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TBM (AVENGER) CALIBRATION TRIALS
ABBOTSFORD, B.C.
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by

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INTRODUCTION

In early December, 1975, CCRI was asked to carry out more calibration trials on the TBM (Avenger) spray aircraft to compare the presently used trailing edge boom system with the above-the-wing (open nozzle system suggested by A. P. Randall in 1973 in terms of droplet spectrum and dispersal.

On December 11, 1975 a meeting was held in Ottawa with spokesmen from FPL, Conair and CCRI present to lay down a set of parameters to be used to carry out the calibration trials. The agreed-upon parameters were as follows:

1. TBM's to fly 165-170 mph.
2. The aircraft height to be 150 ft agl. (above ground level)
3. Formulations to be simulants of fenitrothion emulsion and fenitrothion oil solution.
4. Minimum effective deposit for swath width determination to be 20 drops/cm².
5. Trailing edge boom be calibrated to give 25 gallons per minute with 25 nozzles at 40 psi.
6. Above-the-wing boom system to be used at same rate of flow as trailing edge system (i.e. 25 gallons per minute).
7. No trials with emulsion will be done with a relative humidity higher than 80%.
8. W.W. Hopewell and W. Haliburton to produce a simulant before the trials start.

9. All trials to be carried out in Abbotsford, B.C. area.
10. The trials were to commence during the first week of January, 1976, or as soon as Conair could get aircraft ready.

MATERIALS & METHODS

Experimental Layout

The experimental site was laid out on flat farmland approximately 12 miles from the airport. Two sample lines were laid out, designated x and y. The y line was marked out for 100 yards with samples at 10 yard intervals.

The x line was marked out at 10 yard intervals for the first 200 yards; 20 yard intervals for the next 400 yards and 40 yard intervals to 1 mile. The lines were established approximately 60 to 80 feet apart; one on either side of a roadway. (Fig. 1)

Formulation

The simulant used for the fenitrothion oil solution was made up as follows:

Fuel Oil #2	30% by volume
Fuel Oil #4	50% by volume
Motor Oil 5AE 30	20% by volume

This formulation had very similar characteristics to the actual fenitrothion/oil solution: Density 0.898 g/ml-25°C.

Viscosity 6.09 cp : Surface tension 31.1 dynes/cm

Aircraft

One TBM avenger aircraft (Conair Aviation Ltd.) was used to carry out the trials. It had been equipped with both spray boom systems

