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Toxicity of Imidacloprid and Carbosulfan as Seed Treatment against Sucking Pests of Cotton

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A B S T R A C T

Carbosulfan and imidacloprid are being used for cotton seed treatment in cotton *Gossypium hirsutum* L., to control various early season piercing and sucking pests. To assess the activity of these two seed treating chemicals against sucking pests of cotton, cotton seeds were treated with imidacloprid and different doses of carbosulfan were sown in the field. Untreated seeds were also sown as control treatment. The studies were continued for two years. During the study period recorded various observations on sucking pest population and seed cotton yield. Highest per cent of seed germination, lowest sucking pest population, more number of bolls, maximum boll weight, maximum seed cotton yield were recorded in seeds treated with imidacloprid 75% WS @ 3.5g a.i./kg of seeds followed by seeds treated with carbosulfan 25%DS @ 30g a.i./kg of seeds.

Introduction

Cotton is one of the most important commercial crops in the world. Among the cotton growing countries, India has the largest area of 9 million hectare grown under diverse agro-ecological areas. Cotton is prone to attack at all the stages of growth. Though it has been reported that about 162 insect pests attack on cotton in India (Annon. 1999), only a dozen are major and half of them are key production constraints which cause losses to the extent of 30-80%. Thrips, aphids and whiteflies are the important sucking pests start to de-sap the cotton crop at seedling state and cause heavy losses (Kulakarni *et al.*, 2003).

The objective of this trial was to study the toxicity of carbosulfan and imidacloprid against the sucking pests of cotton in early growth stage.

Materials and Methods

Effect of seed treatment with carbosulfan and imidacloprid on the population of sucking pests were recorded and compared with untreated check during 2011-13 cotton seasons at Agricultural Research Station, Siruguppa in Karnataka. To treat seed imidacloprid 75% WS @ 3.5gm/kg cotton seed was mixed in 200ml of water. Insecticide solution and delinted cotton seed of

commercial variety RAH-100 were vigorously shaken and rotated in plastic bag. Insecticide treated seeds were dried under the shade. Likewise, carbosulfan 25% DS @ 30gm, 17.5gm, 15gm, 12.5gm/kg seed was used for the different treatments and the above mentioned procedure was followed to treat seeds with insecticide. The untreated seeds were used as control treatment. Each year the trial was sown in the 1st week of July. The experiment was laid out in a Randomized Block Design, treatments were replicated 3 times having a plot size of 9.9 X 5.4m. The observations were analyzed by analysis of variance (ANOVA) for each observation (Gomez and Arturo, 1984). Treated and untreated seeds were sown by hand using dibbling method with row spacing of 90cm and in between plants is 30cm.

Seven days after sowing, germination of seed was recorded in each treatment and converted into per cent germination. In each treatment five plants were randomly selected, tagged and recorded various observations on sucking pest population in each plants (bottom, middle and top leaves) and recorded average insect count (No. of insects/leaf) of aphids, jassids and thrips at 7, 14 and 21 days after sowing.

Numbers of bolls/plant were arrived at by taking observations on five tagged plants in each treatment. Boll weight in grams was recorded by weighing twenty uniform bolls taken at randomly in each treatment and recorded single boll weight by taking overall mean of twenty boll weight. Seed cotton yield were recorded on the net plot basis and then converted on a hectare basis (kg/ha).

Results and Discussion

Percent germination

Significantly higher per cent of germination (87.44) was recorded in cotton seeds treated with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds (T7) followed by seeds treated with Carbosulfan 25% DS @ 30 g a.i./kg of seeds (T5) and 17.5 g a.i./kg of seeds (T4) (81.27 % and 80.04% respectively). Lowest per cent of germination was recorded with untreated check (70.57%) compared with all other treatments during 2011-12. The same trend was recorded with during 2012-13 (Table 1).

Effect of seed treatment on sucking population

Seven days after spray, the cotton seeds treated with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds recorded significantly lesser aphid population (0.4) followed by Carbosulfan 25% DS @ 30 g a.i./kg of seeds (0.73) and Carbosulfan 25% DS @ 17.5 g a.i./kg of seeds (0.93) which were on par with each other statistically and significantly lesser aphid population compared to control and rest of the treatments (Table 2). Same trend was also recorded in jassid (Table 3) and thrips population (Table 4) during 2011-12. The same trend was also observed during 2012-13.

