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Effect of Different Formulations and Methods of Application of Insecticides on Some Sucking Pests and their Predator in Cotton

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ABSTRACT

Foliar application of dimethoate was relatively safe to the predator, *Menochilus sexmaculata* Fab. and was effective against the leaf hopper *Amrasca biguttula biguttula* Ishida from 28 to 52 days after sowing. Seed treatment with Carbofuran 40F was the next best and gave protection from the leaf hoppers from germination to 42 days after sowing and was also safe to the predator. Although soil application with aldicarb or carbofuran reduced the abundance of the predator, it was the most effective treatment for the aphid, *Aphis gossypii* Glov.

Key Words : Cotton, pesticides, soil application, seed treatment, foliar application, Coccinellid, jassid, aphid

Adkisson (1971) stated that sufficient knowledge is available to reduce insecticidal use by 50 percent or more on several major crops, and to accomplish this, pest management programmes must include more of selective method of application of insecticides. There are several relatively simpler ways by which over-treatments could be avoided (Metcalf, 1974). Use of improved application techniques, adoption of seed treatment etc. are some of the progressive measures to curtail the adverse effects of insecticidal application on non-target organisms (Metcalf, 1975). The present investigation was designed to study the effect of different formulations and methods of application of insecticides on sucking pests (aphid, jassid) and their predator (coccinellid) in cotton.

MATERIALS AND METHODS

A field experiment was conducted during 1983-84 winter cotton season with seven treatments (Table 1) which were replicated four times in a randomised block design. The variety MCU 5 VT was used and the recommended agronomic practices were followed. Carbosulfan 25 SD and carbofuran 35 ST were directly mixed with delinted seeds. Carbofuran 40F was applied on to the delinted seeds using starch as sticker. The granules of aldicarb and carbofuran were applied ten days after sowing (DAS) while all the foliar sprays were applied thrice, 20, 34 and 49 days after sowing with 200, 265 and 400 lit. of spray fluid/ha respectively, using a high volume sprayer.

Population of both nymphs and apterus adults of aphid, the total number of nymphs of jassid and the total number of larvae of coccinellid predator present on two leaves, one each from top and middle portion in each of the ten randomly selected plants per plot was assessed upto 62 DAS. Subsequently, common insecticidal treatments were given for controlling the bollworms. Seed cotton yield was assessed at harvest. Plant height, biomass and fruiting parts production upto 62 DAS were also assessed. Biomass (dry matter) production was assessed by sampling one plant in each of the ten rows of the plot leaving the border rows and plants. The height of the pulled out plants was measured from the O node and then dried at 105°C to constant weight.

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Table 1. Effect of Seed treatment, Soil and foliar application of insecticides on *A.biguttula biguttula*

Winter 1983-84

Treatment	No.of jassids/20 leaves - days after sowing (DAS)							Mean
	19	28	34	42	47	55	62	
Seed treatment with carbosulfan 25SD at 1g ai / 100g seed	3.5 (1.85)	7.25 (2.82)	9.25 (2.99)	11.25 (3.31)	14.0 (3.59)	13.75 (3.65)	14.5 (3.80)	10.50 (3.14)
Seed treatment with carbofuran 35ST at 1 g ai / 100g seed	3.25 (1.74)	6.5 (2.50)	8.25 (2.80)	11.75 (3.38)	9.0 (2.94)	19.75 (4.38)	18.0 (4.11)	10.92 (3.12)
Seed treatment with carbofuran 40F at 5 g ai / 100g seed	2.0 (1.35)	3.0 (1.65)	5.5 (2.24)	6.5 (2.46)	13.25 (3.47)	16.00 (3.91)	14.5 (3.77)	8.67 (2.69)
Soil application of carbofuran G at 1.0 kg ai/ha	3.5 (1.79)	3.0 (1.65)	1.25 (1.10)	1.5 (1.21)	3.25 (1.66)	8.5 (2.84)	9.5 (3.04)	4.35 (1.90)
Soil application of aldicarb G at 1.0 kg ai/ha	3.75 (1.86)	3.25 (1.73)	2.25 (1.46)	1.75 (1.25)	5.25 (2.27)	8.0 (2.31)	8.0 (2.80)	4.60 (1.95)
Foliar spray with dimethoate at 188 g ai/ha	4.0 (1.89)	3.0 (1.65)	7.0 (2.47)	1.75 (1.29)	6.25 (2.37)	4.25 (1.75)	9.25 (3.00)	5.07 (2.06)
Untreated check	7.25 (2.68)	13.75 (3.67)	17.5 (4.16)	15.75 (3.93)	17.25 (4.00)	20.00 (4.41)	17.0 (3.99)	15.50 (3.83)
Period mean	3.89 (1.88)	5.67 (2.24)	7.28 (2.46)	7.17 (2.40)	9.75 (2.90)	12.89 (3.32)	12.96 (3.50)	

