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INSECTICIDES RESIDUES IN RICE

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Application of certain organophosphatic insecticides viz., fenthion, phosphamidon, monocrotophos, dimethoate, fenitrothion, phosalone chlorpyriphos, methyl parathion, dichlorvos and quinalphos to rice (var : IR 20) at 0.05 per cent concentration 20, 35 and 50 days after transplanting had not left any residues (45 days after the last spray) in the hand pounded rice. The dissipation of fenthion and dichlorvos was found total as neither the hand pounded rice nor the bran and straw contained any amount of residues. Although some of them had left residues in bran and straw, they were found well below the tolerance levels. The study has suggested that all the insecticides tried in this investigation could be safely used for the protection of rice crop if used 45 days before harvest.

A wide array of plant protection chemicals are being used to control pests attacking rice and owing to the differences in the intrinsic physical and chemical properties of the insecticides, the plant factor and environmental conditions, the degradation and persistence of each chemical on the plant may vary. Hence the bioefficacy and persistence of the plant protection chemicals are total of the above mentioned factors and a thorough knowledge on their initial deposit, the rate of degrdation and the terminal residues in the harvested produce will help to understand their efficient and economic use in rice (var : I. R. 20) as test crop and certain organophosphatic insecticides (10) spray as treatments to evaluate their persistence in rice plant.

MATERIALS AND METHODS

A field experiment was conducted in rice (var : I. R 20) at the Agricultural Research Station, Bhavanisagar with insecticides. The treatments consisted of 0.05% spray of 10 different organophosphatic insecticides. The insecticides were sprayed 20, 35 and 50 days after transplanting. The treatments were replicated thrice in a randomised block design. The grain and straw samples were collected at harvest (45 days after the last spray). The grain samples were separated into hand pounded grain and bran. The samples were then analysed for the residues of insecticides.

The samples were extracted with acetone and after evaporation of the solvent, the residue was dissolved in hexane. The hexane phase was then reextracted with acetonitrile. The acetonitrile portion was evaporated to near dryness and redissolved in 3:7 acetone-chloroform mixture and passed through a column containing 1:1: mixture of charcoal: celite and MgO. The eluted extract was concentrated and made to a known volume. From suitable aliquots, the residues of all the insecticides were estimated by the method of Getz and Walts (1964). The detection limit ranged between 5 and 10kg and the sensitivity of the method or the different compounds ranged between 0.03 and 0.10 ppm for a sample size of 50 gms in the case a grain and 25 gms in the case of bran and straw. The recovery of the different insecticides in grain, straw and bran ranged between 85.50 to 96.00 per cent. The results were confirmed by thin-layer chromatography techniques.

RESULTS AND DISCUSSION

Table 1 provides the values of insecticides residues found in hand pounded rice, bran and straw samples. It is interesting to note that none of the chemicals had left residues in the hand pounded rice. In bran also except phosphamidon, monocrotophos, dimethoate, and fenitrothion, all the others had left non-detectable residues. Among the chemicals which had left residues in bran, phosphamidon registered the highest concentration (0.10 ppm) followed by monocrotophos (0.086 ppm) dimethoate (0.060 ppm) and fenitrothion (0.050 ppm). The residues were all below the tolerance level (Anon, 1981). Except fenthion and dichlorvos treatments, all other chemicals had left residues in straw samples. Like bran, in straw samples also phosphamidon had recorded the highest concentration (0.18 ppm) of residues. This was followed by monocrotophos, fenitrothion, dimethoate, chlorphyriphos, phosalone, quinalphos and methyl parathion treatments in the decreasing order.

Among the chemicals tried, only fenthion and dichlorvos residues were not found in all the three samples viz. hand pounded rice bran and straw. This indicated that the degradation of these compounds were quick and in about 45 days the chemicals disappeared completely from the plant and grain surface. Dichlorvos is a volatile contact, poison and is 1000 times more

Table 1. Insecticides residues in rice, bran and straw.