Fourteen days after spray, seeds treated with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds recorded significantly lesser aphid population (0.02) followed by Carbosulfan 25% DS 30 g a.i./kg of seeds (0.04) and highest aphid population was recorded with control (0.40) during 2011-12 (Table 2). Significantly lesser population of jassids (Table 3) and thrips (Table 4) were recorded with sees treated with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds, followed by Carbosulfan 25% DS 30 g a.i./kg of seeds compared with other treatments and untreated check. During 2012-13 same trend was recorded with all the three sucking pests.

Twenty one days after spray, seeds treated with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds recorded significantly lesser aphid

population (0.15) followed by Carbosulfan 25% DS 30 g a.i./kg of seeds (0.28) which were on par with each other. Rest of the treatments recorded significantly higher aphid population compared with above two treatments (Table 2). Same trend was also recorded in jassid (Table 3) and thrips population (Table 4) during 2011-12.

Comparatively more number of sucking pests were recorded during 2012-13, significantly lesser aphid population were recorded in seeds treated with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds (2.15) followed by Carbosulfan 25% DS 30 g a.i./kg of seeds (2.41). The same trend was recorded with jassid and thrips population.

Number of bolls per plant, boll weight (gms) and seed cotton yield (kgs/ha)

More number of bolls per plant was recorded in seeds treated with Imidacloprid 75% WS @ 3.5 g a.i./kg seeds (44.6), Carbosulfan 25% DS 30 g a.i./kg seeds (37.2) and Carbosulfan 25% DS 17.5g a.i./kg seeds (37) and lowest was recorded in untreated control (29.5) during 2011-12. But significantly higher number of bolls per plant was recorded in seeds treated with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds (36.66), Carbosulfan 25% DS 30 g a.i./kg of seeds (31.93) and Carbosulfan 25% DS 17.5g a.i./kg of seeds (31.76) which were on par with each other statistically and rest of the treatments recorded lesser number of bolls per plant compared with above treatments (Table 5) during 2012-13.

Higher boll weight was recorded with the treatment treated with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds (3.53g) followed by Carbosulfan 25% DS 30 g a.i./kg (3.30g) and Carbosulfan 25% DS 17.5g a.i./kg (3.3.17g) and lowest boll weight was recorded with untreated control (2.57g) (Table 5) during 2011-12. There is no significantly difference in the boll weight recorded with all the treatments. Same trend was also recorded during 2012-13.

Table.1 Bio-efficacy of Carbosulfan 25% DS seed treatment in cotton for germination

Treatments	Per cent germination	
	2011-12	2012-13
T1: Untreated control	70.57	80.6
T2: Carbosulfan 25% DS @ 12.5 g a.i./kg of seeds	75.31	81.2
T3: Carbosulfan 25% DS @ 15 g a.i./kg of seeds	75.92	81.2
T4: Carbosulfan 25% DS @ 17.5 g a.i./kg of seeds	80.04	81.4
T5: Carbosulfan 25% DS @ 30 g a.i./kg of seeds	81.27	81.8
T6: Carbosulfan 25% DS (Existing source) @ 15 g a.i./kg of seeds	77.28	82.2
T7: Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds	87.44	83.4
S Em ±	**2.76**	**3.04**
CD @ 5%	**8.52**	**9.36**

Table.2 Bio-efficacy of carbosulfan 25% DS against aphid population on cotton

Treatments	Aphids/leaf					
	7 DAS		14 DAS		21 DAS	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
T1	2.60	2.40	0.40	3.40	1.28	3.28
T2	2.27	2.07	0.20	3.20	1.13	3.13
T3	1.87	1.67	0.11	3.15	1.01	3.00
T4	0.93	0.73	0.09	3.11	0.62	2.79
T5	0.73	0.53	0.04	3.02	0.28	2.41
T6	1.47	0.80	0.15	3.09	0.95	2.61
T7	0.40	0.27	0.02	2.92	0.15	2.15
S Em ±	**0.15**	**0.08**	**0.01**	**0.26**	**0.08**	**0.15**
CD @ 5%	**0.45**	**0.24**	**0.04**	**0.79**	**0.25**	**0.44**

Table.3 Bioefficacy of carbosulfan 25% DS against jassid population on cotton

Treatments	Jassid/leaf					
	7 DAS		14 DAS		21 DAS	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
T1	1.60	1.40	1.57	6.47	2.42	7.87
T2	1.40	1.20	1.46	6.40	2.29	6.40
T3	1.33	1.13	1.20	5.93	2.22	5.93
T4	1.27	1.13	1.20	5.40	2.09	5.40
T5	1.00	0.80	1.19	4.67	2.06	5.33
T6	1.33	1.03	1.22	3.93	2.22	3.93
T7	0.73	0.53	1.08	3.47	1.46	3.20
S Em ±	**0.14**	**0.09**	**0.13**	**0.42**	**0.12**	**0.38**
CD @ 5%	**0.42**	**0.28**	**0.41**	**1.29**	**0.38**	**1.16**

