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BIO–EFFICACY OF TOLFENPYRAD 15 EC AGAINST SUCKING PESTS OF CUMIN

N. R. PATEL, R. K. JAIMAN[1] AND B. G. PRAJAPATI

Centre for Research on Seed Spices, S. D. Agricultural University,Jagudan–382 710, Dist. Mehsana, Gujarat,India
[1]Centre of Excellence for Research on wheat, S. D. Agricultural University,Vijapur–382 870, Dist. Mehsana, Gujarat,India; E–mail: jaimanrs74@gmail.com

ABSTRACT

A field trial was undertaken at Centre for Research on Seed Spices, Jagudan during *rabi* 2010–11 and 2011–12 to determine the effective doses of tolfenpyrad 15EC against aphids and thrips on cumin alongwith neonicotinoid group of insecticides. Eight treatments of tolfenpyrad 15EC@ 100g a.i./ha, 125g a.i./ha, 150g a.i./ha, 300g a.i./ha(only for phytotoxicity), imidacloprid 17.8SL@ 25g a.i./ha, acetamiprid 20SP @ 20g a.i./ha, thiamethoxam 25WG @ 25g a.i./ha and untreated control were evaluated against aphids and thrips in cumin. Among them, tolfenpyrad15 EC at 125 and 150g a.i./ ha were highly effective in controlling the aphids and thrips in cumin. Mean number of coccinellids, syrphids, spiders and C*hrysoperla carnea* did not differ in different treatments during both the years of experimentation.Tolfenpyrad 15EC@ 150g a.i./ha maximum seed yield of cumin(415 kg/ha) as compared to the rest of the treatments. Minimum avoidable loss (5.54%) in seed yield of cumin was observed in tolfenpyrad 15EC@ 125g a.i./ha. The highest dose of tolfenpyrad 15EC@300g a.i./ha did not produce any phytotoxicity symptoms on the treated crop.

Key words: Bio–efficacy, sucking pests, natural enemies, tolfenpyrad, phytotoxicity, cumin

INTRODUCTION

Cumin (*Cuminum cyminum* L.), an important spice crop, is mostly cultivated in the arid regions of Gujarat and Rajasthan states of India. The productivity of this crop is mainly constrained by important insect pests *viz*., aphid, *Myzus persicae* Sultzer,; thrips, *Thrips tabaci* Lindeman,; green bug, *Lygus compestris*; *Systole albipennis* Walker,; gram pod borer, *Helicoverpa armigera* (Hubner) Hardwick and brown wheat mite, *Petrobia latens*. Among them, cumin aphid and thrips are important sucking pests in cumin growing regions. Cumin aphid causes serious damage at flowering stage of the crop by desaping the cell sap, as a result of which yellowing and curling of the leaves is exhibited at the initial stage, later the plants show stunted growth and the inflorescence set few seeds which are shriveled. Thrips cause considerable damage and the yield is affected quantitatively and qualitatively. Over the years, sucking pests have developed tolerance to some commonly used insecticides. Tolfenpyrad is a broad spectrum insecticide and has been used in vegetables, particularly cruciferous leafy vegetables, fruits and other high value produce since 2002.It acts mainly through inhibition of the mitochondrial electron transport system. Tolfenpyrad also provides contact activity against target pests on egg, larval, nymphal and adult stages and also exhibits antifeedant activity especially against lepidopteran insects (Anonymous, 1996). During the present study, field efficacy of tolfenpyrad 15EC against aphids and thrips was tested for two consecutive seasons, *rabi* 2010–11 and 2011–12 in cumin crop.

MATERIALS AND METHODS

A field experiment was conducted at Centre for Research on Seed Spices, Jagudan,Gujarat during *rabi* 2010–11 and 2011–12 to evaluate the bio–efficacy of different doses of tolfenpyrad 15EC alongwith neonicotinoid group of insecticides.The trial was laid out in a randomized block design (RBD) with eight treatments and three replications (Table 1). The size of each plot measured 4.0×3.0 m^2.Gujarat Cumin 4 was spaced at 30cm. All the recommended agronomic practices were adopted as per package of practices except insecticidal sprays.

