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DOWNWIND TRAVEL OF HERBICIDES (U)

(Procedures to be Used in Trials 12-19,  
Field Experiment No. 593)

Prepared by

B.G. Cameron and J. Monaghan

DRB PROJECT NO. 97-97-01

June, 1971

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OFFICIAL MEMORANDUM No. 10/71

3. 12. 1971

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1971-01

Downward travel of herbicides

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Dr. J. Cameron and Dr. Monahan

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June 1971

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DEFENCE RESEARCH ESTABLISHMENT SUFFIELD  
RALSTON ALBERTA

SUFFIELD MEMORANDUM NO. 48/71

DOWNWIND TRAVEL OF HERBICIDES (U)

(Procedures to be Used in Trials 12-19,  
Field Experiment No. 593)

Prepared by

B.G. Cameron and J. Monaghan

1. REFERENCES

- a. Saskatchewan Research Council (SRC) letter dated 14 May 69 (DRES 221-50/3)
- b. Proposed pesticide field trial program, prepared by SRC 23 June 69
- c. DRB 6800-1-1 dated 3 July 69
- d. Suffield Memorandum No. 71/69
- e. DRB 652 dated 28 April 70
- f. Suffield Memorandum No. 18/70
- g. Field Trials suggested by Canada Department of Agriculture (CDA), 5 Feb 71

2. PURPOSE

DRES has provided assistance to the Saskatchewan Research Council (SRC) and the Canada Department of Agriculture (CDA) in trials under FE 593 in 1969 and 1970. The purpose of these trials has been to assess the downwind drift of selected 2,4-D formulations, when sprayed at normal agricultural rates, under similar weather conditions and this overall purpose is to be maintained in the current series of trials.

Tentative results from trials 4-11 of this series suggest that downwind drift of 2,4-D dimethylamine is restricted to fine aerosol released with the spray, but in the case of the butyl ester, the initial drift of aerosol is followed by vapour evolved from the sprayed area. SRC/CDA wish to confirm these results and to determine the droplet and vapour components of downwind drift for 2,4-D isooctyl ester.

DRES is interested in this trial series for the purpose of making fundamental measurements on the sprayed material. For this reason DRES has entered more fully into the trial program and has agreed to share the cost of the tagged 2,4-D esters and amine which are to be used, in addition to providing facilities for the trials and for subsequent analysis.

### 3. OBJECTIVES

#### a. SRC/CDA

- 1) To spray areas of prairie terrain separately with 2,4-D dimethylamine, butyl ester and isooctyl ester.
- 2) To obtain aerosol samples at the downwind edge of an area sprayed with 2,4-D dimethylamine.
- 3) To obtain initial aerosol and sequential vapour samples at the downwind edge and downwind of areas sprayed with 2,4-D butyl ester and 2,4-D isooctyl ester.

#### b. DRES

- 1) To determine the mmd of spray from a selected spray nozzle.
- 2) To determine the density and drop size of ground deposits from the sprays with each 2,4-D compound.
- 3) To determine the drop size of the airborne droplet clouds and the change in droplet size with downwind distance.

### 4. SCOPE

Two successful trials are required with each of the three materials. If time and weather permit, two further trials with 2,4-D dimethylamine will be attempted: one under optimum spraying conditions and one at high wind speeds.

5. SITE

A suitable area near the Vertical Grid Layout.

6. WEATHER

- a) Wind direction: any
- b) Wind speed: 8-16 mi/hr; but >16 mi/hr for one dimethylaniline trial
- c) Air Temperature: not higher than 95°F
- d) Precipitation: nil for 24 hr prior to and during a trial
- e) Stability: neutral to moderate lapse

7. MATERIAL

- a) 2,4-D butyl ester, 2,4-D dimethylaniline and 2,4-D isooctyl ester, all tagged C<sup>14</sup>. Activity 2.5 mCi, minimum per trial.
- b) The above three materials, untagged, provided by CDA.
- c) Boom sprayer complete with nozzles size 65015
- d) Pie plates: 24 per trial
- e) Cascade Impactors: 9 per trial
- f) Chromatographic (silica gel) paper 4"x4": 24 per trial
- g) Rotary droplet samplers: 10 per trial
- h) Airborne Cloud Samplers: 66
- i) Gasoline Pumps: 27 plus spares
- j) 5KVA Electrical Generator

## 8. LAYOUT

Details of the sampling layout are given in Figure 1.

### Ground Contamination Sampling

Dry pie plates each containing a 4"x4" sheet of silica gel chromatographic paper will be used as ground samplers. The desired ground contamination density is 10 oz. 2,4-D ester or amine per acre.

Rotary droplet samplers will be used to collect sprayed droplets for sizing. A suitable source of electric power is required for this purpose.

