DATA EVALUATION RECORD

STUDY 12

CHEM 036101 Trifluralin §163-3

FORMULATION--90--FORMULATION NOT IDENTIFIED

STUDY ID 40673601G
Hollingsworth, E.B. 1980. Volatility of trifluralin from field soil. Weed Sci. 28:224-228.

DIRECT REVIEW TIME = 10

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11 JUL 1994

CONCLUSIONS:

Mobility - Field Volatility

This field volatility study provides supplemental data. It cannot be used to fulfill the data requirement (163-2). These data were taken from published articles and were not originally designed to satisfy Subdivision N data requirements. Therefore, it is difficult to draw the conclusions needed for an environmental fate assessment. However, these data and the other published volatility data submitted (MRID 40673601A, 40673601B, 40673601C, 40673601D, 40673601F, 40673601G) do indicate the following:

1. Volatility may be a major route of dissipation for trifluralin.

2. Trifluralin appears to volatilize (≈25 to 60% of applied in 11 days).

3. Laboratory volatility data are needed to determine relative rate of dissipation due to volatility in relation to other routes of dissipation.

4. No further field volatility data are needed until evaluation of acceptable laboratory volatility data is completed.

In this study the soill was not analyzed for trifluralin. Therefore, the application rate was not confirmed, and the concentration of trifluralin in the air could not be related to the concentration of trifluralin in the soil.

METHODOLOGY:

Trifluralin (formulation and concentration not reported) was broadcast applied to a plot (0.2 ha) of Bosket silt loam soil (18% sand, 58% silt, 24% clay, 1.3% organic matter, pH 6.3, CEC not provided) at 0.8 kg/ha (site location not reported). Immediately after application, the trifluralin was incorporated to 7.5 cm with a spring-tooth harrow and the field was planted to soybeans. Air samplers were installed "a few hours" after pesticide incorporation. The air samplers were pyramid-shaped aluminum enclosures (Figure 1) which covered 0.37 m^2 of soil surface; two were used in 1976, and four in 1977. The sampling port for the enclosure was at the top of the pyramid; an air intake with a polyurethane plug was located above the pyramid and vented near the soil surface inside the pyramid. The intake port was equipped with a flowmeter and the air was drawn through tygon tubing to a 250-mL gas washing bottle with an ethylene glycol trapping solution (100 mL); the tubing and gas washing bottles were covered with aluminum foil to prevent photolysis. The air samplers were tubing attached to a centrally located yacuum pump. Air samples were collected with a flow rate of 1.3 m^3/day (12 turnovers/day). Air samples were collected continuously for 120 days in 1976 and 1977, with sampling intervals lasting from 24 hours to 8 days. Additional "free air" was sampled over the field at two locations: 1.2 m above the soil surface in 1976, and at four locations 0.3 and 1.5 m above the soil surface in 1977. The air was drawn through a glass wool filter and an ethylene glycol trapping solution; the air flow rates were 1.3 m^3/day. Samples were drawn continuously for 118 and 103 days in 1976 and 1977, respectively; sampling intervals were 4 to 14 days. A rain gauge was located near the plot; additional climatological data came from the NOAA weather station located approximately 1 km northwest of the plot. The ethylene glycol in the trapping solution was diluted with aqueous sodium chloride and extracted three times with hexane. The hexane extracts were combined, partitioned with aqueous sodium chloride, dried over sodium sulfate, and evaporated to dryness at 45 C. The residue was dissolved in hexane and analyzed by GC with electron capture detection. Recovery efficiency from the ethylene glycol solution was 90-95%.

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DATA SUMMARY:

Trifluralin (formulation and concentration not reported) applied at 0.8 kg/ha, was volatile from silt loam soil at an undisclosed location; 2.5-4.0 g/ha trifluralin was recovered as vapor after 4 months which accounted for 0.32-0.45% of the applied trifluralin. In 1977, in the aluminum enclosures, a maximum rate of 3.4 ug/m^3 was observed at 24 days, which declined to 1.0 ug/m^3 at 29 days, and continued to decline throughout the 120-day study. The rate was not reported for the aluminum enclosures in 1976.

Air temperatures ranged from 13 to 33 C with 35.9 cm of rainfall in 1976; air temperatures ranged from 12 to 34 C with 33.6 cm of rainfall in 1977 (Table 1).

COMMENTS:

1. The soil was not analyzed for trifluralin; therefore, the application rate was not confirmed, and the concentration of trifluralin in the air could not be related to the concentration of trifluralin in the soil.

2. The formulation of the test substance was not reported.

3. The soil CEC and soil adsorption K values were not reported.

4. The data cited in this review were taken from the text instead of the figures; the figures were difficult to accurately interpret due to the poor copy received for review.