Sl. No.	Chemical	Dose %	No. of sprays	Interval between last spray and harvest (days)	Residues in ppm Hand pounded rice	bran	Straw	Tolerence level Rice	Straw
1.	Fenthion	0.05	3	45	ND	ND	ND	0.1	0.5*
2.	Phosphamidon	,,	,,	,,	ND	0.10	0.18	0.05*	NA
3.	Monocrotophos	,,	,,	,,	ND	0.686	0.15	NA	NA
4.	Dimethoate	,,	,,	,,	ND	0.060	0.10	NA	NA
								0.5 for sorghum	
5.	Fenitrothion	,,	,,	,,	ND	0.050	0.12	0.005*	NA
6.	Phosalone	,,	,,	,,	ND	ND	0.060	NA	NA
7.	Chlorphyriphos	,,	,,	,,	ND	ND	0.082	NA	NA
								0.75**	
8.	Methylparathion	,,	,,	,,	ND	ND	0.043	1.00*	-NA
9.	Dichlorvos	,,	,,	,,	ND	ND	ND	1.00	NA
10.	Quinalphos	,,	,,	,,	ND	ND	0.050	NA	NA

ND — Non-detectable ; NA — Figures not available for rice

* — Tolerance levels established by CIB India.

** — Tolerance levels for other grain crops.

than many organophosphorus compounds. Further, the presence of moisture (morning dew) on the plant foliage breaks down dichlorvos with the formation of acidic products like dimethyl phosphoric acid, dichloro acetaldehyde etc. Therefore dichlorvos is expected to degrade faster at field conditions. Rajak and Krishnamurthy (1974) observed that dichlorvos was only adsorbed on the grain surface when used as a grain surface used as a grain protectant and had not entered the grain.

Fenthion is a photosensitive compound and degrades faster under bright sunlight. Therefore the observed quicker dissipation of this chemical in straw and rice grain might be due to the photodecomposition nature of fenthion.

In the case of phosalone, methyl parathion and quinalphos neither the hand pounded rice nor the bran had recorded residues. However, the straw contained residues. Chemicals like phosphamidon, monocrotophos dimethoate and fenitrothion had left residues both in bran and straw although the hand pounded rice did not contain any residues. Murthy *et al.*, (1984) reported that 0.05% spray of 0.5 kg ai/ha dust application of quinalphos to rice at the time of flowering had left 0.250 to 0.577 ppm of residues in straw while in rice bran it ranged between 0.039 to 0.076 ppm. Hand pounded rice did not contain any toxic residues of quinalphos. Their results suggested that spraying or dusting could be taken up even 10 days before harvest and feed the straw to the cattle immediately after harvest. Rajukkannu *et al.*, (1984) in their earlier studies observed that although phosalone residues were not detected in hand pounded rice of IR 20, other varieties like Bhavani and culture 658 recorded residues to the level of 0.40 to 0.46 ppm in hand pounded rice. This suggested that the accumulation of residues varied with the varieties. From their recent studies (Rajukkannu *et al.*, 1985) they concluded that 0.1% spray of fenthion, fenitrothion, malathion and dusting of quinalphos (25 kg/ha) at the time of flowering or grain formation required just 10 days as waiting period. However quinalphos and monocrotophos applications required a waiting period of 12 and 15 days respectively.

The present investigation revealed that all the organophosphorus insecticides tried in the studies had not left any residues in the hand pounded rice grain when used 45 days prior to harvest. Although some of them had left residues in bran and straw, they were all well below the tolerance levels and suggest that all the inscecticides tried in this investigation could be safely used for protection of rice 45 days prior to harvest without any residue hazard.

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EFFECT OF FOLIAR APPLICATION OF N, P, K AND S ON GRAIN YIELD AND YIELD COMPONENTS OF CORN (*Zea mays* L.)*

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The effect of foliar application of N, P, K and S on the grain yield and yield components of corn was investigated. The results showed that neither the fifteen factorial treatments alone nor all the twenty-eight treatments used had a significant effect, ($P < 0.05$) on the grain yield and yield components. However, the grain yield of the factorial treatments was positively and significantly correlated with seed size, ($P < 0.01$) and ear length, ($P < 0.05$), but both yield components did not significantly influence grain yield. Based upon these results, foliar application of micro-nutrients on corn to increase grain yields may not be worthwhile.

Although foliar fertilization constitutes one of the many important milestones in the progress of agricultural crop production, it has been used principally in cases requiring quick recovery from a micro-nutrient deficiency. Foliar application of macro-nutrients either in single or complete formulations, generally, has not been widely investigated as a method of fertilizing grain crops to increase grain yields. Results from limited studies of foliar application of N and or P on corn have been conflicting. Some workers have reported yield increases (Thomas, 1960; Singh and Sarolia, 1970; Barel, 1975) while some reported on yield increase (Schumacher and Welch, 1970).

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