GAU Res. J. 1992. 17 (2) : 165-167

Fate of Phorate in the Soils of Soybean and Okra Crops

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Among several factors responsible for influencing the fate of insecticides in soil, mode of cultivation and cover crop practices are the most important. Besides, growth of plants may contribute to the disappearance rate of pesticides. Various workers have reported the fate of phorate in the soils of rapeseed (Jain *et al.*, 1974 a), mustard (Agnihotri *et al.*, 1975) and cowpea (Verma and Rattan Lal, 1978) crops. However, no published literature is available on the persistance of phorate in the soils of soybean and okra crops during *kharif* season. Therefore, this study was undertaken.

The field experiments were laid out in a randomised blocks at the farm of Indian Agricultural Research Institute, New Delhi during *kharif* season of 1985 at two dosages of phorate 10 G, viz., 1.5 kg and 2.0 kg a.i./ha applied in furrows before sowing. The soybean crop was sown in a plot size of 3 m x 2.25 m with a row to row distance of 37.5 cm, while the okra crop was sown in plot size of 3 m x 3 m with a spacing of 45 cm x 15 cm. Representative sample of 50 g was taken for extraction, clean up and residue estimation. Residues of phorate 10 G in soil were determined at 0, 15, 30, 45 and 60 days after the treatment. The residues were estimated by two methods viz., microbioassay (Kavadia and Rattan Lal, 1967) and colorimetric method by Getz and Watts (1964) as modified by Jain *et al.*, (1974). The sensitivity of bioassay and chemoassay methods was 0.18 and 0.1 ppm, respectively. The data on residues of phorate was statisitically analysed and RL_{50} values were worked out (Hoskins, 1961). The mean percentage recovery of phorate in the soil samples fortified at the level of 5 and 10 ppm was 86.4% by chemoassay and 89.25% by bioassay methods respectively.

The data on the persistence and dissipation of phorate in the soil of soybean crop indicated that the initial levels of 8.48 and 8.27 ppm of phorate at 1.5 kg a.i/ha declined to 0.78 and 0.62 ppm on 30th day when estimated by colorimetric and bioassay methods respectively (Table 1). The residues were below detectable level after 45 days of treatment. Similar trend was noticed at higher dose (2.0 kg a.i/ha) of phorate. But the residues were below detectable level after 60 days of the treatment. Thus it could be seen that phorate residues at both levels were found to degrade by about 90 per cent 15 days after its application. The faster rate of dissipation of phorate from soil might be due to continuous rainfall causing leaching (Furmidge *et al.*, 1966); quicker uptake by plants (Talekar *et al.*, 1977) and biodegradation of phorate by certain group of micro-organism as reported by Ahmed and Casida (1958). However faster degradation of phorate at 1.5 and 2.0 kg a.i./ha was reported in the soil of cowpea (Verma and Rattan Lal, (1978).

TABLE 1

Dissipation of phorate (ppm) in the soil of Soybean and Okra crops.

Dosage (kg a.i./ha.)	Method of analysis	Crop	Days after application 0	15	30	45	60	Regression equation $Y = (10)^2$	RL_{50} (Days)
1.5	Colorimetric	Soybean	8.48	1.20 (85.84)	0.78 (90.80)	ND	—	0.8173 — 0.0345 x	8.72
		Okra	8.69	2.90 (66.62)	1.18 (86.42)	0.58 (93.33)	ND	0.9866 — 0.0261 x	11.53
	Bioassay	Soybean	8.27	1.09 (86.81)	0.62 (92.50)	ND	—	0.8116 — 0.0375 x	8.02
		Okra	8.21	2.04 (75.15)	1.03 (87.45)	0.22 (97.32)	ND	0.8967 — 0.0334 x	9.01
2.0	Colorimetric	Soybean	9.85	1.25 (87.30)	0.90 (90.86)	0.27 (97.25)	ND	0.8434 — 0.0322 x	9.34
		Okra	10.79	2.88 (73.30)	1.23 (88.60)	0.68 (93.69)	ND	0.9477 — 0.0264 x	11.40
	Bioassay	Soybean	9.43	1.12 (88.12)	0.68 (91.78)	0.15 (98.40)	ND	0.8498 — 0.0374 x	8.05
		Okra	9.86	2.43 (75.35)	0.94 (90.46)	0.30 (96.95)	ND	0.9518 — 0.0331 x	9.09

Figures in parentheses indicate percentage reduction of residues

ND — Not dectectable RL_{50} = Residue half life in days.

