*J. of Agril. Mach. & Mech. 1 (1). 1994 : 17—22*

# COMPARISON OF DRIFT FROM CHARGED AND UNCHARGED SPRAYS

**Md. Daulat Hussain and Murshed Alam***

## ABSTRACT

Spray drifts from small sprayers were measured using isokinetic drift monitoring equipment. Fluorescent dye was used to quantify the amount of drift by using a fluorometer. The results showed that charging the spray droplets producing from small sprayers reduced the drift to a great extent in windy conditions.

Key words : Drifts, deposion. fluorescent dye, fluorometer, spray and sprayer.

## INTRODUCTION

Drift refers to the movement of air borne pesticide particles or droplets away from the target area. Small sprayers produce droplets having size ranges from less than 10 μm to more than 499 μm in diameter under different operating conditions[2]. The small droplets smaller than 100/μm are dispersed by the wind over large areas to downwind. Spray drift is caused by the interaction of wind conditions, terminal velocity of droplet from the nozzle. The other factors which are directly or indirectly responsible are : travelling speed, drop-size distribution of sprays, height of the nozzle from the target point, rate of evaporation of the air borne spray droplets which increase their drift potential by reducing their diameters . The drift of the pesticide contributes to the problem of environmental pollution and makes the chemical control of pests inefficient, uneconomical, and hazardous to the people, farm animals and wildlife. The drift may also cause serious damage to pollinators, scavengers, parasites and predators and financial risk to the pesticide applicators. In the case of herbicides, the drift can cause damage to sensitive crops growing downwind of the treated area. The drift of pesticide can be an important cause of illegal residues on food and fodder crops.

The control of drift in the application of pesticides is a pressing problem. The conventional spray appliances produce a wide range of droplet sizes. The droplet below 50 μm are generally prone to drift. The amount of such droplets varies in different kinds of pesticide applications, (Table 1).

*Professor and Assistant Professor respectively of the Dept. of Farm Power & Machinery, Bangladesh Agricultural University, Mymensingh, Bangladesh

Table 1. Volume Medium Diameter of Different Types of Sprays.

| | Aerosols | Mists | Fine sprays | Medium sprays | Coarse sprays | Very coarse sprays |
|---|---|---|---|---|---|---|
| VMD (µm ) | 11 | 86 | 130 | 278 | 460 | 900 |

Source : Bindra & Singh (1971)

There is no known way in which the drift of agricultural chemicals can be entirely eliminated. The drift can, however, be kept at the minimum by the following ways :

i) Consideration of meteorological conditions.
ii) Proper distance between target and nozzle.
iii) Use of hoods and shields.
iv) Production of large droplets.
v) Use of suitable formulations.
iv) Use of additives.
vii) Electrostatic charging of the pesticide materials.

Spray drift has been measured by different authors and crop damage due to spray drift has been reported ( Drift of herbicides BCPC 1983). This paper has described the effect of electrostatically charged sprays on the amount of drift in field condition.

## MATERIALS AND METHODS

Experiments were carried out at the University of Hohenheim and Technical University of Berlin using small sprayers to find out the drifts under different operating conditions. The area of the experimental plot was 200 square meter. The drifts were measured at distances of 25 m (10m to the left and to the right of the center line of sprayers ) and 50 m away from the center line of sprayers. The experimental setup is shown in Figure 1.

Iso-kinetic drift monitoring equipment was used in the experiment is shown in Figure 2 to collect the amount of spray residues that drifted at different heights from the ground under experimental conditions.

Drifts were measured upto a height of 4 m from the ground. The working principle of the iso-kinetic drift monitoring equipment was the following :

Special filter papers were introduced into the small casings of the equipment. Behind the casing there was a small 24 volt DC motor for driving the fan. The fan was directly coupled to the motor. Filter papers allow air to pass through it. Spray droplets floating in the air were sucked up by the fan and deposited on the filter paper. There was an electronic circuit arrangement in the equipment to synchronize the speed of the fan to that with the velocity of air prevailling in the experimental field.

