Mobility - Laboratory Volatility

This laboratory 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 other published volatility data submitted (MRID 40673601B, 40673601C, 40673601D, 40673601E, 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. Data are needed to determine relative rate of dissipation due to volatility in relation to other routes of dissipation.
In the data submitted, the concentration of trifluralin in air and soil was not determined/analyzed for/or furnished. In addition, the application rate and material balances could not be confirmed and the concentration of trifluralin residues in the air could not be related to the concentration of trifluralin residues in the soil. Furthermore, the study was terminated before the pattern of decline of the test substance was established.

**METHODOLOGY:**

An aqueous solution (10 mL) of a "commercial formulation" of trifluralin (concentration and formulation not identified) was sprayed onto the surface of three soils (Table 1) at a nominal rate of 2.24 kg/ha; the soils were in metal containers (5.6 cm diameter, 4.5 cm height). The moisture content of the soil was adjusted to field capacity, and the incubation temperature was 40°C. The treated soil was placed inside a glass cylindrical chamber with air drawn through a charcoal filter and then into the chamber at 0.04 m³/hour. The air was then vented through a florisil column (14 cm x 22 mm). After 3 hours of incubation, the florisil column was removed and rinsed with methanol. The methanol solution was analyzed by GC with electron capture detection. Additionally, volatility was intensively measured from one soil, the Lakeland sand, at soil moisture contents of air dry and saturation, and at temperatures of 30°C and 50°C. All experiments were conducted in triplicate.

**DATA SUMMARY:**

Trifluralin (formulation not specified), at 2.24 kg/ha, volatilized from three soils incubated at field capacity and 40°C. For the Lakeland sand, increasing soil moisture from air dry to field capacity appears to increase volatility at all temperatures. After 3 hours of volatilization from the Lakeland sand at 50°C, approximately 4.5% of the total applied trifluralin volatilized at 0% moisture; 25% and 24% volatilized from 8% and 12% moistures, respectively (reviewer estimated from Figure 3).

The reported vapor pressure of trifluralin was 1.1 x 10^-4 mm Hg at 25°C; volatility and air concentrations of trifluralin were not reported.

**COMMENTS:**

1. The registrant did not determine the concentration of trifluralin in the air. The nominal application rate was not confirmed; all data were expressed as "% of herbicide lost in 3 hours". The actual air and soil concentrations of trifluralin apparently were not determined.
2. Soil samples were not analyzed for trifluralin. Therefore, the pattern of decline of trifluralin from the soil could not be measured. In addition, the application rate was not confirmed and the concentration of trifluralin in the air could not be related to the amount of trifluralin in the soil.

3. The study was terminated before a pattern of decline could be established. There was only one sampling interval, at 3 hours posttreatment, therefore, no half-life could be estimated.

4. The test substance was uncharacterized, other than indicating it was a "commercial herbicide formulation".

5. The efficiency of the florisil trapping solution was not reported.

6. The study authors stated that there was no significant difference in the volatility of granular trifluralin with increasing soil moisture, and that more trifluralin was lost from "sprayed" than from granular applications. Experiments with granular formulations were not described in the methodology; therefore, it was not possible to assess this statement.

7. This study also included information on two other pesticides, benefin and nitralin; photodecomposition of the three pesticides was discussed, as well. These portions of the study were not reviewed since they are not pertinent to Subdivision N guidelines.

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.

9. EFGWB prefers that [14C]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 only.
Table 1: Characteristics of the three soils used in these studies taken from the Ap horizon.

<table>
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<th>Soil type</th>
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<td>pH</td>
<td>CEC</td>
<td>% Sand</td>
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<td>12.3</td>
<td>6.8</td>
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<tr>
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<td>12.9</td>
<td>5.9</td>
<td>4.9</td>
<td>11.7</td>
</tr>
</tbody>
</table>

Volume 21, Issue 5 (September), 1973
STUDY AUTHOR(S)'S RESULTS AND/OR CONCLUSIONS

(INCLUDING PERTINENT TABLES AND FIGURES)
WEED SCIENCE

Figure 1. Trifluralin and benfotiamine volatilization from Laffey sand at 30 C and temperature as influenced by soil moisture and formulation.

