



## **Imidacloprid Seed Treatment Effect on Sucking Pests, Predators, Plant Growth and Productivity in Cotton**

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### **ABSTRACT**

*Imidacloprid seed treatment reduced the jassid populations by 65% in research station studies without affecting predator coccinellids. In farmer participatory trials aimed at area-wide management of cotton pests during the past two seasons, it reduced jassids by 62-79% and aphids by 66-72% without affecting the predator coccinellids. It also substantially increased plant height (23-30%) up to eight weeks from planting and increased square production (32-49%) during the initial fruiting period. Further, it helped to eliminate foliar sprays against sucking pests in 19 out of 20 farms for 40-50 days. Fields that did not receive seed treatment, required 1-3 foliar sprays to keep the sucking pests under check. This seed treatment, combined with other management tactics employed for area-wide management of cotton pests, resulted in an increase in seed cotton yields by 28-31% over farmer managed fields without seed treatment.*

### **Introduction**

Sufficient knowledge is available to reduce insecticide use by 50% or more in India on several crops including cotton and to accomplish this, pest management programmes must include selective method of application of insecticides (Adkisson, 1971). Use of seed treatment is one of the selective methods to reduce insecticide usage per unit area and to minimize the adverse effects on non target organisms (Metcalf, 1974). During the early growth period of cotton, sucking pests particularly jassid and aphid de-sap and retard the growth and vitality of the plants. Granular and foliar applications targeted against these pests often prove to be toxic to parasites and predators (Surulivelu and Kumaraswami, 1990; Surulivelu, 1991; Kidd *et al.*, 1996). Therefore, studies were made to manage these pests without causing damage to the predators, using imidacloprid as seed treatment.

### **Material and Methods**

Delinted seeds of *Gossypium hirsutum* varieties (LRA 5166, Anjali) and hybrids (Savita, Surya) were treated with imidacloprid 70 S @ 5g a.i./ha using water @ 3 ml/g and dried in shade. Treated seeds and untreated seeds (control) of the same variety/hybrid were grown side by side in six farmers' fields of 0.4 ha each during winter cotton season 1996-97 (August to February) at Idigarai village near Coimbatore. Observations on jassid, *Amrasca biguttula* Ishida; aphid- *Aphis gossypii* Glov. and predator coccinellids were made during the early crop growth period 19 to 48 days after sowing (DAS) from 20 randomly selected plants per field at weekly interval. Plant growth and square production were observed during 56 to 63 DAS, while the yield was assessed at harvest. During 1997-98, imidacloprid treated seeds of cotton hybrid Savita were planted in 20 farmers' fields of 0.8 ha each at Kalipatti village

near Palani as part of a farmer participatory IPM programme and observations were made on pests and predators. In the same year, an experiment was conducted in the Regional Station of Central Institute for Cotton Research (CICR), Coimbatore, to assess the effect of imidacloprid seed treatment on sucking pests and predators.

### **Results and Discussion**

#### ***Spray Reduction***

Imidacloprid seed treatment was effective against the sucking pests jassids, aphids and thrips that are normally present in this region. Control fields sown with untreated seeds of both varieties and hybrids required 1 to 3 foliar applications with systemic insecticides like oxy-demeton methyl, dimethoate etc., while there was no need for any foliar application on fields sown with treated seeds of either varieties or hybrids.

In farmer managed fields, spray decisions were made by farmers themselves without applying any standard criteria like economic threshold levels and this resulted in more spray at short intervals. However, in most fields, only one application was required (either seed treatment or foliar) to manage the sucking pests up to 50 DAS.

#### ***Effects on pests and predator in varietal cotton***

Imidacloprid treated fields had 79% fewer jassids (range 1.3-6.3/20 leaves); 72% aphid (range 5.0-30.7/20 leaves) and there was very little difference in respect to predator coccinellid populations compared to untreated fields. Thus, imidacloprid was effective against jassid and aphid without affecting the coccinellid predators (Table 1).

Investigations carried out at the farm of the Central Institute for Cotton Research, Regional Station, Coimbatore revealed that imidacloprid reduced jassid populations by 65% without affecting the predator coccinellids and the density of jassids did not influence the predator coccinellids activity (Fig. 1).

