DATA EVALUATION RECORD

STUDY 7

PC No. 000011	Iodomethane	§163-3

CAS No. 74-88-4
DP Barcode D280800
FORMULATION–TECHNICAL MATERIAL

STUDY ID 45593822
Baker, F. C., L. Estigoy, M. Gillis, and T. Belcher. 2002. Environmental (off-site) monitoring and directflux/indirect flux determination of iodomethane (TM-425) under field conditions. PTRL Project No. 975W. PTRL Report No. 975W-1. Unpublished study performed by PTRL West, Inc., Hercules, CA, Excel Research Services, Inc., Fresno, CA, Agvise Laboratories, Inc., Northwood, ND, and Bolsa Research Associates, Inc., Hollister, CA, and submitted by Tomen Agro, Inc., San Francisco, CA.

DIRECT REVIEW TIME =

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ABSTRACT

The volatilization of iodomethane (methyl iodide; TM-425; analytical purity >99.8%; Lot No. 030501) was studied in a bareground plot (324 x 330) of sand soil (0- to 6-inch depth, 91% sand, 6% silt, 3% clay, 0.5% organic matter, pH 6.6, bulk density 1.38 g/cc, CEC 4.9 [units not reported]) located in Manteca, California. Iodomethane was applied via broadcast shank injection at a target rate of 235 lb a.i./A (actual application rate was 242 lb a.i./A) to a 324 x 330 ft bareground plot and followed simultaneously with a standard 1 mil plastic tarp over the treated plot. Volatilized iodomethane was collected at the center of the treated plot at 15, 30, 50, 80, and 150 cm above ground level, and at 30 (8 samplers) and 141.1 feet (4 samplers) from the perimeter of the treated plot on all four sides of the plot (5 ft height). Air sampling began immediately following the application at intervals of 0-3 hr., 3-6 hr., 6-8 hr., and 8-19 hr. On days 1 through 10, sampling intervals were approximately 0-12 hr and 12-24 hr, corresponding to day and night. Volatilization was determined using the aerodynamic flux method (flux density using 30 and 80 cm sampling heights at plot center).

Volatilization of iodomethane exhibited pronounced diurnal fluctuation, with daytime period flux rates greater than nighttime period flux rates. Volatilization decreased from 481 µg/m^2-sec during the 3-hours following application, to 276 µg/m^2-sec at 3-6 hours, 87 µg/m^2-sec at 6-8 hours, and 48 µg/m^2-sec at 8-19 hours on day 0. In the first 12 hours of day 1 (daytime), volatilization had increased to 115 µg/m^2-sec, before decreasing to 17 µg/m^2-sec at 12-24 hours (nighttime) of day 1. Volatilization ranged from 6-34 µg/m^2-sec on day 2, 3-32 µg/m^2-sec on days 3 through 8, and was 3 µg/m^2-sec on days 9 and 10 posttreatment. At a height of 30 cm, the concentration of iodomethane in air was 5345 µg/m^3 in the first 3 hours after application, 3522 µg/m^3 at 3-6 hours, 5726 µg/m^3 at 8 to 19 hours, an average of 2013 µg/m^3 on day 1, 428 µg/m^3 on day 2, 700 µg/m^3 on day 4, 363 µg/m^3 on day 7, and 71 µg/m^3 on day 10. At a height of 80 cm, the concentration of iodomethane in air was 2626 µg/m^3 in the first 3 hours after application, 1544 µg/m^3 at 3-6 hours, 1058 µg/m^3 at 8 to 19 hours, an average of 592 µg/m^3 on day 1, 137 µg/m^3 on day 2, 216 µg/m^3 on day 4, 97 µg/m^3 on day 7, and 27 µg/m^3 on day 10. The total mass of iodomethane lost from the soil was 94% of the applied (554 lb or 251 kg) after 10 days. The greatest mass loss, 21%, occurred during the first three hours of application, while a mass loss of 41% occurred within the first 24 hours, and a 62% mass loss occurred within the first 2 days following application. During the study, average daily temperatures (1.8 m height) ranged from 18 to 21°C and wind speed (10 m height) ranged from 3.0 to 8.9 m/second.

The study is **acceptable** and satisfies the guideline requirements for a U.S. EPA Subdivision N, section 163-3, field volatility study.