### Vapour and Aerosol Sampling

Vapour and aerosol samples will be collected by silica gel samplers operated at  $50 \text{ l.min}^{-1}$  by gasoline pumps. Silica gel samplers equipped with a "snoot" attachment will be oriented downwind at all sampling positions for measurement of vapour components. Aerosol and vapour components will be measured at some sampling positions by means of unprotected silica gel samplers oriented upwind.

Samples of the airborne particulate cloud will be taken for sizing by Cascade impactors.

## 9. METEOROLOGICAL OBSERVATIONS

A met station will be set up in a position close to the upwind edge of the layout. The following meteorological information is required:

- a. Wind speeds at 1/2, 2 and 4m
- b. Wind direction at 2m
- c. Air and surface temperatures
- d. Temperature gradient 4m - 1/2m
- e. Relative humidity
- f. Cloud conditions and sunshine

# 10. PROCEDURE

Initial dilution of the tagged 2,4-D formulations with untagged material will be done at the Radiactive Stores site. Subsequent addition of water will be done at the trial site.

The layout will be oriented on the basis of the forecast wind direction and the spray area marked out with its long axis crosswind. After all samplers have been emplaced and tested, a "dry" run will be made with the boom sprayer to check traverse speed, following which the apparatus will be charged with the designated material. Aspirated samplers and the rotary drop samplers will be started and on instructions from H/TSS the area will be sprayed in a single pass. Zero for the trial will be the start of spraying. The residual agent in the sprayer will be weighed to determine the weight of charging dispersed.

Silica gel samplers will be oriented as follows at 1/2m, 1m and 2m heights:

| <u>MATERIAL<br/>POSITION</u> | <u>AMINE</u> | <u>BUTYL ESTER</u> | <u>ISOCTYL ESTER</u> |
|------------------------------|--------------|--------------------|----------------------|
| 1                            | 1 U + 3 D    | 1 U + 3 D          | 1 U + 3 D            |
| 2                            | 1 D          | 1 D                | 1 D                  |
| 3                            | 1 D          | 1 D                | 1 D                  |
| 4                            | 1 U + 3 D    | 1 U + 3 D          | 1 U + 3 D            |
| 5                            | 1 D          | 1 D                | 1 D                  |
| 6                            | 1 D          | 1 D                | 1 D                  |
| 7                            | 1 U + 3 D    | 1 U + 3 D          | 1 U + 3 D            |
| 8                            | 1 U + 1 D    | 1 D                | 1 D                  |
| 9                            | 1 U + 1 D    | 1 D                | 1 D                  |
| 10                           | 1 U + 1 D    | 1 D                | 1 D                  |

U = upwind

D = downwind

Vapour and aerosol sampling will proceed according to the following schedule:

Aerosol sampling:

- a) Silica gel samplers Z to Z + 3 min.
- b) Cascade impactors: Z to Z + 3 min.

Vapour sampling:

- a) Silica gel samplers at positions 1, 4, 7.
  - Z to Z + 3,
  - Z + 3 to Z + 30,
  - Z + 30 to Z + 90 min.
- b) Silica gel samplers at remaining positions:
  - Z to Z + 90 min.

Pie plates will be capped and picked up as soon as the spray pass is completed. Rotary samplers will be switched off and collected thereafter.

11. PHOTOGRAPHY

A still, black and white, photographic record is required of the layout and sampling equipment.

12. ANALYSIS

Ground contamination, vapour and aerosol sampling will be analyzed by liquid scintillation counting by CDA with DRES assistance. Droplet sizing from rotary sampler records will also be carried out at DRES. Analysis of cascade impactor samples will be carried out by SRC/CDA.

1. RADIATION SAFETY

- a) It is expected that a total of 30 mCi of  $C^{14}$  tagged 2,4-D ester and amine will be at DRES prior to this series of trials.

amount of  $C^{14}$  to be used in any one trial will be 2.5-4.0 mCi. On receipt, the tagged 2,4-D ester and 2,4-D amine will be kept in the Radioactive Storage Building. All mixing of these materials for spraying will be done at that location.

b) Film badges will be worn by all personnel engaged in the trials with radioactive material.

c) The vehicle used to transport tagged material from the mixing site to the layout will carry "Radioactive Material" signs front and rear and on both sides. The boom sprayer reservoir will carry a trifoil radiation warning sign.

d) The boom sprayer will be flushed three times with water and once with isopropyl alcohol following each spray run with tagged material. Unused residues from these trials will be collected on site in suitable containers which will be dumped in the Radioactive Disposal Area.

e) Rooms 222E and 222P, Central Laboratory, are designated as the areas in which samples from trials with tagged materials will be handled. The rooms will be signed accordingly (medium level laboratory) and access to them will be restricted to personnel directly concerned with this field experiment.