Table.4 Bioefficacy of carbosulfan 25% DS against thrips population on cotton

Treatments	Thrips/leaf					
	7 DAS		14 DAS		21 DAS	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
T1	2.68	2.48	2.88	4.47	2.61	3.09
T2	1.80	1.60	2.71	3.08	2.59	2.94
T3	1.53	1.33	2.02	2.91	2.22	2.85
T4	1.20	1.00	1.99	2.73	1.73	2.81
T5	1.00	0.80	1.62	2.22	1.68	2.72
T6	1.60	1.40	2.04	2.24	2.35	2.74
T7	0.93	0.73	1.40	2.19	1.64	2.23
S Em ±	**0.14**	**0.12**	**0.22**	**0.24**	**0.23**	**0.26**
CD @ 5%	**0.43**	**0.36**	**0.68**	**0.74**	**0.72**	**0.81**

Table.5 Effect of carbosulfan 25% DS seed treatment in cotton on No. of bolls/plant, boll weight (g) and seed cotton yield

Treat	No. of bolls/plant		Boll weight (g)		Seed cotton yield (kg/ha)	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
T1	29.5	26.46	2.57	3.63	1034	1265
T2	32.2	28.66	3.03	3.63	1038	1304
T3	34.3	29.86	3.10	3.66	1048	1307
T4	37.0	31.76	3.17	3.72	1116	1361
T5	37.2	31.93	3.30	3.80	1229	1375
T6	36.2	30.70	3.07	3.73	1082	1351
T7	44.6	36.66	3.53	3.80	1340	1433
S Em ±	**3.00**	**1.71**	**0.27**	**0.13**	**98**	**104.88**
CD @ 5%	**NS**	**4.98**	**NS**	**NS**	**NS**	**NS**

Highest quantity of seed cotton yield (1340 kg) was recorded in seeds treated with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds, followed by Carbosulfan 25% DS 30 g a.i./kg (1229kg) and Carbosulfan 25% DS 17.5g a.i./kg (1116kg) and lowest seed cotton yield was recorded with untreated control (1034kg) (Table 5). There is no significant difference in the seed cotton yield recorded with all the treatments during 2011-12. Same trend was also recorded during 2012-13.

The prime objective of the study was to assess the effect of seed treatment insecticides imidacloprid and carbosulfan against sucking pests of cotton. Seed treatment chemicals gave significant control up to 30 days after sowing compared to untreated check. Overall seed treated with the imidacloprid gave better control of sucking pests compared with carbosulfan and untreated check. Present investigations are fully agreed with the previous findings of Dhandapani *et al.*, (2002) indicated that imidacloprid controlled those sucking pests attacking cotton for up to 8 weeks after sowing. Mishra (2002) found that imidacloprid proved significantly superior in controlling aphids and jassids. Aslam *et al.*, (2004) mentioned that imidacloprid was the most effective on jassids and was effective up to 7 days on thrips (Wilde *et al.*, 1999; Graham, 1998; Burd *et al.*, 1996; Almand, 1995; Mckirdy and Jones, 1996; Bradley *et al.*, 1998; Graham *et al.*, 1995; Harvey *et al.*, 1996).

The highest per cent of germination (87.44) was recorded in cotton seeds treated with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds. The present findings are agreed with Graham *et al.*, (1995) reported that imidacloprid seed treatment at the rate of 5g/kg of seeds enhanced the germination percentage compared to untreated control under field condition.

Highest quantity of seed cotton yield (1340 kg) was recorded in seeds treated with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds, followed by Carbosulfan 25% DS 30 g a.i./kg (1229kg) and Carbosulfan 25% DS 17.5g a.i./kg (1116kg) and lowest seed cotton yield was recorded with untreated control (1034kg). Present trial results similar with results of Hussain *et al.*, (2012) reported that cotton cultivar produced significantly higher yield when seeds were treated with imidacloprid (Gaucho 70 WS) at 5.5g/kg of

fuzzy seed. Seed treatment with Imidacloprid 75% WS @ 3.5 g a.i./kg of seeds had a good control in minimizing the sucking pests population followed by Carbosulfan 25% DS @ 30 g a.i./kg of seeds and Carbosulfan 25% DS @ 17.5 g a.i./kg of seeds.

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