MATERIALS AND METHODS

Iodomethane (methyl iodide; TM-425; analytical purity >99.8%; Lot No. 030501; p. 345) was applied at a target rate of 235 lb a.i./A (12.4 gal/A) to a bareground plot (324 x 330 ft; Figure 2, p. 101) of sand soil (0- to 6-inch depth, 91% sand, 6% silt, 3% clay, 0.5% organic matter, pH 6.6, bulk density 1.38 g/cc, CEC 4.9 [units not reported]; Appendix B, Table 2, p. 185) located in Manteca, California (p. 24; Appendix B, pp. 178-180).

Physico-chemical properties of iodomethane:

Parameter	Details	Comments
Molecular weight:	141.9 g/mole	
Molecular formula:	CH_3I	
Appearance	Clear, colorless to light red	
Solubility in water	14.2 g/L	
Vapor pressure/volatility:	398 mm Hg	at 25°C
Density:	2.28 g/mL at 25°C	MRID 45593710, p. 33
Boiling point	42.5°C	MRID 45593710, p. 33
Stability at room temperature	Not reported	

Data obtained from p. 25; Appendix E, pp. 345 and 347 of the study report.

The application was via broadcast flat-fume shallow shank injection on September 18, 2001 (Appendix B, Table 1, p. 184, Figure 2, p. 215). The shank assembly consisted of 12 hose ends spaced approximately 12 inches apart. Shank depth was approximately 11 inches. A total of five test cylinders were required for the application (six passes each). Test cylinders were weighed prior to and after completion of six passes to verify that the application rate was being maintained throughout the plot. In field measurements (based on the mean weight of iodomethane per pass) confirmed that the actual application rate was 242 lb a.i./A or 102.8% of the target rate (p. 32; Appendix B, Tables 3-4, pp. 186-187). A standard 1 mil polyethylene tarp was immediately applied over the treated plot. The tarp was cut five days after application of the test substance and removed seven days after application. Ground preparation for planting immediately followed tarp removal to reflect normal practices.

Air was monitored for iodomethane using Anasorb (coconut) charcoal sorbent tubes that were placed in the center and perimeter of the treated area and attached to air sampling pumps calibrated to deliver an air flow rate of approximately 50 mL/minute (Appendix B, pp. 178, 180-181). Five air samplers were placed vertically at 15, 30, 50, 80, and 150 cm above ground level on a mast located at the center of the treated plot (samplers 13-17, respectively). The center mast was placed into position soon after application to the center pass was completed. Twelve additional masts were positioned outside of the treated area and were equipped with one air sampler positioned approximately 5 feet above the soil surface. Eight of these air sampling masts (samplers 1-8) were located around the perimeter of the plot, 30 feet from the plot edges, and the remaining four masts (samplers 9-12) were located 100 feet from each corner on a diagonal (diagonal distance 141.4 feet). Air sampling began immediately following the application at intervals of 0-3 hr., 3-6 hr., 6-8 hr., and 8-19 hr. On days 1 through 10, sampling intervals were approximately 0-12 hr and 12-24 hr, corresponding to day and night (p. 32). Upon collection, the charcoal adsorption tubes were placed inside a cooler containing dry ice until transport to the analytical laboratory. The air flow rate of the samplers was noted at the start and end of each trapping period.

Wind and temperature were measured at the center of the test site. Wind speed and direction, air temperature, soil temperature (1 and 8 cm below tarp surface, 8 cm below bare soil surface, and 28 cm below bed surface), relative humidity, rainfall, barometric pressure, and solar radiation were measured 34 feet outside the northeast corner of the test plot (Appendix B, p. 182, Table 6, p. 212; Appendix C, pp. 311-343).

Iodomethane was extracted from the air sample tubes and analyzed by GC/ECD (p. 28, Appendix G, p. 351). Charcoal samples from the front-end and back-end of each adsorption tube were removed and placed in separate amber glass vials, along with front-end glass wool and back-end foam. The samples were then extracted with cold ethyl acetate (5 mL front-end, and 4 mL back-end) by vortexing for one minute and placed on ice for 10 minutes. Extracts were separated from charcoal by centrifugation for two minutes and aliquots were analyzed for iodomethane by GC (J&W Scientific GS-Gaspro column, 30 m x 0.32 mm I.D.) with electron capture detection (GC/ECD; Appendix H, p. 353).