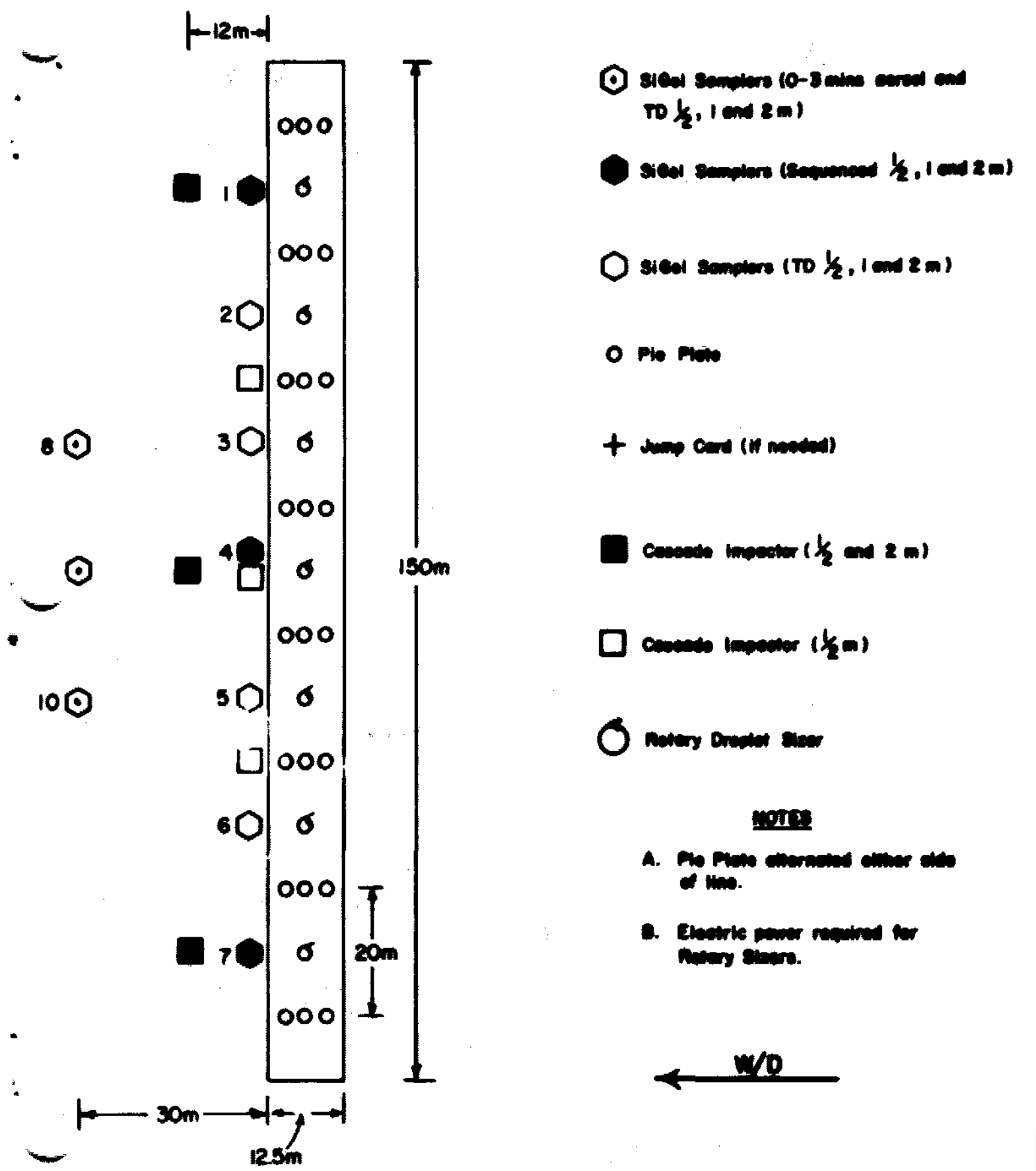
f) A post trial survey will be conducted to follow the decay of beta activity in the sprayed area. It is expected that this will not be measurable for more than 30 days.

## 15. ADMINISTRATION

H/Chem

Provide Radiation Safety Officer, Chemical test team, Co-ordinate sampling schedule and record sampling times. Provide sampling equipment; arrange for purchase of  $C^{14}$  tagged materials; assist in analysis; prepare report dealing with DRES objectives. Provide film badges as required.

|               |                                                                                                                                                                                                                                                                                                         |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H/Tech S.     | In charge of trial. Layout preparation. Record zero and spray run times. Provide spray apparatus. Sample of sprayed materials to Chem S. Mix 2,4-D materials and water is directed by SRC. Provide "Radioactive Material" signs for Munitions vehicle as required. Record of amount of agent dispersed. |
| H/Met         | Forecast and meteorological observations.                                                                                                                                                                                                                                                               |
| SRC/CDA       | Provide untagged 2,4-D esters and amine. Assist in layout and sample preparation and analysis. Prepare report dealing with SRC/CDA objectives.                                                                                                                                                          |
| H/Photo Group | Still photography.                                                                                                                                                                                                                                                                                      |



LAYOUT DIAGRAM F.E. 593 (TRIALS 12-19)

FIGURE 1