Figures in parentheses are $\sqrt{X}$. Foliar applications were given on 20, 34 and 48 DAS; Granular treatments were given on 10 DAS

C.D. (P=0.05) Treatment (T) = 0.40** Period (P) = 0.40** P x T = 1.06*

* Significant at 5% level ** Significant at 1% level

RESULTS AND DISCUSSION

Soil application of carbofuran and aldicarb granules and foliar application of dimethoate were identical in effects and registered higher reduction of the leaf hoppers (Table 1). Among the three seed treatments, carbofuran 40F effected the highest reduction and was effective from germination to 42 DAS.Seed treatment with carbosulfan 25 SD reduced the leaf hoppers population significantly only on 34 DAS while carbofuran 35 ST was effective from 28 to 55 DAS.

There were significant differences in the incidence of aphid population between the treatments (Table 2). Soil application of aldicarb reduced the population significantly over all other treatments, except carbofuran soil application which was the second best. Both the seed treatments *viz.*, carbosulfan 25 SD as well as carbofuran 35 ST and foliar applications of dimethoate were moderately effective, while carbofuran 40F was ineffective. The aphid population showed significant differences in the various growth periods *viz.*, 19 to 62 DAS. The interaction

Table 2. Effect of Seed treatment, granular and foliar application of insecticides on *A. gossypii*

Winter 1983-84

Treatment	No.of aphids/20 leaves - days after sowing (DAS)							Mean
	19	28	34	42	47	55	62	
Seed treatment with carbosulfan 25SD at 1g ai / 100g seed	8.50 (2.83)	20.75 (4.45)	16.00 (3.92)	15.75 (3.74)	22.25 (4.64)	41.00 (5.98)	55.50 (7.14)	25.67 (4.67)
Seed treatment with carbofuran 35ST at 1 g ai / 100g seed	2.50 (1.56)	51.75 (6.77)	28.25 (4.91)	11.75 (3.33)	7.25 (2.35)	43.00 (6.45)	78.50 (8.72)	31.85 (4.87)
Seed treatment with carbofuran 40F at 5 g ai / 100g seed	8.00 (2.76)	24.25 (4.87)	35.25 (5.72)	13.25 (3.57)	21.75 (4.72)	34.50 (5.82)	64.75 (7.93)	28.82 (5.06)
Soil application of carbofuran G at 1.0 kg ai/ha	3.75 (1.90)	18.25 (4.01)	21.00 (4.34)	10.25 (2.97)	11.75 (3.25)	27.25 (5.13)	61.50 (7.75)	21.96 (4.19)
Soil application of aldicarb G at 1.0 kg ai/ha	5.00 (2.11)	13.00 (3.31)	18.50 (4.14)	4.75 (2.08)	8.25 (2.75)	23.00 (4.75)	30.00 (5.16)	14.64 (3.47)
Foliar spray with dimethoate at 188 g ai/ha	4.50 (2.10)	21.00 (4.26)	31.25 (5.48)	11.25 (3.12)	33.00 (5.47)	40.00 (6.15)	60.00 (7.72)	28.71 (4.90)
Untreated check	43.00 (6.38)	38.50 (6.11)	33.00 (5.27)	12.25 (3.32)	18.25 (3.96)	36.00 (5.86)	38.25 (6.19)	31.32 (5.30)
Period mean	10.75 (2.81)	26.78 (4.83)	26.17 (4.83)	11.32 (3.16)	17.50 (3.88)	34.96 (5.74)	55.50 (7.23)	

Figures in parenthesis are $\sqrt{X}$; Treatment timings: Foliar application on 20, 34 and 48 DAS
Granular treatments were given on 10 DAS

C.D. (P=0.05) Treatment (T) = 0.77** Period (P) = 0.77** P x T = 2.03*

* Significant at 1% level ** Significant at 5% level

effect of period and treatment showed significant differences. On 28 DAS, the effective treatments were soil application of aldicarb and carbofuran. None of the treatments were effective against the aphid during the period 34 to 62 DAS.