5. The vapor pressure of trifluralin was not reported.

6. EFGWB prefers that [^{14}C]residues in samples be separated by chromatographic methods (such as TLC, HPLC, and GC) solvent systems of different polarity, and that specific compounds isolated by chromatography be identified using a confirmatory method such as MS in addition to comparison to the R_f of reference standards.

   In this study aliquots of the extracts were analyzed by GC.

7. The study author associated volatility with rainfall events; in 1976, 20.7 cm of rain fell in the first 30 days after treatment. When the soil was excessively wet, volatilization stopped but increased during soil drying.

8. This study is one of several published papers included as appendices to MRID 40673601 (Day, E.W. 1988. Laboratory and field volatility studies with trifluralin from soil. Laboratory Project ID. EWD8807). This document was submitted as an assessment of the potential inhalation hazard of trifluralin to exposed workers. Because this portion of the document contains summary data only and is not pertinent to

Subdivision N guidelines, it was not reviewed; only the published papers in the appendices have been reviewed.

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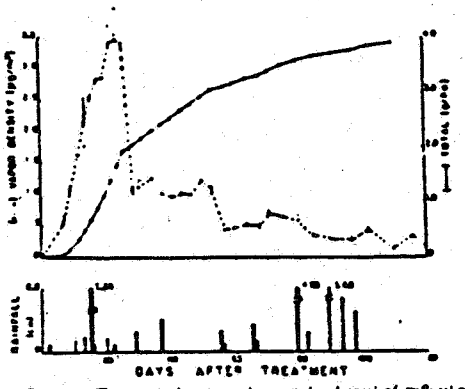
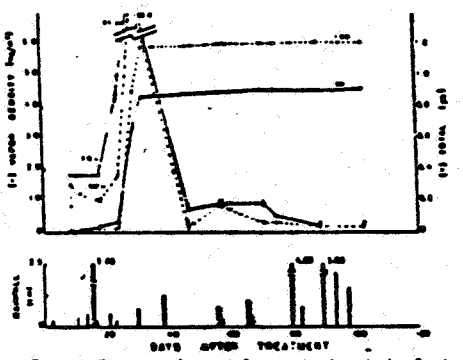


DAYS AFTER TREATMENT

Figure 4. The vapor density and accumulated total of trifluralin vapors obtained over a 120 day period in 1977 from an opaque enclosure covering 0.37 m^2 of field soil. Each value represents four replications and indicates the average vapor density per day. Rainfall distributions also shown.



DAYS AFTER TREATMENT

Figure 5. The vapor density and accumulated total of trifluralin vapor collected during a 108-day period in 1978 using air probe samplers located 0.3 and 1.5 m above the soil surface. Each value is an average of four replications and shows the average vapor density per day. Rainfall distributions also shown.

210, 190 and 190 C, respectively. Trifluralin was recovered from the ethylene glycol with an efficiency of 90 to 95%. Sample results were adjusted for this recovery efficiency and the trifluralin concentration calculated as either micrograms or nanograms per cubic meter of air obtained over a 24-h period. The cumulative vapor loss over the 4-month period was also calculated for each of the 2 yr.

RESULTS AND DISCUSSION

The weather data for the 2 yr (Table 1) provide several facts critical to interpretation of the results. For the 10 days prior to treatment more rain fell in 1977 than in 1976, but more rain fell in the first 30 days after treatment in 1976 than in 1977. The average daily evaporation, temperature, and solar radiation were higher for the first 30 days in 1977 than for the corresponding period in 1976. This initial 30-day period, when the herbicide concentration in the soil was greatest, had the greatest potential for volatilization of trifluralin.

In 1976, trifluralin volatilization within the enclosure declined slightly for the first 7 days after treatment (Figure 2). The 5.3-cm rainfall on the 7th day followed by the 2.6-cm event on the 10th day corresponded to a marked increase in the herbicide vapor recovered. Although the rain did not fall directly on the soil beneath the enclosure, the soil underneath the enclosure became thoroughly wet through capillary movement. Vapor density decreased dramatically during the 9 to 14 day period following the 7.9 cm of rainfall. More than 12 cm of rain fell between 14 and 26 days after treatment. This unusual amount of rainfall caused the soil to become saturated with free water remaining on the surface of the soil in many places to day 26. Trifluralin vaporization was suppressed from day 17 to 35, but as the soil lost the excess water the vapor density of trifluralin increased. Longer sampling periods were necessary to obtain measurable trifluralin from the free air above the field, but the results (Figure 3) also indicated diminished volatility during the period of excessive soil moisture and decreasing volatility from 40 days after treatment until the end of the season.