The period of the sprayed trifluralin from approximately 2 to 6% at a soil temperature of 30 C (Figure 1) increased soil moisture beyond field capacity to saturation further increased the volatilization of trifluralin. There was no significant increase in volatilization of granular trifluralin or of either formulation of benfotiamine with increasing soil moisture level (Figure 1). The commercial granular formulation of trifluralin had a volatility pattern similar to that of benfotiamine, but there was significantly more trifluralin volatilized from a sprayed application at saturation than benfotiamine (Figure 1). Granular formulations of chlorpropham (isopropyl-m-chlorophenylisopropylamine) (10) and dichlobenil (2,6-dichlorobenzonitrile) (11) reduced vapor losses compared to spray applications, whereas granular formulations of EPTC [5-ethyl dipropylthioethersulphonate (4) and propanil (isopropylcarbamate) (10) resulted in similar vapor losses.

The volatilization of trifluralin and benfotiamine at a soil temperature of 40 C was greater than that which occurred at 30 C (Figures 1 and 2). Trifluralin volatilization from a sprayed formulation was two to three times greater at field capacity saturation than either a spray or granular formulation of benfotiamine or the granular formulation of trifluralin. Volatilization of trifluralin and benfotiamine, either as a sprayed or granular formulation, increased significantly at 40 C as the moisture content of the soil was increased from air dryness to field capacity but did not increase significantly from field capacity to saturation (Figure 2).

The vapor loss of trifluralin from a metal surface was approximately twice the volatility of benfotiamine (Table 2).

Volume 21, Issue 5 (September), 1973
Trifluralin as a spray application was approximately twice as volatile as benefin from soils at field capacity or saturation at all soil temperatures studied. Increasing the soil temperature resulted in an increase of vapor loss of trifluralin and benefin. Similar results have been reported for benefin (12), dichlobenil (11), chlorpropham and prophen (10).

Increasing soil moisture from air dryness to field capacity consistently resulted in an increase in trifluralin volatility at all soil temperatures studied. A similar increase for benefin occurred at a soil temperature of 40 and 50 °C. Generally, increasing soil moisture beyond field capacity did not increase volatility of trifluralin or benefin. Speculation that moisture interferes with absorption of volatile herbicides has been previously suggested (4, 10, 11) and seems to fit this model.

No loss of nazarine was detected under any of the conditions studied. The gas chromatographic technique employed had a detection limit of 0.023 ng for nazarine. Empirically, nazarine was expected to be less volatile than benefin and trifluralin because the vapor pressure from Hz at 25 to 30 °C of nazarine (1.0 X 10^-9) is lower than that of benefin (3.89 X 10^-9) and trifluralin (1.14 X 10^-9).

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Volume 21, Issue 5 (September), 1973

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It has been reported (3, 7) that natalin is not volatile from soil. The volatility of a sprayed formulation of trifluralin and benzin from three different soils at field capacity was also studied at 40°C soil temperatures (Figure 4). The volatility of trifluralin decreased as the cation exchange capacity of the soil increased. Statistically only the vapor loss of trifluralin from Lakeland sand was different from that of Sharkey clay. The loss of trifluralin was greater than benzin at each cation exchange level.

Photodecomposition. The photodecomposition of trifluralin, benzin, and natalin were studied by analyzing the residual amount of herbicide remaining on soil following light exposure. The amount of trifluralin or benzin remaining following 24 hr of exposure to light as bioassayed was not significantly lower than a corresponding check kept in the dark or from the zero time exposure; the zero-time bioassay indicated approximately 12 ppm of trifluralin or benzin in the soil (Figures 5 and 6). There was a trend downward in the amount of herbicide remaining when exposed to light, but this was not statistically different from the corresponding dark check.

There was no loss of activity of natalin when exposed to light for 72 hr. Natalin that was sprayed and fumigated immediately was approximately 12 ppm and was not statistically different from any of the data presented

Volatilization of trifluralin and benzin appears to be a more important means of dissipation from soil than photodecomposition. A direction comparison can not be made between the volatility studies conducted for 3 hr and photodecomposition studies conducted for 24 and 72 hr. Within the same exposure period, there is an upturn in trifluralin and benzin activity.

Figure 5. The amount of trifluralin remaining on Lakeland sand soil surface after 24 or 72 hr of exposure to darkness and light (ultra-violet) at 25°C. Columns having the same letters are statistically different at the 5% level of probability according to Duncan's multiple range test.

Volume 21, Issue 5 (September), 1973