The population of the predatory beetles, *M.sexmaculata* in plots that had received seed treatments and foliar applications with dimethoate was identical with that of untreated check (Table 3). But, soil application of carbofuran and aldicarb registered significantly less population of the predator. Among the two, carbofuran was found to support the least number of the predator (Fig.1). The predator population was always fluctuating in the various growth periods. It was maximum on 62 DAS and lowest on 42 and 55 DAS.

Seed treatment with carbofuran 40F showed a significant increase in plant height over dimethoate treatment and check 30 DAS. However, all the treatments were identical and superior to check in significantly increasing

Table 3. Effect of Seed treatment and soil and foliar application of insecticides on *M. sexmaculata*

Winter 1983-84

Treatment	No.of larvae/20 leaves - days after sowing (DAS)						Mean
	28	34	42	47	55	62	
Seed treatment with carbosulfan 25SD at 1g ai / 100g seed	5.75 (2.35)	11.00 (3.26)	3.25 (1.72)	7.25 (2.49)	5.00 (1.96)	22.25 (4.65)	9.08 (2.74)
Seed treatment with carbofuran 35ST at 1 g ai / 100g seed	17.75 (3.55)	7.75 (2.67)	1.00 (1.00)	9.25 (2.75)	1.25 (1.10)	20.50 (4.36)	9.58 (2.57)
Seed treatment with carbofuran 40F at 5 g ai / 100g seed	6.00 (2.37)	13.25 (3.39)	7.50 (2.57)	13.50 (3.13)	5.50 (2.17)	16.75 (3.84)	10.41 (2.91)
Soil application of carbofuran G at 1.0 kg ai/ha	4.75 (1.99)	5.75 (2.24)	2.75 (1.61)	3.00 (1.50)	2.25 (1.36)	9.50 (2.91)	4.66 (1.93)
Soil application of aldicarb G at 1.0 kg ai/ha	2.75 (1.61)	4.25 (2.02)	1.25 (1.10)	14.00 (3.55)	1.50 (1.20)	20.25 (4.45)	7.33 (2.32)
Foliar spray with dimethoate at 188 g ai/ha	5.25 (2.16)	13.25 (3.21)	6.00 (2.39)	20.75 (4.36)	7.00 (2.15)	22.00 (4.57)	11.58 (2.92)
Untreated check	6.00 (2.40)	8.00 (2.82)	6.00 (2.39)	6.00 (2.43)	6.75 (2.22)	12.50 (3.30)	7.54 (2.59)
Period mean	6.89 (2.35)	9.04 (2.80)	3.28 (1.64)	10.53 (2.89)	4.17 (1.74)	17.67 (4.01)	

Figures in parenthesis are $\sqrt{X}$; Treatment timings: Foliar application on 20, 34 and 48 DAS Granular treatments were given on 10 DAS

C.D. (P=0.05) Treatment (T) = 0.63** Period (P) = 0.59** P x T = NS*

* Significant at 5% level ** Significant at 1% level

the plant height 39 DAS. Significant difference in respect of plant weight was not seen among the treatments 30 DAS. However, on 39 DAS, all the treatments were identical and superior to check in increasing the dry weight per plant, ranging from 36.48 to 53.78 per cent over the latter. All the treatments were equally effective and significantly superior to check in increasing the number of retained fruiting parts 63 DAS (Table 4).

The presence of highest number of coccinellids in the plots treated with dimethoate may be due to its moderate effectiveness on aphid which might have permitted more number of predators to colonize on the unaffected individuals. It was also true that the quantum of toxicant used with dimethoate was considerably low (188 g ai/ha) as compared to granular applications (1.0kg ai/ha) and this might have also influenced the predator activity. The decline of predator

Table 4. Plant growth (height), dry matter production and productivity as influenced by Seed treatment, Soil and foliar application of insecticides