GC/ECD method:

Carrier gas - flow	Helium - 2 mL per minute
Detector gas - flow:	Nitrogen gas (makeup) - 40-60 mL per minute
Injector temperature: Detector temperature:	200°C 300°C
Injection volume	1 µL
Temperature program:	5 min. at 80°C, then 30°C per minute to 200°C 1 min. at 200°C, then 50°C per minute to 260°C 7 minutes at 260°C
Retention time:	Not reported

Data obtained from Appendix H, p. 351 and 353 of the study report.

The theoretical limit of quantitation of iodomethane in air is about 1.9 ppb, based on the lowest fortification method validation of 1 ppm on charcoal (p. 31). In the current study, field trapping efficiency was validated at 1.1ppb (time weighted for 10 hours). The limit of detection was 2 ppt iodomethane collected at a flow rate of 50 mL/min for 12 hours. Recovery efficiencies from charcoal adsorption tubes fortified with iodomethane at 1.1 and 1100 ppb in air (0.208 and 208 µg/tube, respectively) averaged 66.3% and 62.7% of the applied, respectively, from triplicate transit stability samples (Table III, p. 43). All calculated iodomethane residues were corrected for a 60% recovery (p. 35).

The study author reported the storage stability of iodomethane on charcoal was previously investigated (MRID 45593710, PTRL West, Inc. Report 983W) and found to be excellent during 7 days storage at -20°C, and acceptable for up to 30 days (p. 29).

RESULTS/DISCUSSION

Volatilization of iodomethane exhibited pronounced diurnal fluctuation, with daytime period flux rates greater than nighttime period flux rates (Appendix C, Graph 1, p. 303). Volatilization decreased from 481 µg/m^2-sec during the 3-hours following application, to 276 µg/m^2-sec at 3-6 hours, 87 µg/m^2-sec at 6-8 hours, and 48 µg/m^2-sec at 8-19 hours on day 0. In the first 12 hours of day 1 (daytime), volatilization had increased to 115 µg/m^2-sec, before decreasing to 17 µg/m^2-sec at 12-24 hours (nighttime) on day 1. Volatilization ranged from 6-34 µg/m^2-sec on day 2, 3-32 µg/m^2-sec on days 3 through 8, and 3 µg/m^2-sec on days 9 and 10 posttreatment (Appendix C, Table 7, p. 302). At a height of 30 cm, the concentration of iodomethane in air was 5345 µg/m^3 in the first 3 hours after application, 3522 µg/m^3 at 3-6 hours, 5726 µg/m^3 at 8 to 19 hours, an average of 2013 µg/m^3 on day 1, 428 µg/m^3 on day 2, 700 µg/m^3 on day 4, 363 µg/m^3 on day 7, and 71 µg/m^3 on day 10 (Appendix C, Table 7, p 302). At a height of 80 cm, the concentration of iodomethane in air was 2626 µg/m^3 in the first 3 hours after application, 1544 µg/m^3 at 3-6 hours, 1058 µg/m^3 at 8 to 19 hours, an average of 592 µg/m^3 on day 1, 137 µg/m^3 on day 2, 216 µg/m^3 on day 4, 97 µg/m^3 on day 7, and 27 µg/m^3 on day 10. The total mass of iodomethane lost from the soil was 94% of the applied (554 lb or 251 kg; Appendix C, Table 8, p. 305; Graph 3, p. 307) after 10 days. The greatest mass loss, 21%, occurred during the first three hours of application, while a mass loss of 41% occurred within the first 24 hours, and a 62% mass loss occurred within the first 2 days following application (Appendix C, Table 9, p. 306).

During the study, average daily temperatures (1.8 m height) ranged from 18 to 21°C and wind speed (10 m height) ranged from 3.0 to 8.9 m/second (Appendix B, Table 6, p. 212). Complete meteorological data during the study period is reported in Appendix D (pp. 313-334).

DEFICIENCIES/DEVIATIONS

1. The study was conducted in parallel with the worker and applicator exposure study: PTRL West, Inc. Report 974W: Worker and applicator exposure under field conditions during application of the fumigant iodomethane (TM-425). F. C. Baker et. al., January, 2002.

2. The plot area had been fallow for the previous three years and no pesticides were applied during this time period nor were any maintenance chemicals applied during the in-life phase of the study (Appendix B, p. 178).

3. The study authors stated that the storage stability of iodomethane on charcoal was investigated previously (MRID 45593710) and "found to be excellent during 7 days storage at -20°C, and acceptable for up to 30 days" (p. 29). Results were not provided. Test samples were stored for a maximum of 3 days prior to extraction with most samples stored for only one day, and field trapping efficiency transport stability samples were stored for two days prior to extraction (p. 35; Table 2, p. 42).