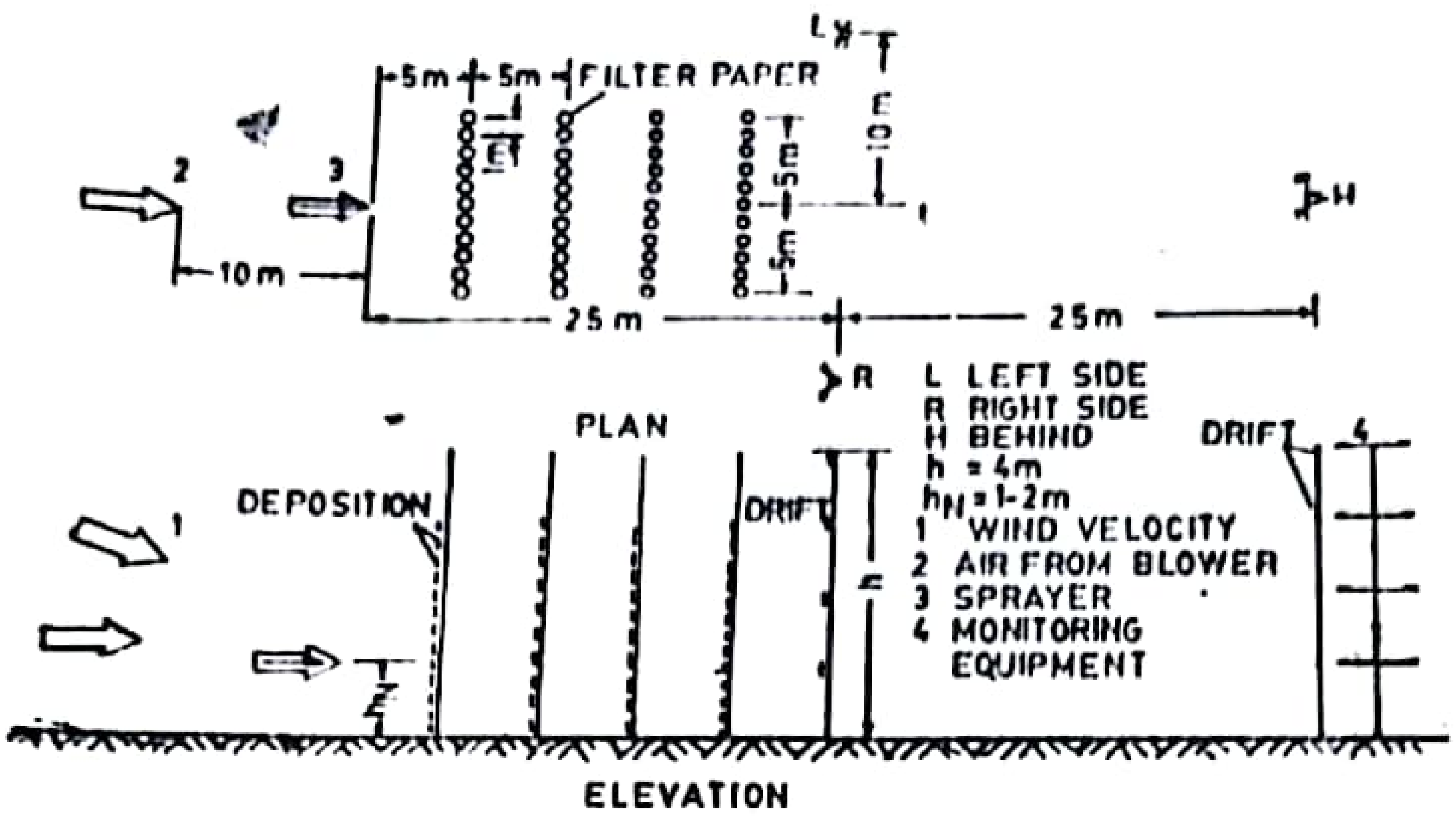
