

Flat fan or cone nozzles for spray distribution in orchards and vineyards? Effect of nozzle type and row distance on the vertical distribution

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INTRODUCTION

Vertical distribution matching the canopy distribution is one of the most important aspects for a good pesticide distribution over the three-dimensional crops. Historically, air assisted sprayers for orchard and vineyard pesticide application have been provided with hollow cone nozzles in order to guarantee a good coverage. However, vertical distribution obtained with hollow cone nozzles does not always follow the canopy distribution in a proper way.

The main objective of this research was to evaluate the effect of different nozzle's spray patterns on vertical distribution of liquid during spray application in orchards and vineyards. Additionally, several specific objectives were defined: a) determine the effect of droplet size of flat fan nozzles (conventional vs air injection) on the obtained spray pattern; b) determine the influence of every single nozzle on the sprayer on the total vertical distribution of liquid; and c) quantify the effect of the distance to the target on the vertical profile.

MATERIAL AND METHODS

Vertical distribution of the liquid was obtained using an AAMS vertical test bench (AAMS-Salvarani, Maldegem, Belgium). This test bench had a total height of 4.5 m and it was provided with 40 individual collectors placed at a uniform distance of 0.10 m. The amount of collected liquid at every single collector was recovered on 40 individuals graduated cylinders. The amount of liquid recovered on every single cylinder was determined by dedicated ultrasonic sensors placed on the head lecture unit, allowing to automatically storage the data.

A conventional mistblower sprayer Inverter Qi 9.0 Ecoteq (Pulverizadores Fede, S.A.) with 2000 L tank capacity and 900 mm diameter axial fan was used for all the trials. The sprayer was provided with 14 nozzle's seats (7 left + 7 right). Transmission power to the sprayer was provided by a Landini Rex 90F (90 CV).

Three different nozzle types were selected, including hollow cone nozzle (Albuz ATI 80-03), air injection flat fan nozzle (Lechler IDK 90-03) and conventional flat fan nozzle with 30° (Lechler series 652.402). The three selected nozzles were tested at 1.0 m, 2.5 m and 5 m distance from the vertical test bench. During the trials, weather data (temperature, relative humidity, wind speed and wind direction) were automatically collected using a WatchDog weather station model 250.

RESULTS

Results indicated a good adaptation of flat fan nozzles, especially the air injection one, for the uniform distribution over the entire canopy. Values of coefficient of variation generated by hollow cone nozzle, air injection flat fan nozzle and conventional flat fan nozzles for 1 m distance from the sprayer to the vertical test bench were 38.5%, 28.1% and 34.7%, respectively (Fig. 1).

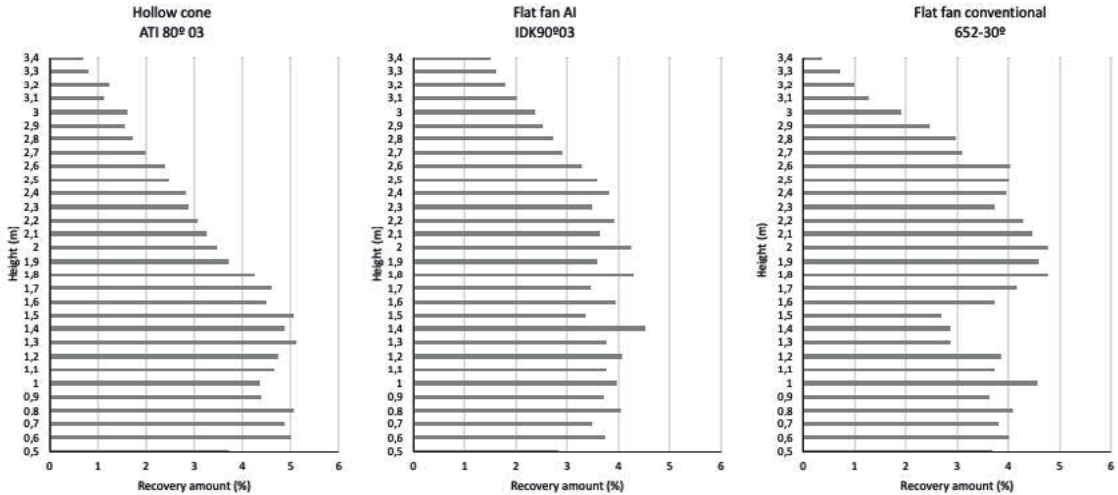


Fig. 1. Vertical distribution obtained with hollow cone nozzles (left), air injection flat fan nozzles (center) and conventional flat fan nozzles (right).