

COMPARATIVE STUDIES ON THE EFFICACY OF ELECTRODYN SPRAY SYSTEM WITH DIFFERENT FLOW RATES AND APPLICATION TECHNIQUES AGAINST INSECT PESTS OF COTTON

Muhammad Ashfaq, Javed Manzoor and Muhammad Afzal

Department of Agricultural Entomology, University of Agriculture, Faisalabad, Pakistan

ABSTRACT

The effect of electrodyn (ED) sprays at different flow rates compared with EC spray against insect pests of cotton, carbofuran (Advantage 20 EC) @ 375 gm a.i. ha⁻¹ proved to be the best against sucking insects, viz., jassid, whitefly and thrips. No significant difference was found in the effectiveness of the ED insecticides, 150 and 200 gm/litre, applied at the respective flow rates of 0.05, 0.10 and 0.025 ml/sec against insect of cotton. The ED formulations of λ -cyhalothrin proved significantly better against bollworms infestation on flowers and bolls while λ -cyhalothrin 2.5 EC @ 20 gm a.i. ha⁻¹ proved highly effective against bollworms infestation on squares.

INTRODUCTION

The application of chemicals through Electrodyn (ED) spray system is being claimed to be simple, safer and easy to use without any material losses. The electrodynamic technology uses electrical forces to generate very small and slightly charged droplets and propels them towards the crop. Ghaffar (1988) could not find significant difference in the control of insect pests of cotton with cymbush 3 EC and Karate 2 ED as compared with the application of cymbush with Knapsack sprayer.

Coffee (1981) described that electrodynamic crop spraying applies smaller droplets (100/ μ m) of a narrow size spectrum, at ultra low volume. Besides, the spray comprises of positively charged droplets which wrap around the plant carrying negative charge. In this way coverage of different plant parts is achieved and very little spray is wasted through drift and drip (Anonymous, 1984). It was further claimed that this system of spray has many advantages viz., no maintenance cost, neither filling, nor mixing of chemicals and requirement for water, further it involves ultra low energy consumption and ultra low volume application without any drift problem (Javaid *et al.*, 2000, 2004).

Keeping in view the aforesaid advantages of electrodyn (ED) spray system, carbosulfan (Advantage) applications through Ed system at nozzle flow rates of 0.025, 0.05 and 0.10 ml/sec

compared by application Carbofuran (Advantage 20 EC) at the rate of 375 gm a.i./ha with Knapsack sprayer against insect pests. Similarly, insecticide λ -cyhalothrin ED at 0.05 and 0.10 ml/sec. was tested against bollworms and compared with λ -cyhalothrin 2.5 EC applied through Knapsack sprayer.

MATERIALS AND METHODS

The cotton variety FH-87 was grown on 15.06.1988 in two areas following Randomized Complete Block Design with 4 replications, in the Experimental Area of the Department of Agri. Entomology, University of Agriculture, Faisalabad. Size of plot was 6.12 \times 6.88 meters with 8 rows. The plant to plant and row to row distance was 37.5 cm and 0.76 m, respectively.

Prior to bollworms infestation the crop in area-II received two applications of carbosulfan ED with yellow nozzle, flow rate 0.05 ml/sec. at 14 days interval to protect it from the attack of sucking insects.

Observations on the population of insect pest viz., cotton jassid, *Amrasca devastans* Dist., whitefly, *Bemisia tabaci* Genn. and thrips, *Thrips tabaci* Lind. were recorded before the first spray and then on the 3rd, 6th and 10th day after the insecticidal application.

The damaged squares, flowers and bolls, per 100 each were randomly selected from each treatment on the 3rd, 6th and 10th day after the treatment and percent damage was worked out.

The yield of seed cotton was also recorded. The data were analysed statistically by Duncan's Multiple Range test was applied to test the significance of results.