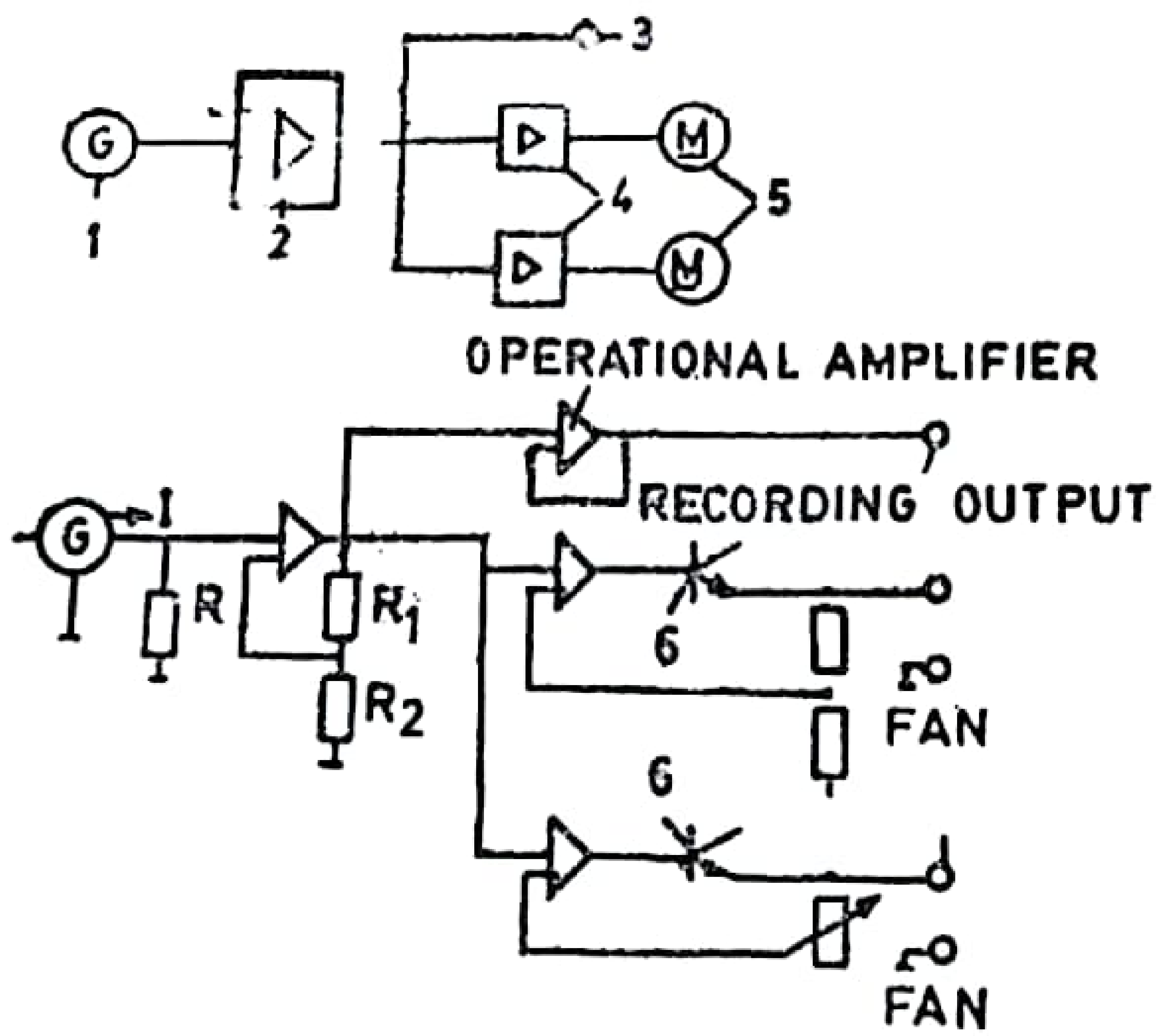