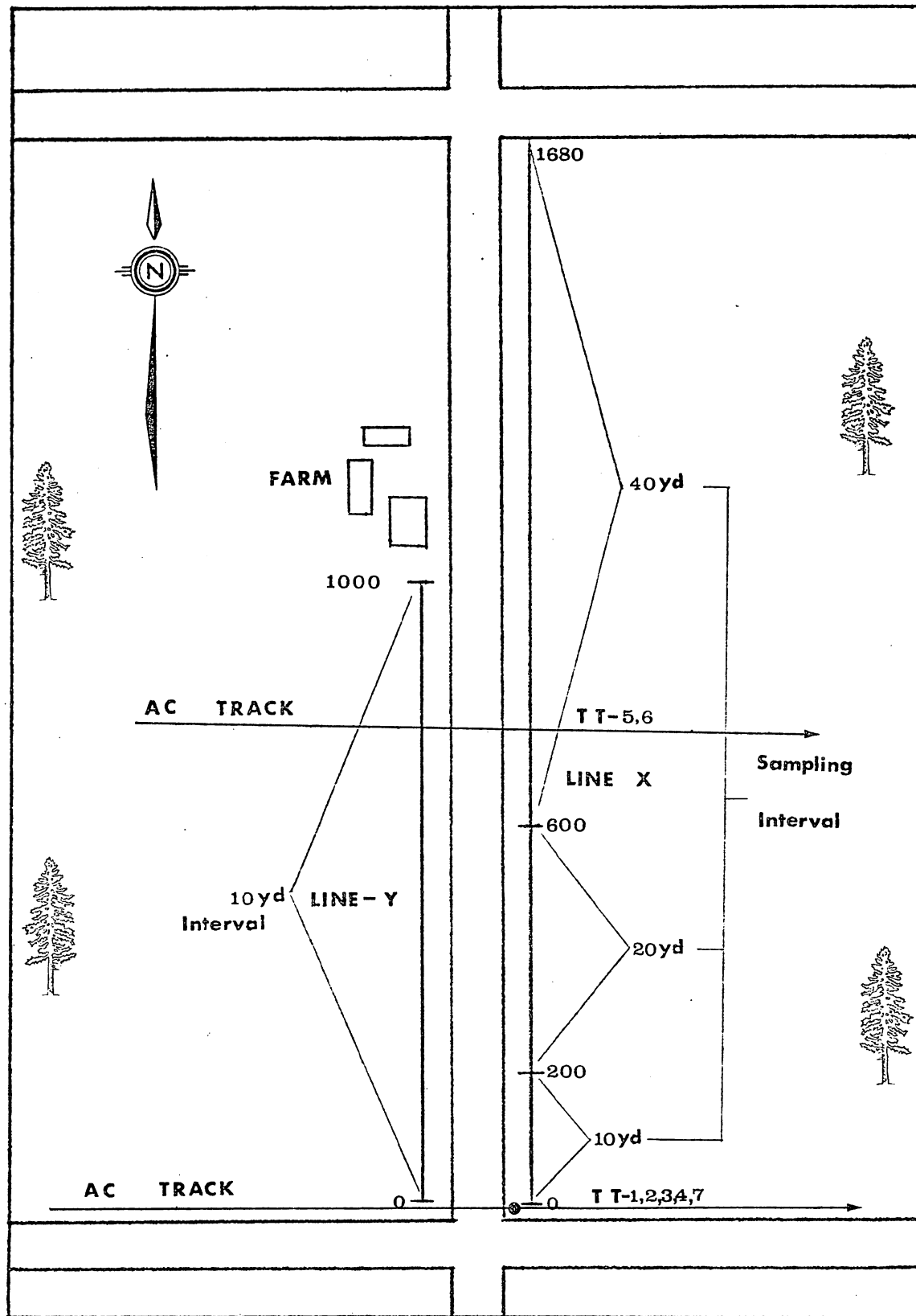


FIGURE 1; DIAGRAM OF EXPERIMENTAL LAYOUT.

so that it could be switched from one to the other in a matter of minutes.

Sample Units

Two types of sample units were used to recover deposit during the trials. The y line had 2 Kromekote^R cards (4 inch x 4 inch) at each sampling point while the x line had one 4" x 4" Kromkote^R card as well as two 50 x 75 mm glass slides. These two methods would give physical as well as chemical analysis data of the deposited portion of the spray.

RESULTS AND DISCUSSION

The only definite conclusion that can be drawn from these tests was that the weather in the Vancouver area of B.C. in January does not lend itself to the carrying out of spray calibration trials. The trials were plagued by bad weather such as rain, wind, snow and more rain. Despite these adverse conditions seven trials were carried out before the limited budget was completely expended and the crew was forced to return home.

In order to be able to compare test results, the trials must be grouped into 2 groups under similar meteorological conditions. Tests TT-1, 2, 3, 4 and 7 had similar high wind, isothermic to lapse conditions and average RH of 80% while tests TT-5 and TT-6 had virtually no wind and a higher relative humidity (90% average) along with slightly cooler temperatures. (Beveridge, W. J. G. file report No. 36 - Jan. 1976).

Recorded ground deposits were well below the 20 drop/cm² level on TT-1, 2, 3, 4 and 7 which were sprayed under 8 - 14 mph wind

conditions. These trials were sprayed with the aircraft tracking over the "0" point or the south end of the layout. TT-5 and TT-6 (no or very little wind) were sprayed with the aircraft tracking over the center of the layout as wind directions were constantly changing from north to south. These two trials therefore showed a much higher deposited density than the other trials.

Figure 2 and 3 show deposits across the layout for each trial in terms of drops/cm² and volume (oz/ac).

A summary of all pertinent information of each trial is presented in Table I.

From these data it is apparent that the droplet spectrum produced by both systems is within the allowable parameters of the operational budworm program. These parameters are:

MMD	90 u
NMD	40 u
D Max	200 u

One can see that there are differences in droplet spectra between trials but whether they are due to the two different systems or due to changing wind and weather conditions cannot be accurately determined.

TABLE I
SUMMARY CALIBRATION DATA - TBM TRIALS - 1976

TRIAL NO.	RATE OF FLOW	AVE DROPS /CM ²	AVE OZ/AC (FL)	MMD (u)	NMD (u)	DMAX (u)	WIND SPEED	WIND DIR	TEMP °C	RH%	NO. NOZZLE	BOOM SYSTEM
TT-1	25gpm	0.71	0.40	138	58	278	9	215	5.0	83	24	Above wing-open nozzle 7° forward
TT-2	25gpm	1.91	0.43	95	47	219	11	135	5.6	85	24	Above Wing 8010 tips 7° forward
TT-3	25gpm	1.22	0.54	128	65	278	10	225	6.0	85	24	Trailing Edge 8010 tips 5° forward
TT-4	25gpm	1.70	0.39	96	46	219	13.6	220	6.4	78	24	Trailing Edge 8010 tips 45° forward
TT-5	25gpm	14.09	2.85	116	33	278	0-1	*	4.4	93	40	Above Wing Open Nozzles 7° forward
TT-6	25gpm	8.67	1.40	106	28	219	1.6	225	4.5	90	24	Trailing Edge 8010 tips 45°
TT-7	25gpm	1.99	0.45	97	42	219	8.1	220	4.3	87	24	Above Wing 8010 tips 45° forward

* Wind constantly changing directions.

