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Research Paper

Insecticide Residues in *Abelmoscous esculantus(Lady's fingers)* Crop Grown in Treated Soil

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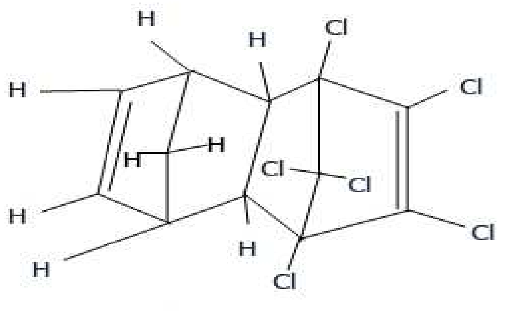
Abstract- *The pesticides, which leave residues in the soil for a fairly long time, are easily translocated in plants to contaminate their edible portions significantly. This results in constant exposure to humans and animals to pesticides and contamination of their flesh, blood, milk and meat. These situations have threatened nature's ecosystem seriously. This investigations on different concentrations of organochlorine insecticides (lindane, aldrine) & organophosphorous insecticide (Monocrotophos) with respect to a major tropical vegetable crop of Aabelmoschus esculantus (Lady's finger or OKRA) under similar conditions have been the pivotal text of this paper and were performed by pot culture analysis and Thin Layer Chromatography (T.L.C.) techniques. The results showed that at very high levels of pesticides and its constant exposure disturbs soil eco balance irreversibly.*

Key words : *Pesticide , ecosystem , fertilizer , manure , doses , Thin layer chromatography etc.*

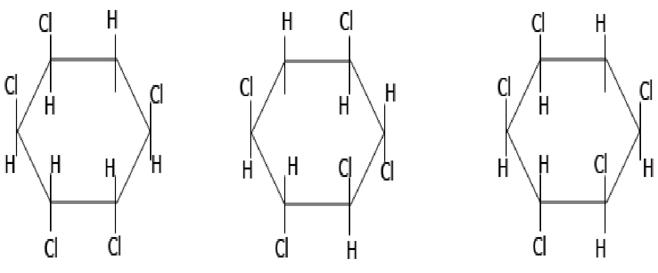
Introduction

Some individual members were selected for investigations[1]:

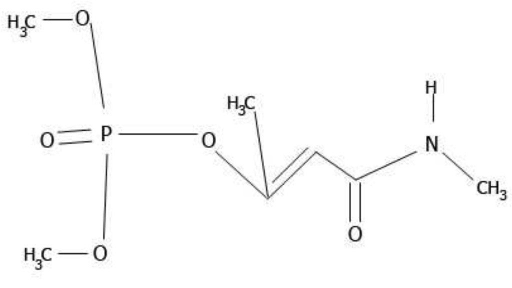
Aldrin: $C_{12}H_8Cl_6$, Molecular weight: 364.93. 1, 8, 9, 10, 11, 11'-hexachlorotetracyclo [6.2.1.1^{3,6}.0^{2,7}]dodeca -4,9-diene.



Benzene Hexa Chloride (BHC): $C_6H_6Cl_6$, Molecular weight: 298.8 1,2,3,4,5,6-hexachlorocyclohexane (lindane)



Monocrotophos: $C_{17}H_{14}O_5PN$, Molecular Weight: 224. Dimethyl 1-methyl 2-N-methyl carbamoyl vinyl Phosphate.



Indiscriminate use of pesticides to increase crop yields and preserve food stuffs have resulted in their increasing residues in man and in environment [2, 3]. Potter[4] has enlisted their main risks – a) poisoning man, particularly through dangerous residues in food stuffs, b) general contamination of the environment by use of persistent chemicals of high biological activity, adversely affecting domestic animals, beneficial insects and wild life and c) the production of new pest strains, resistant to insecticides. Pesticide residues in soil may contaminate the crops grown, changes in soil pH and microbial population, which affect the soil fertility, water pollution etc [5-8]. The data on survey of pesticide residues in plant products (Table 01) show a high level of residues in samples collected from lapse metropolitan of India[9, 10].

Material and Methods

Selection of plant and soil: *Abelmoschus esculantus (Lady's finger or OKRA)* a tropical vegetable crop used extensively all over the country was selected [11]. The department of Soil Survey and Land Use Planning, Indian Agriculture Research Institute (IARI), New Delhi was consulted and sandy loam was considered ideal for vegetable growth.

Sampling and treatment of the soil: The samples representing 15 centimeters depths of the soil were drawn from six different places of the soil profile, mixed thoroughly and air dried. The soil was then passed through a 2000 – micron diameter sieves and leached with water adequately and air dried. Fertilizers and N.P.K. manure were added to soil as per standard [12, 13].

