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Carbofuran Residues in/on Okra Fruits (*Abelmoschus esculentus* (L.) Moench)

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ABSTRACT

Soil application of carbofuran 3 G @ 0.75 kg a.i./ha immediately after germination of okra seed left its residue below detectable level in fruits of first two pickings. Higher doses of carbofuran on the other hand caused residues of higher order and the fruits were unsafe for consumption.

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INTRODUCTION

Okra, *Abelmoschus esculentus* (L.) Moench is attacked by various insect pests. Carbofuran, one of the systemic carbamate insecticide available in market in form of 3 per cent granules has been proved to be effective in controlling the sucking pest of okra by various workers (Palaniswamy and Subramanium, 1972; Palaniswamy *et al.*, 1973; Krishnaiah *et al.*, 1976 ; Gunathilagaraj and Jayraj, 1976; Verma and Tripathi, 1977; Ramamohana and Ayyana, 1977; Sinha *et al.*, 1981 ; Srinivasan and Krishnakumar, 1983 ; Anonymous, 1984). Its growth stimulating and yield promoting effects have also been observed by Perumal *et al.*, 1971; Palaniswamy *et al.*, 1974 ; Shanthakumar *et al.*, 1975).

The farmers of South Gujarat are after to apply the carbofuran granules in soil either at the time of sowing or after germination of the seed for the control of sucking pests in the earlier period of the okra crop. Since no information is available except the work done by Thirumorthy *et al.*, (1975) on toxic residue of carbofuran in/on okra fruits from the first two harvest of the crop, the present investigations were carried out so that the farmers can be guided from the point of view of safety to consumers.

MATERIALS AND METHODS

The field experiment with okra crop (Cv.N-5) in *rabi* season of 1983 and 1984 were conducted at the College Farm of Gujarat Agricultural University, Navsari. The carbofuran 3 G was applied in the soil (Black Cotton Soil) as post emergence side dressing @ 0.75 kg a.i./ha, once *i.e.*, immediately and 15 days after germination (Carbofuran- 0+15), abd twice *i.e.*, immediately and 15 days after germination (Carbofuran- 0+15) and thrice i.e. immediately and 15 as well as 30 days after gemination (Carbofuran- 0+15+30). The treatments were replicated

eight times and all the other agrotechniques followed for raising the crop were uniformly the same for all the plots.

For determining the carbofuran residues in/on okra fruits, the samples were taken at the time of first and second picking *i.e.*, on 40th and 45th day after first application in 1983 and 42nd and 49th day after first application in 1984. Fruit samples were taken at random from each plot, they were pooled treatment-wise, chopped finely and finally a representation samples weighing 20 g was taken from each treatment and processed for residue analysis.

The method of analysis was essentially the same as that of Cook (1973). The fruit samples (20 g) were extracted with dichloromethane after hydrolysis with 0.25 N HCl followed by column chromatographic clean-up. The final residue was obtained in 2 ml acetone and 2 µl sample in duplicate were directly injected into gas chromatograph (Varian G.C. Series 3700) equipped with a thermoionic specific detector and recorder. The operating conditions of G.C. were : column 185°C, injector 255°C and detector 263°C. The column consisted of 50 cm long, 3 mm i.d., stainless steel tube packed with 5% OV-101 on Gas chrom Q 60/80 mesh. Gas flow of nitrogen (Carrier gas), hydrogen and air was maintained at 40, 4 and 140 ml per minutes respectively. The average peak height obtained on recorder for the sample was used for estimation of residues using a standard calibration curve. The average recovery as per this procedure in fortified samples had been 86.70% which was used for the correction of the actual data for 100% recovery.

RESULTS AND DISCUSSION

The residue data of carbofuran presented in Table 1 clearly showed that, the treatment of carbofuran-0 was safer as the residues were BDL in the fruits harvested as first and second picking. The other two treatments viz., carbofuran-0+15 and carbofuran-0+15+30 were found not advisable to use for plant protection work in okra crop as there were higher (Av.0.23 and 0.52 ppm) than 0.2 ppm toxic residues (prescribed by FAO/WHO for cauliflower and considering as guideline for okra too, Anonymous, 1978) in okra fruits harvested as first picking after 25 to 26 and 10 to 11 days of last application in respective treatment. However, the okra fruits of second picking harvested 30 to 33 days of last application in the treatment of carbofuran-0+15 may be utilized as the average residue is found to be 0.09 ppm in this treatment which was below 0.2 ppm. Thus, it can be said that, a minimum interval of 30 days should be lapsed between the actual picking of the okra fruits and the treatment of carbofuran 3 G if applied in soil at the rate of 0.75 kg a.i./ha. Thirumurthy *et al.*, (1975) have also indicated the possibility of using the carbofuran application in furrow at the rate of 1.0 kg a.i./ha in okra crop as none of the metabolites of carbofuran was detected on the 50th day after application. Thus, the present finding is nearly in concurrence with them. However, the waiting period of 30 days found in present finding is less than 50 days suggested by above referred workers. This may be due to lower dose (0.75 kg a.i./ha) of carbofuran 3 G used in present experimentation and different agroclimatic condition prevailing in South Gujarat.

Thus, on the basis of present finding, it can be suggested that the treatment of carbofuran 3 G applied in soil @ 0.75 kg a.i./ha immediately after germination (carbofuran-O) can be safely used for the plant protection work on okra crop as the toxic residues of

TABLE 1

Residues of carbofuran in okra fruits.

Sr. No.	Treatments	Days after last application				Residues (ppm)					
		1983		1984		1983		1984		Average	
		First Picking	Second Picking	First Picking	Second Picking	First Picking	Second Picking	First Picking	Second Picking	First Picking	Second Picking
1	2	3	4	5	6	7	8	9	10	11	12
1.	Carbofuran- O	40	45	42	49	BDL	BDL	BDL	BDL	BDL	BDL
2.	Carbofuran- O+15	25	30	26	33	0.33	0.19 (42.42)	0.14	BDL (100.0)	0.23	0.09 (60.87)
3.	Carbofuran-O+15+30	10	15	11	18	0.53	0.29 (45.28)	0.50	0.14 (72.00)	0.52	0.21 (59.62)

1. BDL = Below detectable level.
2. Figures in parentheses are per cent reduction of residues in second picking over first picking.

carbofuran in fruits were found to be less than the permissible tolerance level of 0.2 ppm as prescribed by FAO/WHO (Anonymous, 1978) for cauliflower to be at par for okra also.

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