In 1977 trifluralin was volatilized more rapidly during the first 20 days than in 1978 (Figure 4). Vapor emission increased steadily within the enclosure to a maximum daily rate of 3.4 $\mu g/m^3$ of air at 24 days after treatment and then showed an abrupt decline to 0.8 $\mu g/m^3$ of air on the 29th day. The plot of vapor density within the enclosure beginning 29 days after treatment indicated a continuous decrease in trifluralin volatilized throughout the season. The total mass of trifluralin volatilized with time increased rapidly for the first 30 days, then increased at a much slower rate.

For the first 18 days after treatment in 1977, the vapor density of trifluralin obtained from the free air 0.3 m above the soil remained steady while that from the 1.5-m height showed a decline (Figure 5). Trifluralin vapor densities were much lower in free air than under the enclosure. A total of 6.75 cm of rain fell during the first 18 days, most of it in one event of 5.26 cm. Following this event trifluralin vapors increased to a maximum of 95 ng/m^3 of air for the 0.3-m high probe and 130 ng/m^3 of air for the 1.5-m high probe, then declined rapidly.

Although soil moisture data were not collected during the sampling period, it is obvious that rainfall and resultant soil moisture effects during the first 30 days markedly influenced the volatilization of trifluralin. Rainfall events later in the growing season had little effect on volatilization, probably due to a concurrent decrease in moisture content in the soil, as would be expected. [illegible]

Table 2 Trifluralin vapors recovered during 4-month periods in 1976 and 1977 following application at 0.84 kg/ha to a field of silt loam

Time period	From the enclosure[a] 1976	From the enclosure[a] 1977	From the air probe 1976 1.2 m Ht	From the air probe 1977 0.3 m Ht	From the air probe 1977 1.5 Ht	Proportion of applied herbicide from enclosure 1976	Proportion of applied herbicide from enclosure 1977
	(%)						
First 30 days	26	52	58	74	75	0.08	0.23
Second 30 days	52	29	36	23	24	0.17	0.13
Third 30 days	20	13	10	2	0.7	0.06	0.06
Fourth 30 days	2	6	3	1	0.3	0.01	0.03
					Total	0.32	0.45

[a]Covering 0.37 m^2 soil surface.

The pattern of rainfall and subsequent wetting of soil during the season influenced the amount of trifluralin lost as vapors. The early excessive rainfall in 1976 during the period of highest trifluralin concentration in the soil contributed to a reduction in the total trifluralin volatilized when compared to the total volatilized in 1977. Results from both years are summarized in Table 2. More than 75% of the trifluralin that volatilized each year was accounted for in the first 60 days. A total of only 2.5 to 4.0 g/ha of trifluralin was recovered as vapor over the 4-month periods, corresponding to 0.32 and 0.45% of the amount of trifluralin applied each year.

ACKNOWLEDGMENT

We thank Dot Griffin, Tim Lockley, and Mary E. Smyly for their technical assistance.

LITERATURE CITED

1. Bardsley, C. E., R. E. Savage, and J. C. Walker. 1968. Trifluralin

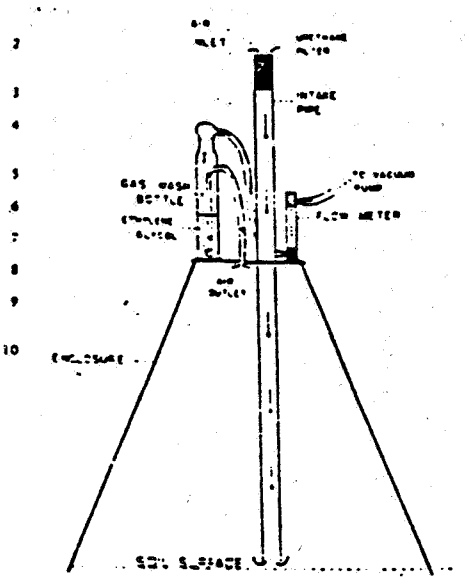


Figure 1. Diagram of an enclosure used for collecting herbicide vapors from a 0.37 m^2 area of soil.

Table 3. Weather data for a 4-month period following herbicide application in 1976 and 1977 during which trifluralin vaporization from a field soil was measured.

Time period	Temperature °C 1976 Max	Temperature °C 1976 Min	Temperature °C 1977 Max	Temperature °C 1977 Min	Rainfall 1976 (cm)	Rainfall 1977 (cm)	Evaporation[a] 1976	Evaporation[a] 1977	Solar radiation[a] 1976 (langleys)	Solar radiation[a] 1977 (langleys)
7th day before treatment					1.8	6.9				
First 30 days	30	19	34	23	30.7	8.5	0.63	0.76	494	609
Second 30 days	33	21	32	22	4.3	2.8	0.68	0.58	549	534
Third 30 days	32	19	32	21	3.7	11.2	0.58	0.56	472	463
Fourth 30 days	29	15	29	12	5.4	6.2	0.46	0.43	407	387
120 day totals					53.9	33.6				

[a]All figures except for rainfall represent average daily values.