Pots numbering and pesticide treatment: Each pot was numbered prior to pesticide treatment. Four different pesticides were selected and in case of each pesticide five doses as X (recommended dose), 5X, 10X, 15X and 20X were used. Three replicates of each dose of the individual pesticides and the control (without pesticide treatment under identical situations) were suitable for the experimental purpose.

Mode of pesticide treatment: The required doses (weighed for three replicate pots) were diluted in 750ml. of tap water and 250ml. dilution in each pot was poured in. No leakage of water from the pots was noticed.

Pesticide residue analysis of soil: The composite soil samples were drawn from 0-15 cms. soil depth in a pot without disturbing the soil system. The pesticides residues of aldrin, BHC were monitored on 7th, 45th and 90th day and of monocrotophos on every 15th day of vegetation. The soil samples were air dried, sieved through 2.0 mm. sieve and the quantitative analysis of these pesticide residues were performed by Thin Layer Chromatography (T.L.C.) as per standard procedure [12, 13].

Results and Discussion

Aldrin: The residues gradually decline with time. The degradation is fast in the beginning and it shows down with the lapse of time (Table 02)**.** Slow decay suggests that volatilization has a very small role in the dissipation of aldrin in soil and the loss is primarily due to biochemical degradation. Slowly later the eco-system adopts the burden of aldrin as is witnessed by its decreased degradation rates. Higher aldrin treatment hampers the potentiality of the eco – system to degrade the pesticide. Thus rate is slowed down, found to be dependent on the concentration of the pesticide. Edwards calculated that it took 1-6 years for 95% degradation of aldrin[11].

BHC: It is evident from the data (Table 03) that the rate of degradation is comparatively faster in the first 07 days than in the following period (the average loss being ≈ 16% in first 07 days and ≈ 57% in 83 days). At the recommended and the higher doses, the component of soil eco – system react initially (say for a week or so) fast to the exposure of BHC, accordingly it is assimilated or degraded fast. Slowly the eco-system adopts the burden of BHC as is witnessed by its decreased degradation rates[14]. At very high levels, particularly after longer (20X, 45 days and beyond) periods, when soil ecosystem has been damaged irreversibly, decomposition occurs of its own and the rate is considerably lowered. This also confirms persisting nature of the pesticides, and agreement with the findings reported by Liechtenstein, Yehouenou, Fang WANG, and Yadav[15-19].Table 03

onocrotophos: The table 04 reveals that the initial residues of monocrotophos after 15 days (when applied at the normal rate and 5, 10, 15, 20, times the normal rate of application) were uniformly about 75 -80 % almost independent of the concentration of the pesticide. The residues gradually decline with time (Table 04). The rapid loss of monocrotophos in soil is attributable partly to its high water solubility, which is responsible for its leaching and stem volatilization and partly to the microbial components of the soil, which help, in the quick degradation of this insecticide[20]. The second treatment is non –exposed to almost free soil eco-system which is now much more potential or confident to degrade the pesticide.

Conclusion

Soil eco-system is imbalanced by aldrin treatment. However at lower doses (up to recommended) this imbalance seems reversible and the eco-system degrades/assimilates aldrin at a definite rate independent of its concentration. At higher doses the eco-system suffers irreversibility. Accordingly degradation is slowed down slowly and depends very much on aldrin concentration. The potentiality of soil eco-system to degrade the BHC residues in soil is adversely affected at all the test doses of BHC with time. At very high levels of BHC its constant exposure disturbs soil eco-balance irreversibly and the eco-system appeared to be tired to much respond in the soil eco-system is imbalanced by monocrotophos treatment, however at lower/higher doses, this imbalance seems reversible.

Acknowledgement

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Table 1. Pesticide residues in plants products (Edible-vegetables)

S. No.	City	No. of sample surveyed	Residues of			Sample having residues above tolerance limit		Remarks
			DDT	BHC	% concentration	Nos.	Percentage	
1	Delhi	60 (eight vegetable)	+	+	100	15	25	10 samples showed residues up to 50 ppm
2	Hydarabad	1248 (Vegetable, Potato)	+	+	60	150	12	-
3	Haryana(Hissar)	195	+	+	59	Nil	-	Endosulfan residues were also detected
4	Mysore	300 (leafy vegetables)	+	+	100	-	-	Especially BHC (0.1-1.7 ppm)
5	Mumbai	232 (Potato)	+	+	All	All	Residues of lindane, dieldrin, endrin have also been reported	0.3-7.04 ppm

Table 2. Aldrin residues in soil (0-15 cms) expressed as sum of aldrin and dieldrin.