Two foliar sprays of respective insecticides were given by means of manually operated knapsack sprayer. First spray was made at threshold level of sucking pests *i.e.* aphids and thrips and subsequent spray was advocated at an interval of twenty three days. The number of sucking pests *viz.,* aphids *Myzus persicae* Sultzer and thrips, *Thrips tabaci* Lindeman were recorded from five randomly selected plants from each replicate prior to and 1, 3, 7, 10 and 15 days after each spray. Similarly, the insecticidal impact was also recorded on natural especially coccinellids, syrphids, spiders and C*hrysoperla carnea*.The data were analyzed for its statistical interpretation with due

Table 1. Details of treatments evaluated against sucking pests of cumin at Jagudan

Sr. No.	Treatments	Dose/ha (ml/g)
1.	Tolfenpyrad 15EC@ 100g a.i./ha	667ml
2.	Tolfenpyrad 15EC@ 125g a.i./ha	833ml
3.	Tolfenpyrad 15EC@ 150g a.i./ha	1000ml
4.	Tolfenpyrad 15EC@ 300g a.i./ha	2000*ml
5.	Imidacloprid17.8 SL@ 25g a.i./ha	140ml
6.	Acetamiprid 20SP @ 20g a.i./ha	100g
7.	Thiamethoxam 25WG @ 25g a.i./ha	100g
8.	Untreated Control	–

*For phytotoxicity studies only.

transformation so as to compare the efficacy of different treatments. The seed yield of cumin was recorded from each net plot at harvest and yield data were converted into hectare basis. From these yield data, percentage of avoidable losses in seed yield of cumin due to sucking pest complex was worked out on the basis of seed yield by using the following formula suggested by Khosla (1977).

Observations on phytotoxicity symptoms *viz*.,leaf

$$\text{Avoidable loss (\%)} = \frac{\text{Highest yield in best treatment} - \text{Yield in other treatment}}{\text{Yield in best treatment}} \times 100$$

injury, wilting, vein clearing and necrosis(epinasty and hyponasty) were recorded up to 15 days after spray application of tolfenpyrad 15EC @ 300g a.i./ha. Observations were recorded on the basis of visual scores shown in table 2.

Table 2. Scores used for effect on crop health

Score	Per cent crop affected
0	No adverse effect
1	1–10
2	11–20
3	21–30
4	31–40
5	41–50
6	51–60
7	61–70
8	71–80
9	81–90
10	91–100

RESULTS AND DISCUSSION

During *rabi* 2010–11, the population of thrips ranged between 14.07 and 15.73 per plant and all the treatments were statistically at par. All tested doses significantly reduced thrips population in treated plots at 3 days of the first spray as compared to untreated control. Among different dosages of tolfenpyrad 15EC, the higher dose (150 a.i./ha) was superior to the rest of the treatments. However, tolfenpyrad 15EC @ 125 a.i./ha remained at par with imidacloprid 17.8SL @ 25 g a.i./ha, acetamiprid 20 SP @ 20 g a.i./ha and thiamethoxam 25WG @ 25 g a.i./ha. Similar trend was also observed 7, 10 and 15 days after both of the sprays (Table 3).

The population of thrips varied from 18.70 to 20.73 per plant and all the treatments remained statistically at par with each other during *rabi* 2011–12. The population of thrips ranged between 2.47 and 4.65 per plant at 7 days of second spray. Among the various dosages of tolfenpyrad 15EC tested, the higher dose was proved to be superior to rest of the treatments. However, tolfenpyrad 15EC @ 125g a.i./ha was statistically at par with imidacloprid 17.8SL @ 25g a.i./ha, acetamiprid 20 SP @ 20g a.i./ha and thiamethoxam 25WG @ 25g a.i./ha (Table 4).

During the first year, population of aphids varied from 157.37 to 171.40 per plant before spray and the population was in the range of 7.03 to 240.33 per plant at 15days of first spray. Tolfenpyrad 15EC at the moderate as well as higher dosages (125 and 150g a.i./ha) was more effective over imidacloprid 17.8SL @ 25g a.i./ha, acetamiprid 20 SP @ 20g a.i./ha, thiamethoxam 25WG @ 25g a.i./ha and tolfenpyrad 15EC @ 100 g a.i./ha. However, the lower as well as higher dosages of tolfenpyrad 15EC remained statistically at par with moderate dose.Similar trend was observed in case of second spray (Table 5).