Area I. Detail of electrodyne (ED), EC and control treatments

Treatments	Nozzle colour	Rows covered	Flow rate of nozzle	Rate	Droplet size
			ml/sec	g/gallon	Micron
Carbosulfan ED	Yellow	1	0.05	100	40-50
Carbosulfan ED	Blue	2	0.10	100	80-90
Carbosulfan ED	White	2	0.025	66	30
Carbosulfan EC	-	2	-	375	-
Control	-	-	-	-	-

Area II. Detail of electrodyne (ED), EC and control treatments

Treatments	Nozzle colour	Rows covered	Flow rate of nozzle	Rate	Droplet size
			ml/sec	gm a.i./ha	Micron
λ -chyhalothrin ED	Yellow	1	0.05	13.4	40-50
λ -chyhalothrin ED	Blue	2	0.10	13.4	80-90
λ -chyhalothrin EC	-	2	-	20.0	-
Control	-	-	-	-	-

RESULTS AND DISCUSSION

The results (Table 1) revealed that both EC and ED formulations of carbosufan (Advantage) proved equally effective against cotton jassid after first spray but the second application of EC formulation gave better results against this insect. Kandoria and Singh (1982) also found EC formulation better than ED application against cotton jassid. However, Cayley *et al.* (1984) reported inferior results with electrostatic sprayer because with this technique 1-2 times more chemical electrostatic on upper leaves of plants and 1-10 times less on lower leaves. Similarly in the present studies the average number of insecticide drops on the upper leaves has also been found 3.6 times more as compared with the efficiency of the ED formulation.

EC formulation was also better against cotton whitefly (Table 2) but Anonymous (1981) reported electrodyn spray to be the best against this insect. Further, both EC and ED formulations of carbosufan have proved equally effective against thrips (Table 3). The findings of Ghaffar (1988) also confirm these results while Arnold *et al.* (1984), Galli and

Nakano (1985), Kisha (1986 a, b) and Ingram *et al.* (1987) got best results with electrodyn spray against different insect pests.

In the present studies the EC formulation of λ -cyhalothrin proved better than ED formulation against spotted bollworms of cotton but Anonymous (1981), Herzog *et al.* (1983) and got best results against bollworms with electrodyn (ED) sprayers. However, Ingram *et al.* (1987) and Ghaffar (1988) found EC and ED formulations equally effective against these insects.

On over all basis EC treatment in the present investigation have been found better than ED treatment for controlling the insect pest complex of cotton. Further the different flow rates of ED sprayer used in these studies did not differ significantly from one another.

Both EC and ED formulations of different insecticides tested, gave significantly, highly yield of seed cotton as compared with check. However, EC formulation proved superior to ED formulation in insect control and increase in yield.

Table 1. Jassid population leaf⁻¹ in different treatments at various post –spray intervals

Treatments	1 st spray				2 nd spray			
	Before	After (days)			Before	After (days)		
		3	6	10		3	6	10
Carbosulfan ED @ 0.05ml/sec	3.86 ^{ns}	2.12b	2.28ab	2.02b	2.01 ^{ns}	1.24c	1.40b	1.87b
Carbosulfan ED @ 0.10ml/sec	4.16	2.14b	2.12b	2.00b	2.29	1.80bc	1.25b	1.70b
Carbosulfan ED @ 0.025 ml/sec	4.00	2.00b	2.17b	2.26b	2.20	2.06b	1.57b	1.50b
Carbosulfan EC @ 375 g / ha	3.90	2.08b	1.75b	1.59c	2.20	0.24d	0.32c	0.52c
Control	3.94	3.11a	2.62a	2.69a	2.25	3.19a	2.44a	3.38a

Table 2. White fly population leaf⁻¹ in different treatments at various post –spray intervals

