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Accumulation of DDT in Soils Following 4 Years of Restricted Use on Cotton[1]

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A mixed farming operation, containing in excess of 600 acres of cotton, was involved in the use of DDT on a restricted basis for 4 growing seasons, 1972-75. Criteria for DDT application were that it be applied only by high-clearance ground equipment at the rate of 1.0 lb AI/acre/application and a maximum of 6 applications per growing season. One of the objectives of this large-scale study was to determine the increase in soil residues of treated fields. A total of 27 fields were involved.

MATERIALS AND METHODS

In June of 1976 those fields previously treated with DDT during the 4-year test period were sampled using the U.S. Department of Agriculture 3-inch core soil sampler, in addition to control fields. The method of sampling consisted of moving diagonally across the field and taking 40 evenly distributed cores. The total sample was air dried in the laboratory, and passed through a motorized screen-pulverizer. After thoroughly mixing, the screened samples, consisting of 50-gram aliquots, were extracted in a Soxhlet apparatus for 15 hours with an azeotropic solvent, hexane and acetone (41:59). The extracts were then washed to remove the acetone, dried through sodium sulfate, and concentrated to about 10 ml for cleanup.

The entire soil extract underwent cleanup on a 4-inch column of activated Florisil. The extract was eluted with 200 ml of 6% diethyl ether in hexane, reduced in volume by evaporation, and adjusted to 10 ml in a glass-stoppered centrifuge tube for analysis by electron capture gas-liquid chromatography. Recovery standards and analytical reagent blanks were carried through the extraction and cleanup procedures for each day's analyses. Recoveries were consistently 90 to 100%; however, these corrections were not applied to the data presented. The minimum sensitivity of the analytical

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method was arbitrarily set at 0.02 ng for p,p'-DDT and p,p'-DDE. The relative sensitivity was 0.003 ppm for soil, based on a minimum sample size and 6 µl extract injected into the chromatograph. Analytical confirmatory tests were conducted on a random basis.

RESULTS

Table 1 compares the initial pretreatment (1972) soil residues with those of 1976. It appears that following 4 years' use of DDT, applied to cotton on a very restricted basis, the average number of applications was 2.63. Stated another way, each acre received an average of 2.63 lbs of DDT over the 4-year test period. As a consequence the soil levels of DDT increased by 0.24 ppm while DDE increased 0.11 ppm, for an average total of 0.35 ppm. Considering the weight of the upper 6"/acre soil layer as 2 million lbs the increase of DDTR in the tillable zone would amount to approximately 0.7 pound, or 27% of that applied during the 4-year period.

The three control fields remained relatively the same with a slight increase in DDT, which would be within the range of analytical variability.

TABLE 1

Pre- and posttreatment levels (PPM) of DDT and DDE in soils of fields treated with DDT at various times during 1972-75 in a cotton pest management program. La Palma, Arizona, 1976.

Pounds DDT Applied/Acre 1972-75	Number of Fields	Pretreatment Soil Residues (1972)			Posttreatment Soil Residues (1976)		
		DDE	DDT	Total	DDE	DDT	Total
1	7	0.73	1.78	2.54	0.96	1.86	2.82
2	8	0.37	1.19	1.56	0.38	1.62	2.00
3	5	1.04	1.70	2.74	1.10	1.64	2.74
4	5	0.98	1.01	1.99	1.12	1.17	2.29
6	1	0.18	0.87	1.05	0.20	2.10	2.30
7	1	1.45	1.36	2.81	1.70	1.80	3.50
Avg. 2.63	--	0.73	1.39	2.12	0.84	1.63	2.47
0 Controls	3	0.49	0.77	1.26	0.47	0.84	1.31