#### ***Effect on pests and predator in hybrid cotton***

Sucking pest jassid and aphid populations were much larger in fields grown with hybrid cotton compared to fields grown with cotton varieties (Table 1, 2). Jassid populations ranged from 3 to 18 and 9 to 43 while aphid population ranged from 1 to 76 and 35 to 240 in treated and control fields respectively. Coccinellid predator populations were 40% higher in treated fields. Hybrid cotton exhibited greater vigour and put forth more foliage and this may be the reason for harbouring a greater populations of aphid and jassid compared to cotton varieties. However, coccinellid populations were slightly higher in varietal fields compared to hybrid cotton (Tables 1, 2). In untreated hybrid cotton, 40% fewer predators were observed and this may be the possible reason for registering high population levels of aphids and jassids in these fields (Table 2).

#### ***Seed treatment as a component of area-wide management of cotton pests***

Observations of jassid in 20 farmers' fields, where imidacloprid seed treatment was used as a component of area-wide management in Kalipatti village during 1997-98, revealed that only one farm had more than 50 jassids / 100 leaves, while the other 19 farms had 0-20 jassids during 25-38 DAS (Fig. 2). Three weeks later, two farms had 42 and 63 jassids, while the remaining 18 farms were free from jassid. This indicates that imidacloprid seed treatment was effective against jassid. The percentage of aphid infested plants in the 20 farms ranged from 0-54%. In seven farms it crossed the economic threshold level (20% infested plants). However, insecticide sprays were not recommended, as predator populations were substantially higher in these fields (ranged from 26-64 / 100 plants). In control fields (farmer managed fields without seed treatment), the farmers applied 1-5 times (mean 3.5 times) to keep the sucking pests under check. This seed treatment, combined with other management tactics employed for area-wide management of cotton pests (Surulivelu, 1997), resulted in an increase in seed cotton yields of 28-31% in farmer participatory fields of Idigarai and Kalipatti villages (Fig. 3).

#### ***Seed treatment influence on plant growth and square production***

Imidacloprid treated seeds of varieties and hybrids resulted in increased plant height by 23-30 % over control. (Table 3) The increase in plant growth also resulted in increased square production by 32-49% in

hybrids and varieties over untreated control plants (Table 3). As a result of heterosis hybrids produced numerically more fruiting points but the increase over the control plants was higher in the case of varieties than hybrids. Thus the varietal response to seed treatment was little higher than hybrids in respect of square production.

This study revealed that cottonseed treatment with imidacloprid gave effective control of aphids and jassids for up to eight weeks. This confirms earlier findings (Attique and Ghaffer, 1996; Mullins and Christie, 1995; Qiang *et al.*, 1995). The predator populations were almost equal in both treated and untreated fields and this is in contrast with the findings of Attique and Ghaffer (1996), who reported that the predator population in the treated plots was lower than in the untreated plots. This study has shown that treated plants were not completely free from aphid infestation. As the coccinellid predator has a close association with its prey, its reduction was not observed in the present study. Careme *et al.* (1996) reported that cotton crops grown with imidacloprid treated seeds matured 10 days earlier than untreated crops. This study also revealed that imidacloprid induced early plant growth and increased square production in the initial fruiting period. Attique and Ghaffer (1996) also observed an increased square production in treated fields over controls.

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**Table 1. Effect of imidacloprid ST on aphid, jassid and predator coccinellid in cotton variety.**

Crop age DAS	Jassid		Aphid		Predator	
	FPT	FM	FPT	FM	FPT	FM
19 - 20	1.3	12.0	1.3	17.0	1.3	1.0
31 - 37	2.7	30.7	4.7	120.7	4.0	4.7
37 - 41	6.3	18.7	32.0	86.3	5.3	5.3
46 - 48	3.7	5.0	30.7	22.7	4.7	4.0
Mean	3.5	16.6	17.2	61.7	3.9	3.8
	(-78.9%)		(- 72.1%)			

DAS - Days After sowing; Population / 20 leaves; - FPT - Farmer Participatory Trial using seed treatment ; FM - Farmer Managed field

**Table 2. Effect of imidacloprid ST on aphid, jassid and predator - coccinellid in hybrid cotton.**

Crop age DAS	Jassid		Aphid		Predator	
	FPT	FM	FPT	FM	FPT	FM
17 -19	4.0	9.0	0.7	35.0	1.3	1.7
31-35	2.5	43.3	38.0	23.7	3.0	4.0
37-41	17.7	21.0	75.7	240.3	7.8	3.3
46-48	11.7	20.7	15.3	78.0	2.7	1.0
Mean	9.0	23.5	32.4	94.3	3.5	2.5
	(-61.7%)		(-65.6%)		(+40%)	

