



Persistent Toxicity of Imidacloprid 17.8 SL to Aphids and Leafhoppers on Cotton

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Experiments were conducted to assess the effect of imidacloprid 17.8 SL as foliar application against aphids and leafhoppers on cotton. The results revealed that cent per cent mortality of aphids was observed upto 7 and 9 days after treatment (DAT) and it was upto 9 and 11 DAT for leafhoppers, when imidacloprid 17.8% SL was applied at 25 and 50 g a.i./ha, respectively. The chemical persisted for 29 days at 50g a.i./ha and 25 days at 25g a.i./ha against aphids and 31 days at 25 and 50 g a.i./ha against leafhoppers.

Key words: Cotton, *Aphis gossypii*, *Amrasca biguttula biguttula*, imidacloprid, persistence

Cotton (*Gossypium spp.*) provides the most versatile fibre and continues to rule as the 'king of apparel fibre'. It is ravaged by several insect pests causing drastic reduction in yield. About 1326 insects and mites all over the world and about 200 in India have been recorded as pests of cotton. In the early stage of the crop, sucking pests like aphids, *Aphis gossypii* (Glover), leafhopper, *Amrasca biguttula biguttula* (Ishida), thrips, *Thrips tabaci* (Hood) and whitefly, *Bemisia tabaci* (Gennadius) and in late stage, bollworm complex cause significant damage to the crop. Sucking pests in the early stage of irrigated cotton cause, on an average, 12 per cent yield loss. The estimated damage due to cotton thrips is 109 kg/acre (Ananthakrishnan, 1973). The loss in yield of seed cotton due to whitefly in Andhra Pradesh was 10 - 25 per cent during 1984-85 and 20 - 45 per cent during 1985-86. Dhawan *et al.* (1988) reported an avoidable loss of 1.10 q/ha seed cotton due to jassid attack.

Newer group of insecticides offer great scope as they maintain high toxicity to insects at lower doses and are not persistent as conventional group of insecticides. Imidacloprid, [1-(6-chloro-3-pyridylmethyl)-N-nitroimidazolidin-2-ylideneamine], one such new compound belonging to neonicotinoid group developed by Nihon Bayer, Japan with the trade name of Confidor®, has superior performance on sucking pests such as leafhoppers, plant hoppers, whiteflies and aphids, certain coleopterans and micro lepidopterans at very low dosage with considerable residual activity and low mammalian toxicity (Elbert *et al.*, 1991). The action of imidacloprid is based on an interference with the transmission of impulses in the nervous system of insects similar to the naturally occurring nicotinoids. Imidacloprid

acts by exciting certain nerve cells on a receptor protein (Matsuo *et al.*, 1998).

Materials and Methods

Experiments were conducted in the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, in the glass house during kharif 2001 and 2002 at 29-30°C to assess the effect of imidacloprid 17.8 SL as foliar application against aphids and leafhoppers with the following treatments:

Imidacloprid 17.8 SL	25 g a.i./ha
Imidacloprid 17.8 SL	50 g a.i./ha
Imidacloprid (200 SL)	25 g a.i./ha
Untreated check	-

The experiment was conducted in a completely randomized block design with six replications. Three doses of insecticides were prepared by dissolving 0.2 and 0.4 ml of imidacloprid 17.8 SL and 0.2 ml of imidacloprid 200 SL in one litre of distilled water which will be equivalent to the doses mentioned above.

MCU 5 cotton plants grown in pots were sprayed with the insecticides at the concentrations mentioned above at 25 days after sowing at the rate of 15 ml per plant using an atomizer. After 2 h, insects were released at the rate of 10 per cage and confined to the respective cages. Mortality count was taken 48 h after treatment. Fresh batch of insects were released at 48 hours interval till there was no mortality. Untreated check was maintained by spraying distilled water. The persistent toxicity of imidacloprid foliar treatments against the aphids and leafhoppers was studied using clip on cage and micro cage, respectively.

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The persistent toxicity of imidacloprid 17.8 SL as foliar application against the aphids was assessed using clip on cage method. Transparent blister pack covers of pharmaceutical tablets were used as clip-on cage to confine the aphids on the cotton leaves after treating them with insecticides as mentioned above. Individual packs of 1.5 cm length, 1.0 cm breadth and 0.5 cm height were used after making perforations with a pin at the top for aeration. Then, the clip-on cages were fixed by inserting the cotton leaf in between the cage and a transparent plastic sheet and held in position using paper clips. Ten apterous aphids of uniform age were released into each cage and the mortality was recorded at 48 h interval. Fresh batch of aphids were released at 48 h interval and continued till no mortality was observed.

The persistent toxicity of imidacloprid 17.8 SL against the leafhoppers was studied using the clip-on micro cages of 3-4 cm diameter made of transparent mylar film sheets for confining the test insects on leaves after treating them with insecticides as mentioned above. Ten leafhoppers

of uniform age were released into each micro cage and the mortality was recorded at 48 h interval. Fresh batch of jassids were released at 48 h interval and continued till no mortality was observed. Untreated control was maintained by spraying distilled water. In both the cases, mortality data were corrected with Abbott's formula (Abbott, 1925).

$$\text{Per cent corrected mortality} = \frac{\text{Per cent test mortality} - \text{Per cent control mortality}}{100 - \text{Per cent control mortality}} \times 100$$

The corrected mortality data were used for computing the persistent toxicity index (PTI). Based on PTI, the order of relative efficacy (ORE) was assigned to the treatments.

