (Location-2) during 2017-18, all the treatments were found significantly superior over untreated control in all the durations. Imidacloprid 600FS @ 4.2 g a.i./kg seed and 3.6 g a.i./kg seed were found as most effective treatments for aphid control in cumin as seed treatment, wherein no aphid population was recorded till 40 days after sowing. 50 days after sowing, a meager aphids (0.12 aphids/plant) appeared on cumin plants treated with imidacloprid 600 FS @ 3.6 g a.i./kg seed which was statistically at par with higher dosage of imidacloprid 600FS @ 4.2 g a.i./kg seed (0.08 aphids/plant). The similar trend of aphid infestation was recorded at 60 days after sowing (Table 4). However, the maximum population (4.28 aphids/plant) was recorded in untreated control plots. Treatment of thiamethoxam 30% FS @ 2.1 g a.i./kg seed (1.12 aphids/plant) and imidacloprid 600FS @ 3.0 g a.i./kg seed (2.24 aphids/plant) were found comparatively lower effective against aphid. Bharpoda *et al.* (2014)^[2] reported that imidacloprid 17.8 SL @0.008%, thiamethoxam 25 WG @0.0125% and diafenthiuron 50 WP @0.05% were found more effective against aphid and whitefly in cotton are accordance with present results for thiamethoxam 25 WG against aphid.

Table 3: Efficacy evaluation of different dosages of imidacloprid 600 FS (Gaucho) against aphid on cumin in two locations during 2016-17

Treatment	Dosage/ kg of seed a.i. (g)	Aphid population (No. of aphid/plant)									
		Ajmer (Location-1)					Budhwara (Location-2)				
		20 DAS	30DAS	40 DAS	50 DAS	60 DAS	20 DAS	30DAS	40 DAS	50 DAS	60 DAS
Untreated Control	-	0.32(0.90)	0.76(1.11)	0.96(1.21)	2.92(1.82)	8.16(2.93)	0.44(0.96)	0.76(1.11)	1.20(1.29)	3.04(1.86)	6.52(2.64)
Imidacloprid 600 FS (Gaucho)	3.0	0.12(0.78)	0.20(0.83)	0.68(1.08)	1.52(1.41)	2.76(1.80)	0.08(0.76)	0.28(0.88)	0.76(1.12)	1.12(1.26)	2.68(1.77)
Imidacloprid 600 FS (Gaucho)	3.6	0.00(0.71)	0.00(0.71)	0.04(0.73)	0.28(0.87)	0.84(1.12)	0.00(0.71)	0.00(0.71)	0.04(0.73)	0.40(0.94)	0.76(1.12)
Imidacloprid 600 FS (Gaucho)	4.2	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.16(0.80)	0.80(1.10)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.28(0.88)	0.76(1.10)
Thiamethoxam 30% FS	2.1	0.08(0.76)	0.12(0.78)	0.12(0.78)	0.64(1.05)	1.12(1.26)	0.08(0.76)	0.12(0.78)	0.32(0.87)	0.76(1.11)	0.92(1.18)
S.Em±		0.03	0.03	0.04	0.10	0.13	0.03	0.04	0.07	0.09	0.09
CD (p=0.05)		0.08	0.10	0.11	0.29	0.38	0.09	0.12	0.21	0.26	0.27

Note: DAS- days after sowing; the figures in parenthesis are sqrt x+ 0.5 transformed value

Table 4: Efficacy evaluation different dosages of imidacloprid 600 FS (Gaucho) against aphid on cumin in two locations during 2017-18

Treatment	Dosage/ kg of seed a.i. (g)	Aphid population (No. of aphid/plant)									
		Ajmer (Location-1)					Budhwara (Location-2)				
		20 DAS	30DAS	40 DAS	50 DAS	60 DAS	20 DAS	30DAS	40 DAS	50 DAS	60 DAS
Untreated Control	-	0.62(1.06)	0.72(1.10)	1.16(1.29)	2.52(1.74)	8.04(2.92)	0.64(1.07)	0.88(1.17)	1.64(1.46)	3.24(1.93)	4.28(2.19)
Imidacloprid 600 FS (Gaucho)	3.0	0.02(0.72)	0.40(0.95)	0.72(1.10)	1.40(1.38)	3.00(1.87)	0.02(0.72)	0.08(0.76)	0.12(0.79)	0.80(1.14)	2.24(1.66)
Imidacloprid 600 FS (Gaucho)	3.6	0.00(0.71)	0.04(0.73)	0.00(0.71)	0.56(1.03)	0.72(1.10)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.12(0.79)	0.76(1.12)
Imidacloprid 600 FS (Gaucho)	4.2	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.56(1.03)	0.64(1.07)	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.08(0.76)	0.56(1.03)
Thiamethoxam 30% FS	2.1	0.00(0.71)	0.00(0.71)	0.36(0.93)	0.80(1.14)	1.56(1.44)	0.02(0.72)	0.12(0.79)	0.08(0.76)	0.40(0.95)	1.12(1.27)
SEM±		0.03	0.03	0.04	0.06	0.10	0.04	0.05	0.03	0.07	0.12
CD (p=0.05)		0.09	0.10	0.11	0.18	0.29	0.11	0.14	0.08	0.22	0.34