The data (Table 1) on the persistence and dissipation of phorate in the soil of Okra crop for lower dose of phorate (1.5 kg a.i./ha) showed that the initial deposits of 8.69 and 8.21 ppm declined to 0.58 and 0.22 on 45th day after application and the residues reached below detectable level on 60th day when estimated by colorimetric and bioassay methods respectively. Similar trend in the dissipation of phorate in the soil was observed for higher dose of phorate 2.0 kg a.i./ha). The results thus indicated that there was 66 to 75 per cent reduction of residues of phorate after 15 days of its application and it reached to 93 to 97 per cent on 45th day after application for both the dosages of phorate.

The dissipation rate of phorate at 15 days after application, was to the extent of over 85 per cent in the soil of soybean crop while it was over 66 per cent in the soil of okra crop during the same period and took 30 days to dissipate to the extent of over 86 per cent, indicating thereby faster dissipation of phorate in the soil of soybean crop. The main reason could be the method of sowing wherein soybean crops was thickly sown by drilling method while okra crop was sown by dibbling method at a spacing of 45 cm x 15 cm. Secondly, the growth of soybean plants at earlier stage was faster as compared to okra which might have influenced the uptake of insecticide. Talekar *et al.* (1977) also reported quicker uptake of phorate in soybean crop within 15 days after application.

(Received on 18th March, 1989)

REFERENCES

Agnihotri, N. P., H. K. Jain; S. Y. Pandey; R. S. Dewan; A. H. Saxena and K. M. Peswani. 1975. Influence of soil moisture on the dissipation of phorate in soil and mustard crop *Brassica campestris* Linn. *Indian J. Ent.*, **37** (1) : 68-71.

Ahmed, M. K. and J. E. Casida. 1958. Metabolism of some organophosphorus insecticides by micro-organism, *J. econ. Ent.*, **51** (1) : 59-63.

Furmidge, C. G. L., A. C. Mill and J. N. Osgerby. 1966. Physicochemical aspects of availability of pesticides in soil. *J. Sci. Fd Agri.* **17** : 518-25.

Getz, M. E. and R. R. Watts. 1964. Application of 4-(nitrobenzyl) pyridine as rapid quantitative reagent for organophosphate pesticides. *J. Assoc. off. Agr. Chem*; **47** : 1094-96.

Hoskins, W. M. 1961. Mathematical treatment of loss of pesticide residues. *Plant protection Bulletin* F. A. O. **9** : 163-169.

Jain, H. K., S. Y. Pande, N. P. Agnihotri and R. S. Dewan. 1974. Rapid estimation of organophosphorus insecticides. *Indian J. Ent.* **36** : 145-48.

Jain, H. K., S. Y. Pande, N. P. Agnihotri, R. S. Dewan, A. N. Saxena and K. M. Peswani 1974. Dissipation of phorate and disulfoton in rapeseed crop (Brassica camperstirs). *Indian J. P. Prot.* **1** (2) : 37-42.

Kavadia, V. S. and Rattan Lal. 1967. Dissipation of insecticide resdues from the crop of Indian rapeseed. *Indian J. Agric. Sci.* **37** : 419-27.

Sarode, S. V. 1978. Residues and Residual toxicity of phorate fentrithien, BHC and lindane on bhindi and cauliflower. Ph.D. thesis submitted to post Graduate School, IARI, New Delhi.

Talekar, N. S. L. T. Sun and E. M. Lee. 1977. Absorption and translocation of soil and foliar applied 14 c-carbofuran and 14c- phorate in soybean and mungbean seeds. *J. Econ. Ent.*, **70** (6) : 185-88.

Verma, S. and Rattan Lal. 1978. Evaluation of pesticides against the pest of cowpea (Vigna sinesis Savi). *Indian J. Ent.*, **40** (1) : 54-58.