During the second year of experimentation (Table 6), the population of aphids were recorded in the range of 167.43 to 181.93 per plant before spray and the population was in the range of 14.73 to 251.33 per plant at 15days of first spray. The dosages of tolfenpyrad 15EC @ 125 and 150g a.i./ha was more effective over imidacloprid 17.8SL @ 25g a.i./ha, acetamiprid 20 SP @ 20g a.i./ha and thiamethoxam 25WG @ 25g a.i./ha. The same trend was observed in second spray.

Population of natural enemies coccinellids, syrphids, spiders and C*hrysoperla carnea* were recorded during the period of study. But the mean number of natural enemies did not differ among the different insecticides tested as well as untreated control during both the years (Table 7).

Table 3. Mean population of thrips per plant in different treatments during *rabi* 2010–11

Sr. No.	Treatments	1st Spray						2nd Spray					
		BS	1DAS	3DAS	7DAS	10DAS	15DAS	BS	1DAS	3DAS	7DAS	10DAS	15DAS
1.	Tolfenpyrad 15EC @ 100 g a.i./ha	15.03* (3.87)	9.60* (3.10)	7.87* (2.80)	6.27* (2.50)	5.87* (2.42)	4.57* (2.13)	14.17* (3.76)	8.80* (2.96)	6.17* (2.47)	4.47* (2.10)	3.50* (1.85)	3.10* (1.75)
2.	Tolfenpyrad 15EC @ 125 g a.i./ha	14.07 (3.75)	7.83 (2.80)	5.60 (2.36)	3.67 (1.91)	2.73 (1.65)	2.50 (1.58)	13.87 (3.71)	6.80 (2.60)	4.40 (2.08)	3.43 (1.85)	2.77 (1.69)	2.43 (1.54)
3.	Tolfenpyrad 15EC @ 150g a.i./ha	14.83 (3.85)	5.97 (2.44)	4.10 (2.02)	3.13 (1.76)	2.37 (1.53)	2.03 (1.41)	13.93 (3.72)	5.93 (2.44)	3.10 (1.76)	2.47 (1.55)	1.67 (1.25)	1.27 (1.12)
4.	Imidacloprid 17.8SL @ 22.5 g a.i./ha	15.57 (3.94)	8.53 (2.92)	4.87 (2.20)	4.57 (2.13)	3.63 (1.89)	2.93 (1.71)	13.43 (3.66)	6.4 (2.56)	4.57 (2.11)	3.57 (1.89)	2.93 (1.70)	2.63 (1.61)
5.	Acetamiprid 20S @ 20g a.i./ha	15.73 (3.97)	8.77 (2.96)	5.57 (2.36)	3.77 (1.94)	3.17 (1.77)	2.67 (1.61)	12.83 (3.58)	6.93 (2.66)	4.83 (2.19)	3.70 (1.92)	3.00 (1.72)	2.47 (1.57)
6.	Thiamethoxam 25WG @ 25g a.i./ha	14.47 (3.80)	10.13 (3.18)	6.17 (2.48)	5.07 (2.25)	4.33 (2.08)	2.57 (1.59)	14.33 (3.78)	6.67 (2.65)	4.75 (2.22)	3.97 (1.99)	3.83 (1.95)	3.17 (1.78)
7.	Control	14.33 (3.78)	16.33 (4.04)	17.13 (4.14)	20.50 (4.53)	22.50 (4.74)	19.17 (4.37)	13.27 (3.64)	13.77 (3.54)	16.47 (4.06)	17.47 (4.18)	18.43 (4.28)	18.03 (4.24)
	C.D. (P = 0.05%)	NS	0.23	0.32	0.27	0.32	0.38	NS	0.48	0.46	0.36	1.29	0.40

* $\sqrt{X+0.5}$ transformed values. Figures in parenthesis are retransformed values

Table 4. Mean population of thrips per plant in different treatments during *rabi* 2011–12

