# Atmospheric Levels of Pesticides in the Mississippi Delta

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There is only a limited amount of research data available on atmospheric levels of pesticides. The most extensive studies are those of Tabor (1965-1966), and Stanley et al. (1971). The samples obtained by Tabor were collected with a particulate air sampler. Since pesticides exist in the atmosphere both in aersol and vapor phases, the levels of pesticides reported by Tabor must be considered to be minimum values. Stanley et al. (1971) used an air sampler designed to sample both aersol and vapor phases of pesticides. They reported that a total of eighteen different pesticides and metabolites were found in air samples collected at nine different locations. Only p,p' DDT and o,p' DDT were found at all locations. The highest levels found were in the agricultural areas of the South. The levels reported by Stanley et al. (1971) varied from the lower limit of detection (0.1 ng of pesticide per $m^3$) to over 2500 ng per $m^3$.

The Mississippi Delta is one of the highest pesticide usage areas of the United States because of intensive cotton production. This study was designed to qualitate and quantitate the atmospheric level of pesticides and their metabolites in one location in the Mid-Delta area.

## Materials and Methods

Sampling Site. Stoneville, Mississippi (located in the middle of the most intensive cotton-growing area of Mississippi) was chosen as the sampling site. The sampler was located on the branch station of the Mississippi Agriculture and Forestry Experiment Station.

Sampling Procedure. Weekly air samples were taken in Stoneville during 1972, 1973, and 1974. A MISCO model 88 air pesticide sampler was used utilizing ethylene glycol as the trapping agent. A timer was set so that the sampler would operate 4.29 minutes every hour for seven days, giving a total collecting time of twelve hours per week. Approximately seven cubic meters of air were sampled per week.

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Analysis. The air samples were analyzed by the procedure described by Thompson (1972). Identification and quantification of the pesticides were accomplished on a Micro Tek MT-220 gas chromatograph with two columns having different resolution characteristics. Instrument parameters were as follows.

Columns: (A) Borosilicate glass, 6' x $\frac{1}{4}$", packed with 1-5% OV-17, 1.95% QF-1 on 80/100 mesh Gas Chrom Q.

(B) Borosilicate glass, 6' x $\frac{1}{4}$", packed with 4% SE-30, 6% QF-1 on 80/100 mesh Gas Chrom Q.

Detector: Electron Capture, having a 130 mc tritium ionizing source.

Temperatures:

| | |
|---|---|
| Injector | 230°C |
| Column | 200°C |
| Detector | 215°C |

Carrier Gas: Prepurified nitrogen flowing at 90 ml/min (Column A) and 60 ml/min (Column B).

## Results and Discussion

Table I presents the maximum levels of the pesticides and metabolites that were found in the 156 weekly air samples collected during the study period. Only p,p' DDT and o,p' DDT were found in all samples. The organophosphates, except for methyl parathion were usually found between June and October. This is the period that corresponds to the pesticide spray season. In 1972 and 1973, methyl parathion was also found between June and October, but in 1974 this pesticide was found at low levels from January through May. The reason for this is unknown. Def, a cotton defoliant, was only found in September and October. As expected the highest levels of pesticides occurred during the summer months. The pesticides that were detected compare very well with those found by Stanley et al. (1971).

Three pesticides, DDT, methyl parathion, and toxaphene, were found more often and at higher levels. These three pesticides are of importance because they represented approximately 95% of all insecticides sold in Mississippi prior to the ban on DDT. After the ban on DDT, methyl parathion and toxaphene made up approximately 88% of all insecticides sold in Mississippi. The monitoring of atmospheric levels of DDT and it's metabolites have been of special interest since the January, 1973 ban on DDT usage.

Table I

Maximum Levels of Pesticides Found in the Weekly Air Samples ($ng/m^3$)

| Pesticide | Level | Pesticide | Level |
|---|---|---|---|
| p,p' DDT | 534.7 | βBHC | 49.4 |
| o,p' DDT | 210.3 | Heptachlor | 0.8 |
| p,p' DDE | 30.3 | Heptachlor Epoxid | 9.3 |
| o,p' DDE | 25.5 | Toxaphene | 1746.5 |
| p,p' DDD | 2.8 | Methyl Parathion | 2060.0 |
| o,p' DDD | 33.3 | Parathion | 4.3 |
| Dieldrin | 12.0 | Malathion | 270.3 |
| Aldrin | 6.9 | Diazinon | 77.4 |
| Endrin | 39.3 | Def | 16.0 |
| Lindane | 9.3 | | |

Table II shows the average monthly total DDT (DDT+ metabolites) air pesticide levels at Stoneville, Mississippi for 1972, 1973, and 1974. There was a tremendous drop from 1972 to 1973 which corresponded to the time of the DDT ban. There also was a 26% drop from 1973 to 1974. This is the first report that we have seen indicating that DDT levels in the environment have decreased since the ban. The decrease in atmospheric levels of DDT is significant as Arthur et al. (1975) have shown that air pesticide levels can lead to significant adipose tissue residues. Even though a decrease in total DDT levels has been found, levels as high as 50 $ng/m^3$ in 1973 and 38 $ng/m^3$ in 1974 were detected in the air at Stoneville. The DDT detected apparently came from the soil. As can be seen in Table II, a sharp increase in total DDT levels was found from February to March and then a leveling off in April. This corresponds to the time when farmers are preparing their fields and planting, thus allowing DDT a better chance to escape from pulverized soil. Following this initial rise, a dramatic increase in DDT levels for 1972 was seen. This was expected since DDT was still being applied. There was also a rise in DDT levels which peaked in August for 1973 and 1974 when DDT usage was supposedly discontinued. It is assumed that this DDT was coming from the soil because of higher temperatures and more frequent tilling of the soil. After August the levels were found to decrease to background levels. The early peak in DDT levels in June of 1973 were unexpected. The same peak was seen in methyl parathion levels for 1973. The DDT levels possibly were caused by an increase in field work by the farmers.