S. No.	Pesticide treatment kg/ha ppm		Percentage loss of aldrin and dieldrin residues* (ppm)					
	Kg/ha	ppm	7th day		45th day		90th day	
			Residues	Loss	Residues	Loss	Residues	Loss
1	0.00	0.00	-	-	-	-	-	-
2	1.25(X)	1.4	1.12	20	0.7	50	ND	-
3	6.25(5X)	7.0	5.6	20	4.2	40	2.24	68
4	12.50(10X)	14.0	11.2	20	8.4	40	3.36	76
5	18.75(15X)	21.0	16.8	20	12.6	40	6.04	76
6	25.00(20X)	28.0	21.0	25	11.2	60.07	7.0	75

*Average of three determinations
N.D. – Not detected

Table 3. BHC residues (γ - isomer) in soil

S. No.	Pesticide treatment kg/ha ppm		Percentage residues* (ppm)					
	Kg ai/ha	ppm	7th day		45th day		90th day	
			Residues	%Loss	Residues	%Loss	Residues	%Loss
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	2.80(X)	2.34	2.34	16.66	1.87	33.33	0.47	83.30
3	14.00(5X)	11.50	11.50	15.00	8.40	40.00	ND	-
4	28.00(10X)	23.34	23.34	16.66	18.67	33.33	7.48	73.3
5	42.00(15X)	37.34	37.34	11.11	28.01	33.33	9.37	77.7
6	56.00(20X)	47.68	47.68	16.66	42.00	25.00	23.36	58.3

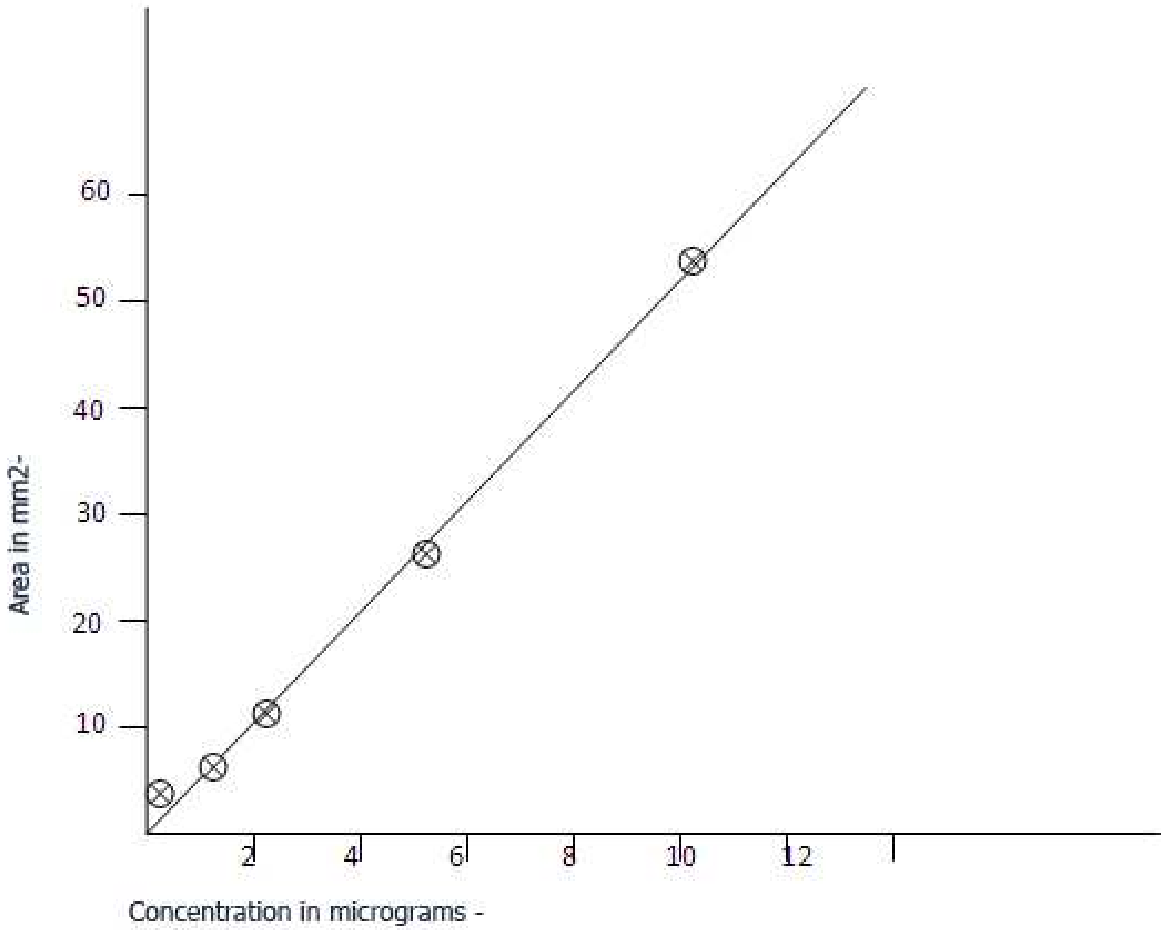
*Average of three determinations
N.D. – Not detected