Sr. No.	Treatments	1st Spray						2nd Spray					
		BS	1DAS	3DAS	7DAS	10DAS	15DAS	BS	1DAS	3DAS	7DAS	10DAS	15DAS
1.	Tolfenpyrad 15EC @ 100 g a.i./ha	18.70* (12.98)	15.70* (3.40)	12.63* (3.55)	6.27* (3.3.5)	5.87* (2.95)	4.57* (2.86)	14.17* (4.17)	8.80* (3.56)	6.17* (3.20)	4.47* (2.94)	3.50* (2.73)	3.10* (2.65)
2.	Tolfenpyrad 15EC @ 125 g a.i./ha	19.23 (13.15)	13.83 (3.11)	10.80 (3.35)	3.67 (2.95)	2.73 (2.79)	2.50 (2.73)	13.87 (4.46)	6.80 (3.35)	4.40 (3.25)	3.43 (2.76)	2.77 (2.61)	2.43 (2.52)
3.	Tolfenpyrad 15EC @ 150g a.i./ha	20.30 (13.52)	12.03 (2.79)	9.20 (3.03)	3.13 (2.84)	2.37 (2.57)	2.03 (2.50)	13.93 (4.23)	5.93 (3.15)	3.10 (2.66)	2.47 (2.54)	1.67 (2.39)	1.27 (2.32)
4.	Imidacloprid 17.8SL @ 22.5 g a.i./ha	20.73 (13.62)	14.60 (3.23)	9.87 (3.14)	4.57 (3.07)	3.63 (2.80)	2.93 (2.73)	13.43 (4.10)	6.43 (3.23)	4.57 (2.93)	3.57 (2.76)	2.93 (2.61)	2.63 (2.58)
5.	Acetamiprid 20S @ 20g a.i./ha	19.27 (13.16)	14.97 (3.24)	10.53 (3.24)	3.77 (2.98)	3.17 (2.79)	2.67 (2.73)	12.83 (4.10)	6.93 (3.29)	4.83 (2.98)	3.70 (2.74)	3.00 (2.63)	2.47 (2.55)
6.	Thiamethoxam 25WG @ 25g a.i./ha	19.90 (13.37)	16.17 (3.48)	11.30 (3.36)	5.07 (3.18)	4.33 (2.95)	2.57 (2.83)	14.33 (4.24)	6.67 (3.28)	4.93 (2.99)	3.97 (2.83)	3.83 (2.81)	3.17 (2.69)
7.	Control	20.67 (13.63)	20.33 (4.51)	21.13 (4.60)	20.50 (4.95)	22.50 (4.79)	19.17 (4.84)	13.27 (4.24)	13.77 (4.18)	16.47 (4.55)	17.47 (4.65)	18.43 (4.69)	18.03 (4.65)
	C.D. (P = 0.05%)	NS	0.45	0.23	0.20	0.27	0.24	NS	0.29	0.36	0.28	0.29	0.26

*$\sqrt{X+0.5}$ transformed values. Figures in parenthesis are retransformed values

Table 5. Mean population of aphids per plant in different treatments during *rabi* 2010–11

Sr. No.	Treatments	1st Spray						2nd Spray					
		BS	1DAS	3DAS	7DAS	10DAS	15DAS	BS	1DAS	3DAS	7DAS	10DAS	15DAS
1.	Tolfenpyrad 15EC @ 100 g a.i./ha	164.23 (12.90)	57.33 (7.57)	42.51 (6.52)	34.63 (5.88)	22.23 (4.71)	20.10 (4.48)	96.43 (9.82)	62.97 (7.93)	50.30 (7.09)	29.90 (5.57)	14.37 (3.78)	13.27 (3.64)
2.	Tolfenpyrad 15EC @ 125 g a.i./ha	157.37 (12.93)	49.23 (7.02)	30.83 (5.55)	22.37 (4.73)	13.03 (3.58)	9.27 (3.01)	97.40 (9.87)	44.93 (6.70)	29.47 (5.42)	17.50 (4.18)	8.80 (2.97)	7.70 (2.77)
3.	Tolfenpyrad 15EC @ 150g a.i./ha	162.27 (12.94)	45.63 (6.76)	27.03 (5.19)	19.90 (4.46)	10.13 (3.17)	7.03 (2.60)	90.57 (9.52)	44.03 (6.63)	29.77 (5.45)	17.67 (4.20)	8.10 (2.84)	7.23 (2.69)
4.	Imidacloprid 17.8SL @ 22.5 g a.i./ha	170.27 (12.92)	52.37 (7.23)	31.47 (5.61)	23.77 (4.86)	13.17 (3.62)	9.53 (3.09)	98.30 (9.91)	46.27 (6.79)	31.20 (5.57)	18.30 (4.28)	11.57 (3.38)	9.57 (3.09)
5.	Acetamiprid 20S @ 20g a.i./ha	168.07 (12.95)	54.33 (7.37)	34.03 (5.83)	24.53 (4.95)	14.97 (3.87)	10.10 (3.61)	100.27 (10.01)	47.93 (6.92)	31.43 (5.60)	18.83 (4.33)	13.10 (3.62)	9.87 (3.14)
6.	Thiamethoxam 25WG @ 25g a.i./ha	171.40 (12.99)	58.03 (7.61)	34.53 (5.88)	25.83 (5.08)	14.83 (3.85)	12.90 (3.58)	97.77 (9.88)	48.23 (6.94)	32.33 (5.69)	18.80 (4.33)	14.57 (3.82)	9.63 (3.10)
7.	Control	166.70 (12.98)	175.83 (13.26)	190.23 (13.79)	215.63 (14.68)	221.67 (14.89)	240.33 (15.50)	168.60 (12.98)	175.57 (13.25)	182.57 (13.51)	190.67 (13.81)	206.77 (14.38)	217.33 (14.74)
	C.D. (P = 0.05%)	NS	0.29	0.36	0.50	0.47	0.55	0.15	0.55	0.45	0.34	0.43	0.43