4. The study authors stated that there was little or no breakthrough of iodomethane residues into the back-end charcoal of air sample tubes under the trapping conditions used in the study (p. 37).

ATTACHMENT 1

Data Critical to the Study Interpretation

THE FOLLOWING ATTACHMENT IS NOT AVAILABLE ELECTRONICALLY
SEE THE FILE COPY

Figure 2. Plot Map.

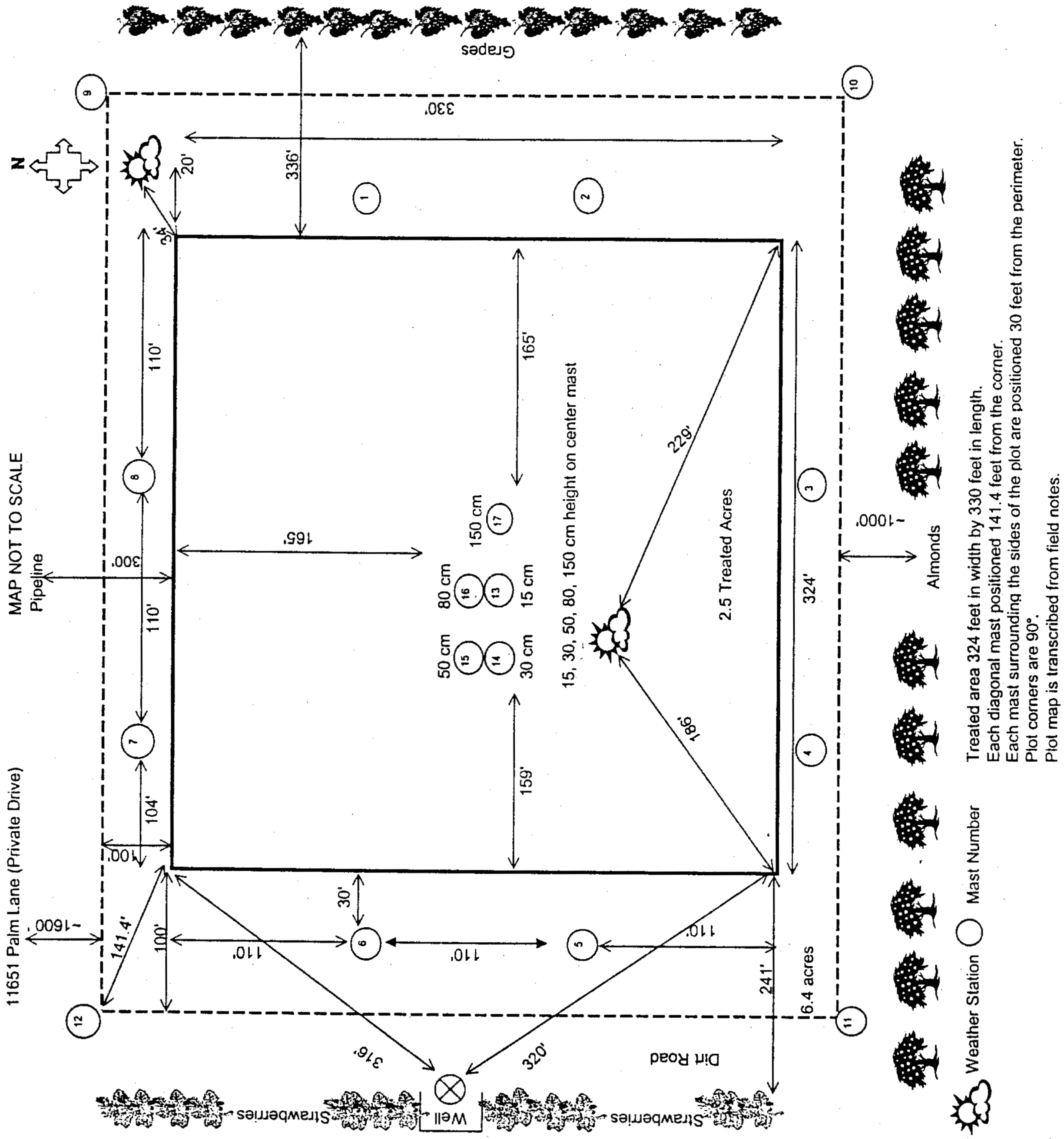

Figure 3. Trapping Efficiency Apparatus.