Results and Discussion

Cent per cent mortality of aphids was observed upto 7 and 9 days after treatment (DAT) when imidacloprid 17.8 SL was applied at 25 and 50 g a.i./ha, respectively (Table 1) and seven days with imidacloprid 200 SL at 25 g a.i./ ha. More than 50

Table 1. Persistent toxicity of imidacloprid 17.8 SL to *Aphis gossypii* on cotton

Treatment	Dose (g a.i./ha)	Corrected per cent mortality/period (days)									
		1	3	5	7	9	11	13	15	17	19
Imidacloprid 17.8 SL (Confidence ®)	25	100	100	100	100	90.00	83.33	63.33	51.67	41.67	25.00
Imidacloprid 17.8 SL (Confidence ®)	50	100	100	100	100	100	96.67	76.67	66.67	56.67	45.00
Imidacloprid 200 SL (Confidor ®)	25	100	100	100	100	93.33	83.33	66.67	55.00	43.33	26.67

Treatment	Dose (g a.i./ha)	Corrected per cent mortality/period (days)									
		21	23	25	27	29	31	P	T	PTI	ORE
Imidacloprid 17.8 SL (Confidence ®)	25	15.00	10.00	3.33	0	0	0	25	48.96	1223.95	3
Imidacloprid 17.8 SL (Confidence ®)	50	36.67	25.00	18.30	11.67	1.67	0	29	58.44	1694.67	1
Imidacloprid 200 SL (Confidor ®)	25	15.00	10.00	5.00	0	0	0	25	49.90	1247.39	2

P - Period of persistence (days)
T - Mean per cent mortality

PTI - Persistent Toxicity Index
ORE - Order of Relative Efficacy

per cent mortality was observed on 15 and 17 DAT with imidacloprid 17.8 SL at 25 and 50 g a.i./ha, respectively. There was progressive reduction in the mortality of aphids as the time increased and the effect of imidacloprid 17.8 SL persisted for 25 and 29 DAT at 25 and 50 g a.i./ha, respectively, while it was 25 days in imidacloprid 200 SL at 25 g a.i./ha.

The order of relative efficacy (ORE) of the insecticides based on the persistent toxicity index (PTI) was: imidacloprid 17.8 SL at 50 g a.i./ha > imidacloprid 200 SL at 25 g a.i./ha > imidacloprid 17.8 SL at 25 g a.i./ha.

When imidacloprid 17.8 SL was applied at 25 and 50 g a.i./ha, cent per cent mortality of leafhoppers

Table 2. Persistent toxicity of Imidacloprid 17.8 SL to *Amrasca biguttula biguttula* on cotton

Treatment	Dose (g a.i./ha)	Corrected per cent mortality/period (days)									
		1	3	5	7	9	11	13	15	17	19
Imidacloprid 17.8 SL (Confidence ®)	25	100	100	100	100	100	97.50	93.06	90.29	84.74	76.95
Imidacloprid 17.8 SL (Confidence ®)	50	100	100	100	100	100	100	95.84	94.45	88.90	87.51
Imidacloprid 200 SL (Confidor ®)	25	100	100	100	100	100	97.36	94.45	90.29	83.35	77.50

Treatment	Dose (g a.i./ha)	Corrected per cent mortality/period (days)											
		21	23	25	27	29	31	33	P	T	PTI	ORE	
Imidacloprid 17.8 SL (Confidence ®)	25	62.51	51.38	35.83	27.63	12.79	3.79	0	31	66.85	2072.39	2	
Imidacloprid 17.8 SL (Confidence ®)	50	64.89	56.69	44.15	37.76	27.49	8.75	0	31	70.97	2199.96	1	
Imidacloprid 200 SL (Confidor ®)	25	58.76	53.61	33.69	24.30	14.30	5.01	0	31	66.62	2065.37	3	

P - Period of persistence (days)
T - Mean per cent mortality

PTI - Persistent Toxicity Index
ORE - Order of Relative Efficacy

was observed upto 9 and 11 days after treatment (DAT), respectively, while it was nine days with imidacloprid 200 SL at 25 g a.i./ ha. More than 50 per cent mortality was observed on 23 DAT with both the doses of imidacloprid 17.8 SL and 200 SL at 25 g a.i./ha treatment. There was progressive reduction in the mortality of leafhoppers as the time increased and the effect of imidacloprid persisted for 31 DAT in all the treatments. The order of relative efficacy (ORE) of the insecticides based on the persistent toxicity index (PTI) was as follows: imidacloprid 17.8 SL at 50 g a.i./ha > imidacloprid 17.8 SL at 25 g a.i./ha > imidacloprid 200 SL at 25 g a.i./ha (Table 2).

The results of persistent toxicity of imidacloprid 17.8 SL as foliar treatment against aphids and leafhoppers on cotton revealed that the chemical persisted for 29 days at 50g a.i./ha and 25 days at 25g a.i./ha against aphids and 31 days at 25 and 50 g a.i./ha against leafhoppers. The results were in agreement with the findings of Kumar (1998), who obtained similar results in cotton and stated that imidacloprid 200 SL foliar spray at 100 and 150 ml/ha persisted for 22 days against *Aphis gossypii* (Glover) and 30 days against *Amrasca biguttula biguttula* (Ishida). Sivaveerapandian (2000) and Babu and Santharam (2000) also reported similar effects on bhendi and groundnut, respectively.

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