Table II

Average Monthly Atmospheric Levels of Total DDT($ng/m^3$)

| | 1972 | 1973 | 1974 |
|---|---|---|---|
| January | 10.8 | 3.9 | 3.0 |
| February | 12.6 | 4.8 | 3.6 |
| March | 32.6 | 11.1 | 7.6 |
| April | 34.1 | 11.4 | 7.7 |
| May | 17.2 | 18.6 | 15.6 |
| June | 16.2 | 49.5 | 12.8 |
| July | 117.3 | 9.6 | 24.3 |
| August | 515.3 | 25.6 | 37.9 |
| September | 378.8 | 24.6 | 19.4 |
| October | 37.6 | 18.9 | 5.1 |
| November | 14.8 | 11.9 | 3.3 |
| December | 6.3 | 2.4 | 2.1 |
| Average | 99.5 | 16.0 | 11.9 |

Table III presents the average monthly methyl parathion levels at the same location for 1972, 1973, and 1974. A tremendous increase in methyl parathion levels was seen in 1973 vs. 1972, the first year after the ban on DDT. The reason for this is not apparent as methyl parathion usage in 1973 was down 38% from 1972. As shown in Table III, methyl parathion was less than 1 $ng/m^3$ from November through May and then increased until it peaked in August or September.

Table III

Average Monthly Atmospheric Levels of Methyl Parathion ($ng/m^3$)

| | 1972 | 1973 | 1974 |
|---|---|---|---|
| January | 0.0 | 0.0 | 1.0 |
| February | 0.0 | 0.0 | 0.3 |
| March | 0.0 | 0.0 | 0.3 |
| April | 0.0 | 0.0 | 0.6 |
| May | 0.0 | 0.0 | 0.6 |
| June | 1.6 | 22.8 | 0.9 |
| July | 61.4 | 4.5 | 40.9 |
| August | 216.9 | 129.3 | 341.1 |
| September | 111.7 | 791.1 | 167.9 |
| October | 1.4 | 17.1 | 2.0 |
| November | 0.0 | 0.0 | 0.0 |
| December | 0.0 | 0.1 | 0.0 |
| Average | 32.8 | 80.4 | 46.3 |

The data for toxaphene is presented in Table IV for 1972, 1973, and 1974. As can be seen, there was a tremendous drop in toxaphene levels from 1972 to 1973. This was probably due to the 55% decrease in toxaphene usage in 1973 vs. 1972. The increase in average toxaphene levels in 1974 over 1973 cannot be explained completely. Part of the increase was probably due to a 22% increase in toxaphene usage in 1974. As with DDT, it can be seen that a sharp increase (only for 1972) in toxaphene air levels was seen between February and March followed by a leveling off. In June another sharp rise was seen which peaked in August or September followed by a decline. It is interesting to note that in both 1972 and 1973 the levels of toxaphene at one time were below 1 $ng/m^3$ but in 1974 they were never below 9.7 $ng/m^3$.

Table IV

Average Monthly Atmospheric Levels of Toxaphene($ng/m^3$)

| | 1972 | 1973 | 1974 |
|---|---|---|---|
| January | 0.0 | 0.0 | 10.9 |
| February | 13.0 | 0.0 | 9.7 |
| March | 68.0 | 16.8 | 19.1 |
| April | 67.4 | 10.8 | 27.7 |
| May | 32.4 | 46.8 | 44.3 |
| June | 44.2 | 109.9 | 38.6 |
| July | 400.7 | 41.1 | 175.0 |
| August | 1540.0 | 268.8 | 903.6 |
| September | 827.9 | 322.6 | 524.6 |
| October | 97.9 | 161.1 | 114.8 |
| November | 9.3 | 0.0 | 32.9 |
| December | 0.0 | 9.9 | 12.6 |
| Average | 258.4 | 82.3 | 159.5 |

There has been some concern expressed over the possibility of increases in endrin usage since DDT is no longer used. The insecticide data for 1972, 1973, and 1974 in Mississippi for endrin shows that there was a 290% increase in endrin sales in 1973 over 1972 sales. Although there was a 290% increase in endrin sales, the total amount of endrin sold was only equal to 2.8% of the toxaphene sales. Endrin usage in 1974 was about the same as in 1973. The 1972, 1973, and 1974 endrin air levels are shown in Table V. As can be seen, the usage data does not correspond to the air levels. The average 1973 air level of endrin was lower than that for 1972 in spite of the 290% increase in sales. In 1974, when the sales of endrin were about

the same as for 1973, there was a 2.5 fold increase in air levels of endrin. The reason for this variation in endrin levels is not clear.

Table V

Average Monthly Atmospheric Levels of Endrin ($ng/m^3$)

| | 1972 | 1973 | 1974 |
|---|---|---|---|
| January | 1.1 | 0.1 | 0.2 |
| February | 1.1 | 0.1 | 0.2 |
| March | 2.1 | 0.7 | 0.6 |
| April | 3.1 | 0.7 | 0.5 |
| May | 1.0 | 1.2 | 0.7 |
| June | 0.9 | 3.8 | 0.7 |
| July | 5.2 | 0.7 | 9.3 |
| August | 10.1 | 5.0 | 27.2 |
| September | 8.8 | 8.4 | 18.8 |
| October | 4.0 | 5.0 | 4.3 |
| November | 0.5 | 1.1 | 1.0 |
| December | 0.0 | 0.2 | 0.5 |
| Average | 3.2 | 2.3 | 5.3 |

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