Note: DAS- days after sowing; the figures in parenthesis are sqrt x+ 0.5 transformed value

Effect on Yield

The data on seed yield of cumin are presented in Table 5 for cropping season rabi 2016-17 and 2017-18 in both the locations Ajmer (location-1) and Budhwara (location-2). In 2016-17, the maximum seed yield of cumin (1180 kg/ha in location-1 and 1305 kg/ha in location-2) was obtained from the plots treated with imidacloprid 600 FS @ 4.2 g a.i./kg seed which was statistically at par with yield obtained from the plots treated with lower dosage of imidacloprid 600 FS @ 3.6 g a.i./kg seed which were 1167 and 1287 kg/ha in location 1 & 2, respectively. The lower yield was obtained in the plots treated with lower dose of imidacloprid 600FS @ 3.0 g a.i./kg seed but significantly superior to control (665 and 775 kg/ha) in both the locations, respectively. Similarly, in

2017-18, the maximum seed yield of cumin (1050 and 1148 kg/ha) was obtained from the plots treated with imidacloprid 600 FS @ 4.2 g a.i./kg seed which was statistically at par with the seed yield (1010 and 1100 kg/ha) obtained from the plots treated with lower dosage of imidacloprid 600 FS @ 3.6 g a.i./kg seed in location 1 & 2, respectively. Similarly, the seed yield 973 and 1024 kg/ha were obtained in the treatment of thiamethoxam 30 FS @ 2.1 g a.i./kg seed in both the locations were significantly lower to imidacloprid 600 FS @ 4.2 g a.i./kg seed but statistically at par with imidacloprid 600 FS @ 3.6 g a.i./kg seed (Table-5). The lower yield (862 and 967 kg/ha) was obtained in plots treated with lower dose of imidacloprid 600FS @ 3.0 g a.i./kg seed but significantly superior to untreated control.

Table 5: Effect of different doses of imidacloprid 600FS (Gaucho) on yield of cumin for two years in two different locations

Treatment	Dosage/ kg of seed a.i. (g)	Yield (kg/ha)			
		2016-17		2017-18	
		Ajmer (Location-1)	Budhwara (Location-2)	Ajmer (Location-1)	Budhwara (Location-2)
T1 Untreated Control	-	665	775	597	670
T2 Imidacloprid 600 FS (Gaucho)	3	924	1008	862	967
T3 Imidacloprid 600 FS (Gaucho)	3.6	1167	1287	1010	1100
T4 Imidacloprid 600 FS (Gaucho)	4.2	1180	1305	1050	1148
T5 Thiamethoxam 30% FS	2.1	1095	1144	973	1024
T6 Imidacloprid 600 FS (Gaucho)	8.4	1170	1296	1022	1100
SEM±	-	16	30	19	34
CD (p=0.05)	-	52	97	57	103

Phytotoxicity

No phytotoxic symptoms were observed on leaves and whole plant of cumin crop up to 35 days after sowing when cumin seed treated with imidacloprid 600 FS @ 4.2 g a.i./kg seed

(Table 6), however small yellowing and epinasty symptoms were seen on few cumin plants treated as seed treatment with imidacloprid 600 FS at higher dose viz., 8.4 g a.i./kg seed at 25 and 30 days after sowing.

Table 6: Phytotoxicity of different doses of imidacloprid 600FS (Gaucho) on cumin plants (overall)

T. No.	Treatment	Dosage/kg seed		Phyto-toxicity days after sowing			
		a.i. (g)	Formulation (ml)	20	25	30	35
1	Untreated control	-	-	-	-	-	-
4	Imidacloprid 600 FS (Gaucho)	4.2	7	-	-	-	-
6	Imidacloprid 600 FS (Gaucho)	8.4	14	-	2	2	2

Effect on natural enemies

Application of imidacloprid 600 FS as seed treatment in different dosages i.e. 3.0, 3.6 and 4.2 g a.i./kg seed did not cause any significant adverse effect on the population of different natural enemies on cumin crop ecosystem up to 60 days after seed sowing.

Conclusion

Efficacy of different dosages of imidacloprid 600 FS ranged from 3.0, 3.6 and 4.2 g a.i./kg seed evaluated as seed treatment against aphids on cumin crop at two different locations for two consecutive years 2016-17 and 2017-18. On the basis of number of aphids counts at 20, 30, 40, 50 and 60 days after sowing, it was found that imidacloprid 600 FS @ 4.2 g a.i./kg seed gave effective control of aphids up to 50 days after sowing, which was statistically at par with lower dosage of imidacloprid 600 FS @ 3.6 g a.i./kg seed at both locations during 2016-17 and 2017-18. Imidacloprid 600 FS @ 4.2 and 3.6 g a.i./kg seed did not cause any phytotoxic symptoms on plants. Similarly, no adverse effect was observed on natural enemies. Imidacloprid 600 FS @ 4.2 and 3.6 g a.i./kg seed were at par in suppressing aphids population on cumin plants and also given higher seed yield.

Acknowledgement

The authors are grateful to Sh. Nilesh Raghuvanshi, Manager, Bayer CropScience Limited, for providing funding to conduct the trials at the centre. We also thankful to the Director, ICAR-National Research Centre on Seed Spices, Ajmer (Rajasthan) for providing support and facilities to carried out the complete research at both the location with smooth functioning.

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