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Spray drift collector efficiency: Assessment of deposition on 2 mm diameter PVC line in a wind tunnel

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Introduction

During pesticide application, 30 – 50% of the applied amount can be lost to the air (Van den Berg *et al.*, 1999) and it may be one reason for atmospheric organic contamination (Samsonov *et al.*, 1998). To quantify pesticide losses of airborne drift, a useful method is to spray a fluorescent dye (Murphy *et al.*, 2000; Parkin and Wheeler, 1996, Solanelles *et al.*, 1996 and Miller and Hadfield, 1989) and to trap it on passive collectors. This method is cheap and easy to set-up but the efficiency of the collectors has to be evaluated. The cylindrical collectors with a diameter of 2 mm and characterized by a smooth and well-defined surface were the most suitable collectors for airborne drift. However, could exist differences in experimental data compared with theoretical assumptions. This discrepancy is related to the maximum values of efficiency which could be influenced by the phenomena of drop adhesion to the collector line. This paper describes a simple test in wind tunnel to estimate collection efficiency in PVC lines, spraying a mixture of tracer dye and surfactant under diverse conditions of wind speed, lines separation and nozzle configuration.

Materials and methods

a. Wind tunnel

In this study the closed-return wind tunnel type Prandtl of Cemagref was used, which has a working section of 1,95 x 2,95 meter, equipped with 6 fans. The tests were carried out at two fan speeds: 400 and 800 rpm for a mean wind velocity of 3,5 and 6,8 m/s respectively.

b. Test description (cf. fig.1)

The nozzle was located 3 meters downwind inside the tunnel at a height of 1,5 m from the floor and in the central horizontal line (figure 1). The experiments were conducted with three nozzle configurations (A: VMD 255 µm; 0.99 l/min; B: VMD 198 µm; 0.73 l/min and C: VMD 146 µm; 0.68 l/min). A solution of 0,1% of tracer dye (fluorescein) and 0,1% of surfactant (Agral ®) was sprayed for 5 seconds to line collectors, placed at 3 m from the nozzle orifice release place. The PVC lines were placed horizontally across the wind direction. The separation between each line was of 300, 400 or 500 mm. Two turbulence configurations were used with wind section, "empty" and with an obstacle (box 2950 x 400 mm) 1.5 m before the nozzle. A total of 24 configurations were carried out with 3 replications of each one.



Fig.1 – Example of test configuration within the tunnel

c. Spray collection efficiency

The volume captured on each line was obtained from spectroscopic measurements. A surface extrapolation, obtained by the relation between tunnel section and influence surface of each line, gave an estimation of the captured flow rate, Q_t . The efficiency is then obtained by Q_t/Q_r , where Q_r stands for the flow rate at the output of the nozzle.

Results

It was observed that the only significant parameter that affects the collector efficiency was the wind velocity. For the standard spraying conditions, when the wind should be less than 3.5 m/s, the observed efficiency would be greater than 77%. The nozzle configuration did not generate differences in the capture efficiency.

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