N.B. All trials done under lapse conditions. i.e. temp. warmer at 1 m. than at 9 m. or under isothermic conditions.

CONCLUSIONS

Due to adverse weather conditions and the resulting few trials that were carried out, the data is not all that conclusive.

Two conclusions could be drawn and they are:

- 1) With the present nozzles and spray configuration, there appears to be little difference between the above-the-boom open nozzle spray system and the presently used trailing edge system in terms of droplet spectrum based on data from these last tests.
- 2) The trailing edge spray system can be improved to give a narrower droplet spectrum and a smaller D_{max} when the nozzles are pointed 45° into the aircraft slipstream.
- 3) There is no significant difference between the above-the-wing boom and trailing edge boom when each are equipped with the same number of nozzles with 8010 spray tips.

NOTE: The above the wing, open nozzle system has not yet been truly evaluated and does have its potentials. Further research and development should be carried out, especially in the field of a new spray nozzle for this system.

FIG. 2 - DEPOSIT GRAPHS

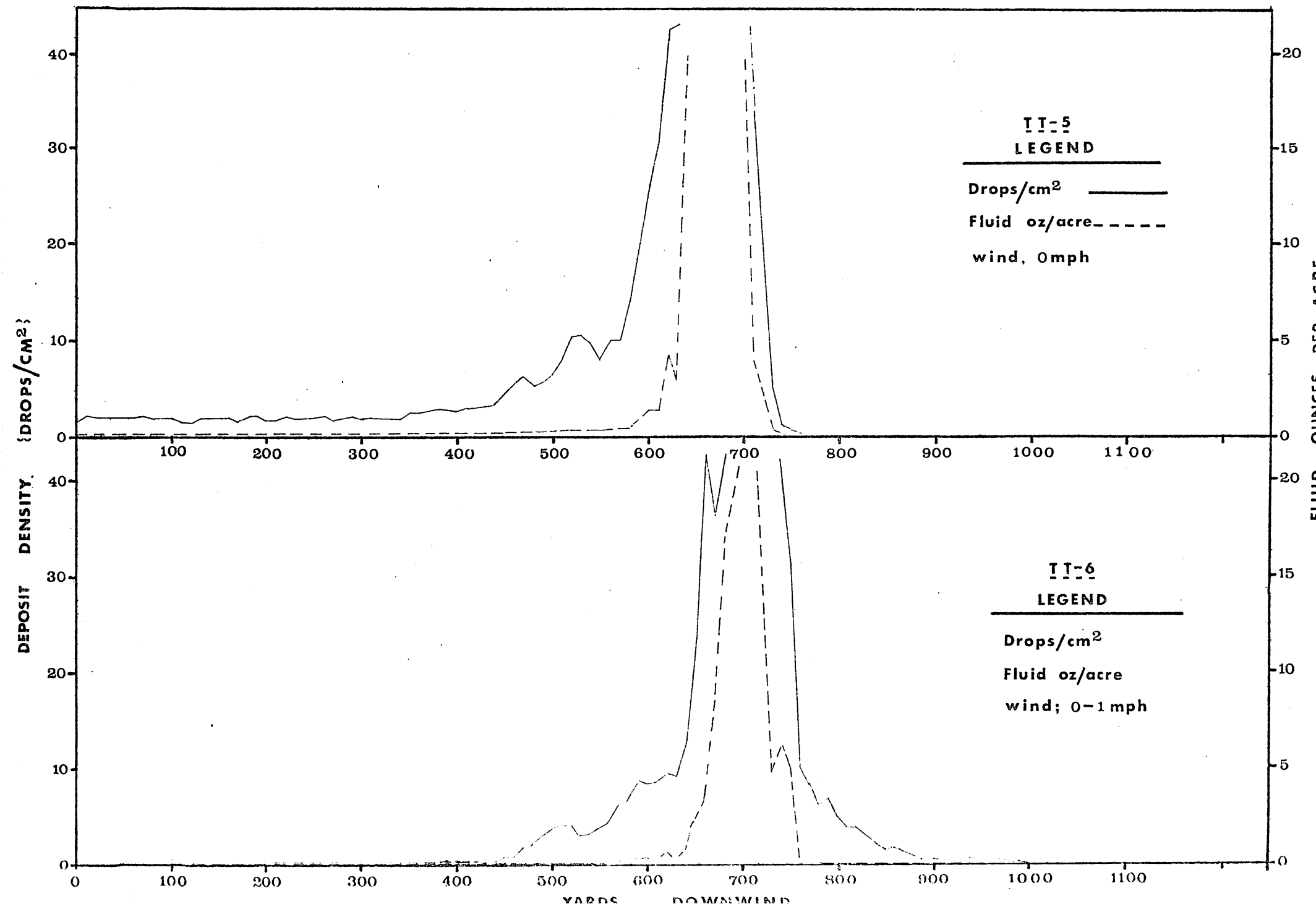


FIG. 3 - DEPOSIT GRAPHS