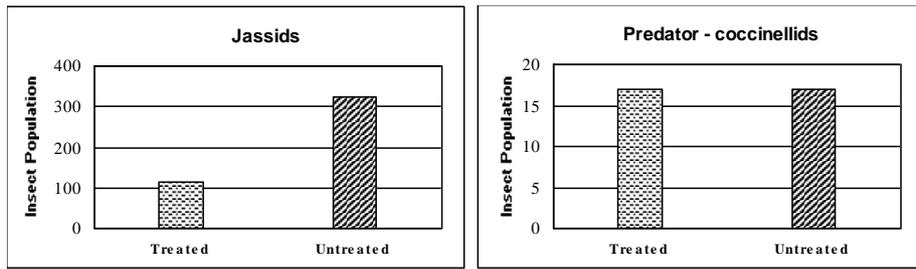
DAS - Days After Sowing; Population / 20 leaves; FPT - Farmer Participatory Trial fields; FM - Farmer Managed fields

**Table 3. Effect of imidacloprid seed treatment on plant growth and productivity.**

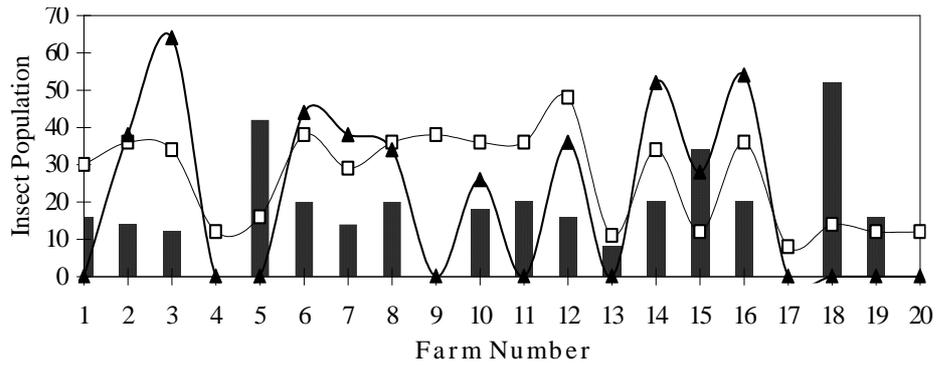
Varieties	Plant height* (cm)		Square produced*	
	FPT	FM	FPT	FM
Farm 1	65.6	52.5	14.4	11.4
Farm 2	60.8	51.0	20.6	13.8
Farm 3	52.0	41.9	12.8	7.0
Mean	59.5	48.5	15.9	10.7
	(+22.7%)		(+48.5%)	
Hybrids	Plant height* (cm)		Square produced*	
Farm 1	79.2	60.8	24.8	20.8
Farm 2	51.8	40.9	13.6	9.3
Farm 3	57.7	43.1	17.4	12.3
Mean	62.9	48.3	18.6	14.1
	(+30.2%)		(+31.9%)	

\*Mean of 20 plants/field; FPT - Farmer Participatory Trial fields; FM - Farmer Managed fields

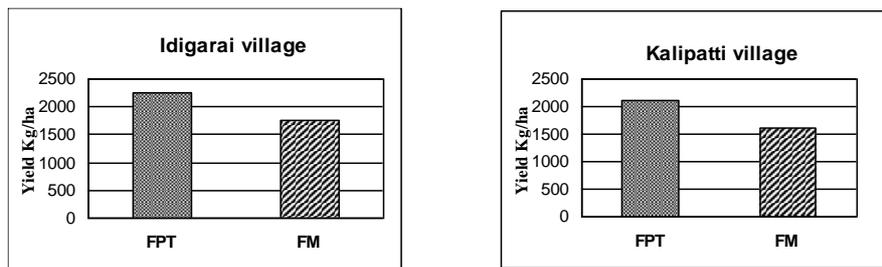
**Figure 1. Imidacloprid ST on pest and predator in cotton.**



**Figure 2. Effect of imidacloprin on sucking pests and predators in cotton.**



**Figure 3. Effect of imidacloprid on yield.**



FPT-Farmer Participatory Trials; FM-Farmer Managed fields