* $\sqrt{X+0.5}$ transformed values. Figures in parenthesis are retransformed values

Table 6. Mean population of aphids per plant in different treatments during *rabi* 2011–12

Sr. No.	Treatments	1st Spray						2nd Spray					
		BS	1DAS	3DAS	7DAS	10DAS	15DAS	BS	1DAS	3DAS	7DAS	10DAS	15DAS
1.	Tolfenpyrad 15EC @ 100 g a.i./ha	167.43 (13.12)	67.40 (8.21)	53.51 (7.31)	45.63 (6.75)	33.23 (5.76)	28.50 (5.33)	104.43 (10.22)	70.97 (8.42)	58.30 (7.64)	37.90 (6.16)	19.37 (4.40)	18.27 (4.27)
2.	Tolfenpyrad 15EC @ 125 g a.i./ha	169.87 (13.13)	58.40 (7.64)	35.63 (5.97)	26.17 (5.10)	18.80 (4.31)	14.77 (3.82)	105.40 (10.27)	52.93 (7.27)	32.57 (5.70)	23.57 (4.85)	13.27 (3.64)	11.30 (3.36)
3.	Tolfenpyrad 15EC @ 150g a.i./ha	173.27 (13.17)	56.63 (7.52)	32.87 (5.73)	25.33 (5.02)	18.60 (4.30)	14.73 (3.83)	98.57 (9.92)	52.03 (7.21)	31.23 (5.59)	22.90 (4.78)	13.17 (3.63)	10.73 (3.27)
4.	Imidacloprid 17.8SL @ 22.5 g a.i./ha	179.23 (13.14)	58.27 (7.63)	34.27 (5.85)	25.67 (5.06)	20.20 (4.48)	16.93 (4.12)	106.30 (10.31)	54.27 (7.36)	36.03 (6.00)	26.30 (5.13)	16.57 (4.06)	14.57 (3.81)
5.	Acetamiprid 20S @ 20g a.i./ha	179.07 (13.15)	59.83 (7.73)	36.03 (6.00)	25.27 (5.02)	20.77 (4.56)	16.37 (4.04)	108.27 (10.40)	55.93 (7.48)	36.33 (6.02)	26.83 (5.18)	16.37 (4.04)	14.87 (3.85)
6.	Thiamethoxam 25WG @ 25g a.i./ha	181.93 (13.15)	57.53 (7.58)	37.63 (6.13)	25.77 (5.08)	20.63 (4.54)	16.53 (4.06)	105.77 (10.28)	56.23 (7.49)	36.80 (6.06)	26.80 (5.18)	17.07 (4.13)	14.63 (3.82)
7.	Control	177.70 (13.16)	186.83 (13.67)	201.23 (14.18)	226.63 (15.04)	232.67 (15.25)	251.33 (15.85)	176.60 (13.29)	183.57 (13.55)	190.57 (13.80)	197.07 (14.04)	211.77 (14.55)	222.33 (14.91)
	C.D. ($P = 0.05\%$)	NS	0.32	0.34	0.63	0.62	0.53	0.15	0.52	0.38	0.29	0.43	0.41