Table 4. Monitoring of monocrotophos residues after its application to the soil '0' day and 45th day

S. No.	Pesticides treatment on '0' day ppm	Monocrotophos residues in soil*						Pesticides treatment on 45thday ppm	Monocrotophos residues in soil*					
		15th Day	% Loss	30th Day	% Loss	45th Day	% Loss		60th Day	% Loss	75th Day	% Loss	90th Day	% Loss
1	0.00	-	-	--	-	-	-	-	-	-	-	-	-	-
2	0.844(X)	0.21	75	0.10	87.5	ND	100	0.844	0.21	75.0	0.09	90.0	ND	100
3	4.22(5X)	1.06	75	0.64	85.0	0.05	99.0	4.22	0.85	80.0	0.43	90.0	ND	100
4	8.44(10X)	2.11	75	0.43	95.0	0.05	99.5	8.44	2.11	83.0	0.64	95.0	0.09	99.00
5	12.66(15X)	3.17	75	1.27	90.0	0.07	99.0	12.66	2.11	83.0	0.64	95.0	0.09	99.33
6	16.88(20X)	3.38	80	1.69	90.0	0.07	99.5	16.88	2.11	87.5	0.85	95.0	0.09	99.50

*Average of three determinations
N.D. – Not detected

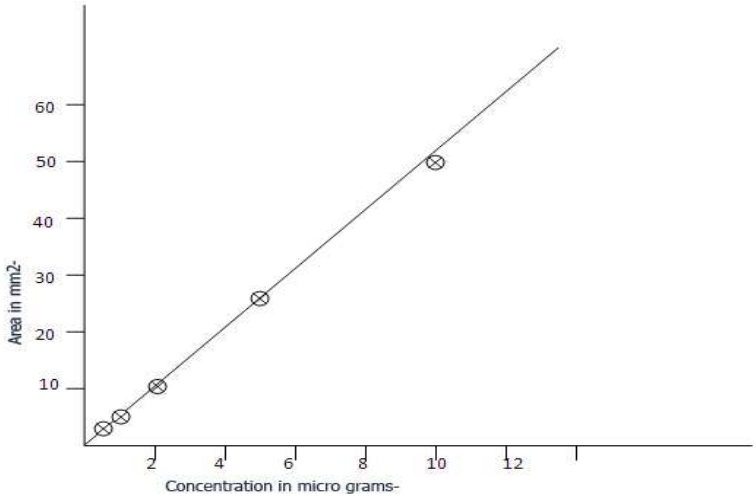
Pesticide-Aldrin;



S. No.	Conc. in μg	Area in mm^2
1	0.5	4.0
2	1.0	5.0
3	2.0	12.0
4	5.0	28.0
5	10.0	55.0

Figure 1: TLC figure for Aldrine

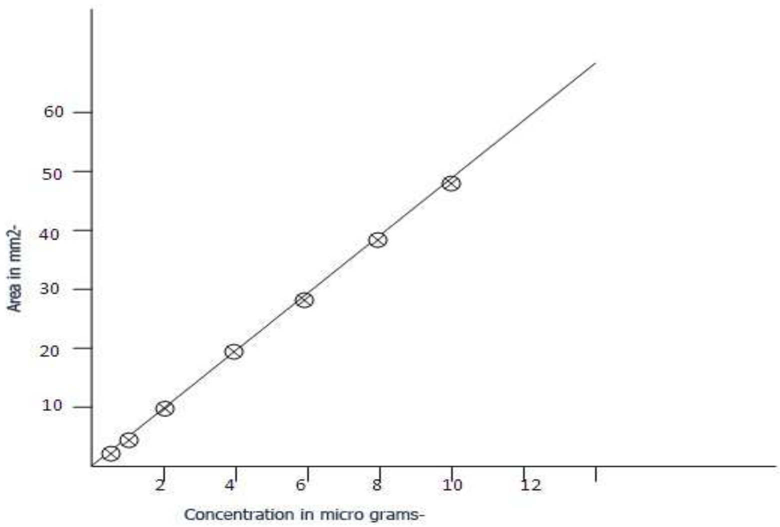
Pesticide – BHC



S. No.	Conc. in µg	Area in mm^2
1	0.5	3.0
2	1.0	5.0
3	2.0	11.0
4	5.0	26.0
5	10.0	50.0

Figure 2: TLC figure for BHC

Pesticides- Monocrotophos;



S. No.	Conc. in µg	Area in mm^2
1	0.5	2.0
2	1.0	4.0
3	2.0	9.0
4	4.0	19.0
5	6.0	27.0
6	8.0	37.0
7	10.0	45.0

Figure 3: TLC figure for Monocrotophos