FIG 1 EXPERIMENTAL SETUP IN THE FIELD,




INSTRUMENTATION SYSTEM

1 VANE TYPE ANEMOMETER  4 POWER AMPLIFIER
2 AMPLIFIER  5 FAN
3 RECORDING OUTPUT  6 TRANSISTOR

FIG 2 ISO-KINETIC DRIFT MONITORING EQUIPMENT AND INSTRUMENTATION SYSTEM.

A large axial blower was installed in the experimental field to supply and direct the desired velocity of air at the time of spraying. The blower delivers air 75,000 cubic meter per hour. The average exit air velocity of the axial blower was about 27 meter per second.

Filter papers having area of 15 square centimeter were used for the collection of spray drifts. 0.2 % BSF diluted in tap water was used as spray-solution. It was assumed that the tracer residue on the target would be analogous to the pesticides active ingredients in the spray. Spray drifts were reclaimed from filter papers by a standard wash procedure using distilled water. This contains 0.03 % methanol. A self-balancing Turner Fluorometer was used to quantify the drift deposition. All sprayers were attached to the test-stand.

## RESULTS AND DISCUSSION

A knapsack sprayer with an air shear nozzle was used for drift test. Drifts were recorded with or without using air supply. The experimental results are shown in Figure 3.

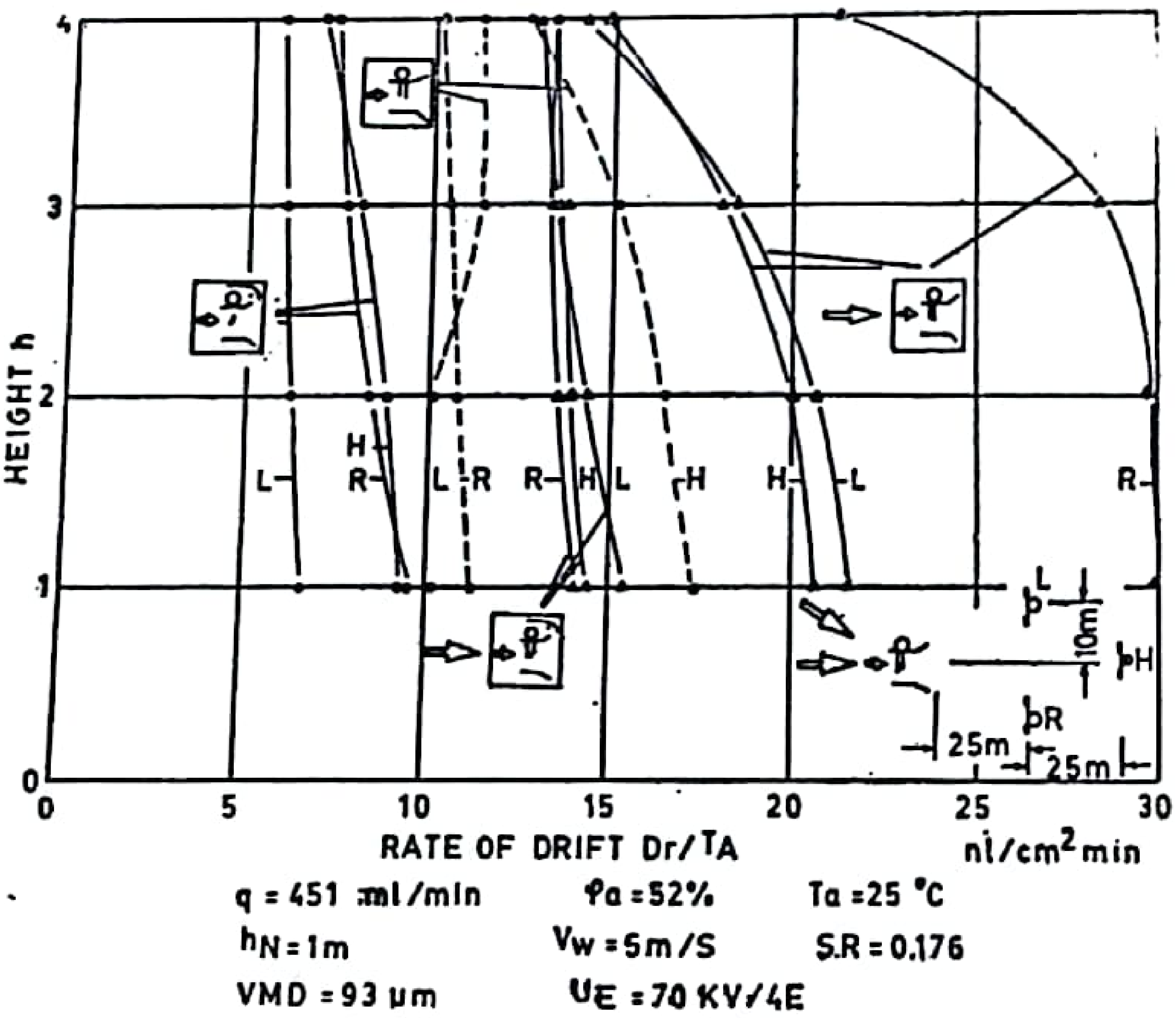



FIG 3 DRIFT AT FIELD CONDITION.

In all four operating conditions, the minimum drift was obtained by using electrostatic charge to spray droplets ( without air supply). Maximum drift was found by using nonelectrostatic charge to spray droplets with air suppiy.

Due to the limited number of drift monitoring stands the drifts were recorded upto a height of 4 m from the ground.

It was recorded that rate of drifts (Dr/TA) was 5 to 8 nl/cm² min for electrostatic charged droplets, 11 to 17 nl/cm² min for uncharged droplets, 14 to 16 nl/cm² min for electrostatic charged droplets with supply air and 17 to 30 nl/cm² min for uncharged droplets with air supply. These results showed that the electrostatic charge had great effect on the amount of pesticide drift.

The reason of reducing drift was that the charged droplets deposited onto the nearest conducting medium and only a little part of it was drifted away. But in case of uncharged droplets, all small droplets were drifted away rather than taking deposition.

Similar trend was found with other small sprayers. Simultaneously, the depositions on the vertical stands which were placed at an interval of 5 m upto 20 m from the spraying nozzle were recorded to find out the amount of sprays drifted from the nozzle of the sprayer. The drifts were recorded with charge and without charge using supply air and without supply air. The height of the vertical stands were 4m from the ground.

In all operating conditions, the depositions decreased sharply with increasing in height and increasing the horizontal distances from the spraying nozzle. The results of the experiment are shown in Figure 4.