* $\sqrt{X+0.5}$ transformed values. Figures in parenthesis are retransformed values

Table 7. Effect of different insecticides on mean population of bio–agents* during *rabi* 2011–12 and 2011–12

Sr. No.	Treatments	1st Spray						2nd Spray					
		BS	1DAS	3DAS	7DAS	10DAS	15DAS	BS	1DAS	3DAS	7DAS	10DAS	15DAS
1.	Tolfenpyrad 15EC @ 100 g a.i./ha	3.0	2.7	2.6	2.6	2.5	2.7	2.4	2.1	2.0	2.1	2.1	2.2
2.	Tolfenpyrad 15EC @ 125 g a.i./ha	2.8	2.6	2.5	2.4	2.6	2.6	2.3	2.1	2.2	2.0	2.1	2.4
3.	Tolfenpyrad 15EC @ 150g a.i./ha	2.7	2.5	2.4	2.4	2.4	2.6	2.2	1.9	2.0	2.3	2.2	2.3
4.	Imidacloprid 17.8SL @ 22.5 g a.i./ha	2.8	2.5	2.5	2.3	2.5	2.5	2.1	1.9	2.0	2.2	2.2	2.4
5.	Acetamiprid 20S @ 20g a.i./ha	2.9	2.7	2.3	2.6	2.5	2.6	2.3	2.0	2.3	2.4	2.3	2.4
6.	Thiamethoxam 25WG @ 25g a.i./ha	2.7	2.5	2.4	2.4	2.5	2.7	2.1	1.9	2.2	2.7	2.6	2.5
7.	Control	2.8	2.8	2.9	2.9	2.9	3.0	3.0	3.1	3.1	2.8	2.9	2.6
	F test	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

* Bio–agents include *Chrysoperla*, Coccinellids, Syrphids and Spiders *etc*.

Table 8. Seed yield of cumin (kg/ha) at harvest in different treatments (2010–11 & 2011–12)

Sr. No.	Treatments	Dose/ha	Seed yield of cumin (kg/ha)			Avoidable loss (%)
			2010–11	2011–12	Mean	
1.	Tolfenpyrad 15EC	100g a.i./ha	400	379	390	6.02
2.	Tolfenpyrad 15EC	125g a.i./ha	402	381	392	5.54
3.	Tolfenpyrad 15EC	150g a.i./ha	423	406	415	0.00
4.	Imidacloprid17.8 SL	25g a.i./ha	390	369	380	8.43
5.	Acetamiprid 20SP	20g a.i./ha	353	331	342	17.59
6.	Thiamethoxam 25WG	25g a.i./ha	394	373	384	7.47
7.	Untreated Control	–	251	228	240	42.17
	S. Em. ±		9.67	9.31	6.71	–
	C.D. (P = 0.05%)		29.83	28.69	19.58	–

The seed yield data on cumin (Table 8) revealed that tolfenpyrad 15EC@ 150g a.i./ha gave maximum yield (415 kg/ha) as compared to the other treatments with the lowest yield in untreated control (240kg/ha).The minimum avoidable losses in cumin seed yield was observed in tolfenpyrad 15EC@ 125g a.i./ha (5.54%), followed by tolfenpyrad 15EC@ 100g a.i./ha (6.02%), thiamethoxam 25WG @ 25g a.i./ha (7.47%), imidacloprid17.8SL @ 25g a.i./ha(8.43%). The highest percentage of avoidable loss was observed in the protected plots (42.17%) of cumin.

Observations recorded for phytotoxicity symptoms (leaf injury, wilting, vein clearing and epinasty and hyponasty) on the crop due to application of tolfenpyrad 15EC @ 300g a.i./ha up to 15 days after the spray showed no visible phytotoxic symptoms as per scores shown in Table 2.

The present findings confirm the findings of Bajpai and Singh (2010) who reported tolfenpyrad 15EC @ 150g a.i./ha to be effective against sucking pests of okra. Saini *et al*. (2010) observed that tolfenpyrad at all the three doses was significantly superior to imidacloprid 17.8SL and thiamethoxam 25WG in suppressing the population of jassids on cotton. More or less similar observations on superiority of tolfenpyrad 15EC against jassid and whitefly in cotton were reported by Kalyan *et al*. (2011).

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