Winter 1983-84

Treatment	Plant height in cm		Dry weight in g/ plant		No. of retained fruiting parts/10 plants	Seed Cotton yield kg/ha**	Per cent increase from check
	30 DAS*	39 DAS*	30 DAS	39 DAS*			
Seed Treatment with Carbosulfan 25 SD at 1g ai/100g seed	9.68[ab]	20.60[a]	8.80	44.13a	185.0[a]	1935[ab]	75.6
Seed treatment with Carbofuran 35ST at 1g ai/ 100 g seed	9.93[ab]	22.20[a]	9.23	48.25a	180.8[a]	1863ab	69.1
Seed treatment with Carbofuran 40F at 5g ai/ 100g seed	10.68[a]	21.68[a]	9.60	47.25[a]	199.5[a]	1739b	57.8
Soil application of carbofuran G at 1.0 kg ai/ha	9.60[ab]	21.98a	8.58	47.75[a]	196.0[a]	1991[ab]	80.7
Soil application of aldicarb G at 1.0 kg ai/ha	10.15[ab]	21.80[a]	8.78	47.50[a]	203.0[a]	2193[a]	99.0
FoliarSpray with Dimethoate at 188 g ai/ha	9.00[bc]	20.55a	8.10	42.83[a]	195.5[a]	1982ab	79.9
Untreated check	8.28[c]	17.60[b]	7.13	31.38[b]	141.5[b]	1102[c]	—
C.D. (P = 0.05)	1.22*	2.53*	N.S.	9.63*	34.2*	330**	—

Means followed by a common letter in a column are not significantly different
Treatment timings: Foliar applications on 20, 34 and 48 DAS; Granular treatments on 10 DAS
* Significant at 5% level; ** Significant at 1% level

population in the granular treatments may be due to the depletion of its prey (aphid) at a greater level as compared to other treatments (Table 2). The population of aphids and coccinellids were found to be in comparable proportion (Table 2,3) in all the treatments including check (excluding granular treatments). This reveals that the prey-predator relationship was in a direct proportion in these treatments. But, the leaf hopper population was altogether different. It was low in dimethoate and granular treatments, at a moderate level in seed treatments and at a very high level in check plots (Table 1).

All the insecticidal treatments were significantly superior to check in increasing the seed cotton yield (Table 4). However, the granular treatment with aldicarb (at 1.0kg) was the best followed by carbofuran granular treatment (at 1.0kg), dimethoate foliar application and seed treatments (Carbosulfan 25 SD and Carbofuran 35 ST), there being no significant difference among them.

The increased yield of seed cotton obtained from aldicarb granular treatment may be due to the production and retention of more number of fruiting parts (Table 4).

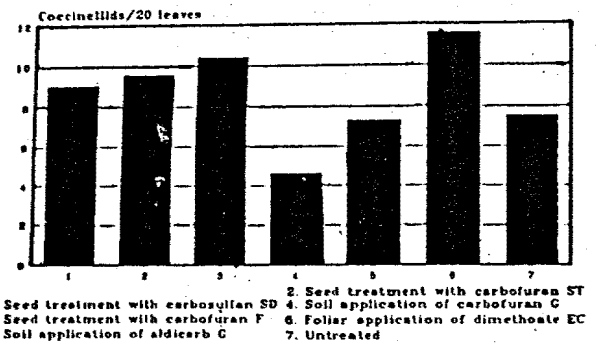

Fig. 1. Influence of seed treatment, soil and foliar application of insecticides on coccinellid population

The effectiveness of aldicarb upto 62 Days (Murthy, 1980a) and carbofuran seed treatment upto 37 days (Murthy, 1980b) for leafhoppers has been reported. The present study has brought out that soil application of carbofuran and aldicarb granules, and foliar application of dimethoate were identical in effect on the leaf hopper. Since the granular treatments were toxic to the *M. sexmaculata* as evidenced from this study and also reported by Ridgway *et al.* (1967) and Timmons (1973), the foliar application of dimethoate is identified as the least harmful method, for leaf hopper control. Further,it was also evident that seed treatment with carbofuran 40F was effective from germination to 42 days after sowing in leaf hopper control and safe to the predator. Although the granular treatments reduced the abundance of the predator, they were the only effective treatments for the control of the aphid. Regupathy and Subramanian (1980) also observed the superior efficacy of aldicarb for the aphids and leafhoppers in cotton.

The present study also indicated that soil application with aldicarb as well as carbofuran, seed treatment with carbofuran and carbosulfan and foliar application with dimethoate were superior to check in increasing the plant height, dry matter production, the number of retained fruiting parts and seed cotton yield.

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