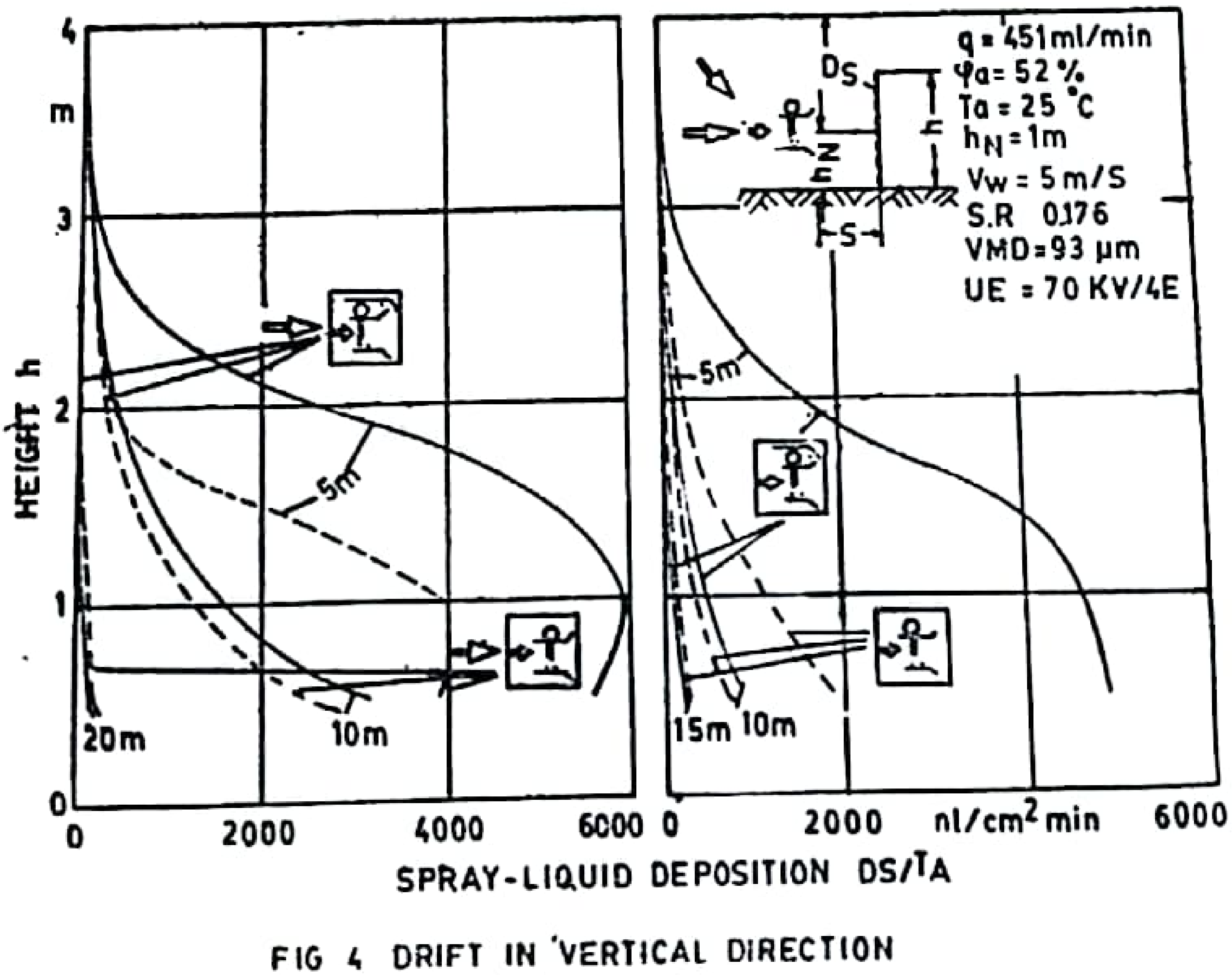



FIG 4 DRIFT IN VERTICAL DIRECTION

The deposition on vertical stands gives an idea of the the rate of drift at certain distances from the nozzle. Using electrostatic charge to spray droplets, the distance of flight of indivivual droplet can be confined within short space. On the basis of the experimental results the following conclusions can be drawn.

a) Charging the spray droplets from knapsack sprayer with air shear nozzle reduced spray drifts to a great extent.

b) Amounts of spray drift increased with increasing wind speed. The rate of drifting of charged droplets was lower than the uncharged droplets.

c) The distance of downwind drift shortened using charge droplets.

d) ULV application is possible using electrostatic charged sprays.

e) Total amount of pesticide requirement can be cut down using electrostatic sprays.

## REFERENCES

Akesson, N. B. & W. E. Yates (1964). Problems Relating to Application of Agricultural Chemicals and Resulting Drift Residues. A Rev. Ent., 9 : 285-318.

Bindra, O. S. & H. Singh. (1971). Pesticide Application Equipment. Oxford and IBH Publishing Company : 245-261.

Brooks, F. (1947). The Drifting of Poisonous Dusts Applied by Aeroplanes and Land Rigs. Agril. Engg., 28 (6) : 233-239.

Butler, B. J., N. B. Akesson & W. E. Yates (1969). Use of Spray Adjuvants to Reduce Drift. Trans Am. Soc. Agric. Engrs, 12 (2) : 182-186.

Courshee, R. J. (1959). Investigations on Spray Drifts. J. Agric. Engng. Res., 4 (2) : 144-152 ; 4 (3) : 229-242,

Hussain, M. D. and E. Moser (1985). Electrostatic Spraying Using a Disc Rotary Sprayer, J. of BAS, 9 (1) : 37-46.

Mury, J. A. & L. M. Vaughan (1970). Measuring Pesticide Drift at distances to 4 miles. Journal of Applied Meteorology. 9 : 79-85.

Report of the Working Party to Review the influence of weather on pesticide application efficiency and safety (1983). The drift of herbicides. BCPC Research and Development Committee.