Treatments	1 st spray				2 nd spray			
	Before	After (days)			Before	After (days)		
		3	6	10		3	6	10
Carbosulfan ED @ 0.05ml/sec	2.98 ^{ns}	1.78 ^{ns}	1.28 ^{ns}	0.70 ^{ns}	1.09 ^{ns}	0.40 ^{ns}	1.00ab	0.88ab
Carbosulfan ED @ 0.10ml/sec	3.04	1.91	1.05	0.78	0.93	0.34	0.75ab	0.92ab
Carbosulfan ED @ 0.025 ml/sec	3.03	1.63	0.94	0.67	1.18	0.32	0.54bc	0.69b
Carbosulfan EC @ 375 g / ha	2.70	1.50	0.88	0.53	1.19	0.30	0.40c	0.32b
Control	2.90	2.80	1.30	0.95	1.03	0.52	1.40a	1.42a

Table 3. Thrips population leaf⁻¹ in different treatments at various post –spray intervals

Treatments	1 st spray				2 nd spray			
	Before	After (days)			Before	After (days)		
		3	6	10		3	6	10
Carbosulfan ED @ 0.05ml/sec	10.10 ^{ns}	9.34b	6.39ab	6.72b	1.89 ^{ns}	Thrips population before 2 nd spray was negligible & non-significant in range of 1.89-2.64 thrips leaf ⁻¹ hence, the effect was not recorded.		
Carbosulfan ED @ 0.10ml/sec	10.27	9.42b	5.87b	5.97b	2.00			
Carbosulfan ED @ 0.025 ml/sec	10.47	8.82b	5.85b	6.64b	2.64			
Carbosulfan EC @ 375 g/ha	10.07	6.84c	4.96b	5.77b	2.20			
Control	10.50	11.29a	7.59a	8.84a	2.30			

Table 4a. Flower infestation (%) by bollworms in different treatments at various post-spray intervals

Treatments	1 st spray				2 nd spray			
	Before	After (days)			Before	After (days)		
		3	6	10		3	6	10
λ -chyhalothrin ED @ 0.05ml/sec	38.42 ^{ns}	25.21b	30.10	23.73a	24.85b	27.33b	19.45b	15.30bc
λ -chyhalothrin ED @ 0.10ml/sec	26.05	27.41b	33.08	24.93b	25.76b	22.15b	24.54b	8.17c
λ -chyhalothrin EC @ 20 g a.i. ha ⁻¹	31.45	20.30b	25.79	15.66b	17.43b	16.41b	18.83b	24.68ab
Control	39.63	43.67a	38.60	42.33a	46.58a	42.25a	37.22a	31.24a

Table 4 b. Squares infestation (%) by bollworms in different treatments at various post-spray intervals

Treatments	1 st spray				2 nd spray			
	Before	After (days)			Before	After (days)		
		3	6	10		3	6	10
λ -chyhalothrin ED @ 0.05ml/sec	22.15 ^{ns}	16.91c	14.39	13.01bc	22.27b	16.97b	12.76b	10.59b
λ -chyhalothrin ED @ 0.10ml/sec	24.12	20.64b	18.81	17.20b	20.18b	13.64c	11.28b	12.51b
λ -chyhalothrin EC @ 20 g a.i. ha ⁻¹	23.10	10.28d	19.48	11.60c	16.03b	9.43d	11.94b	8.27b
Control	20.36	23.87a	24.01	25.39a	30.69a	25.30a	27.81a	25.88a

Table 4 c. Bolls infestation (%) by bollworms in different treatments at various post-spray intervals

Treatments	1 st spray				2 nd spray			
	Before	After (days)			Before	After (days)		
		3	6	10		3	6	10
λ -chyhalothrin ED @ 0.05ml/sec	24.34	10.98b	13.51b	9.90b	14.82 ^{ns}	8.19b	8.86b	7.55c
λ -chyhalothrin ED @ 0.10ml/sec	23.77	12.76b	14.36b	8.52b	16.84	8.48b	6.73b	17.75b
λ -chyhalothrin EC @ 20 g a.i. ha ⁻¹	23.66	16.39b	11.13b	7.64b	13.12	9.68b	7.01b	28.00a
Control	23.26	18.69a	21.74a	13.17a	20.59	18.72a	26.56a	6.25c

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