Influence of sprayer type, air settings and nozzle type on drift during spray application in vineyard. Effect of canopy density on spray retention

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INTRODUCTION

Sprayer types, as well as working parameters, have direct influence on the amount of spray retained on the canopy. This research was focused on the quantification of spray amount that exceeded the last canopy row during the spray application in a vineyard parcel.

LIDAR sensor was selected as alternative method for drift measurements, following the previous research (Gil et al., 2013). The objective of this research was to evaluate the effect of canopy characteristics on drift, by measuring the amount of liquid exceeding the last sprayed row, and compare the ground deposition out of the target area with the measurements obtained with LIDAR sensor.

MATERIALS AND METHODS

A conventional mistblower sprayer and a multi row sprayer were tested at 38.000 m^3/h and 7.000 m^3/h respectively, applying an average rate of 369-398 l/ha. Conventional hollow cone (ATR Albuz nozzles) and air injection nozzles (TVI Albuz nozzles) were used separately maintaining the same other working parameters (Table 1). Canopy characteristics of the complete nine last rows of the parcel were obtained using a LiDAR SICK LMS 200. Previous circulation on the field with the tractor equipped with LiDAR sensor allowed to obtain the canopy maps with detailed information about canopy density, canopy height, and canopy width along the row lines.

Table 1. Sprayers settings during the field trials

Sprayer	Air flow		Nozzle type (n°)	Pressure	Droplet	Application rate	
	$m \cdot s^{-1}$	$m^3 \cdot h^{-1}$		(bar)	size(1)	$L \cdot min^{-1(2)}$	$L \cdot ha^{-1}$
Master 2000	24.4	27,507	ATR yellow (10)	8.0	VF	0.92	369
		27,507	TVI 80015 (10)	8.0	C	0.98	393
Master 2000	31.1	34,959	ATR yellow (10)	8.0	VF	0.92	369
		34,959	TVI 80015 (10)	8.0	C	0.98	393
Iris-2	14.6	6,423	ATR orange (16)	8.0	VF	1.24	398

(1) According to BCPC classification (VF: Very Fine; C: Coarse); (2) Flow rate per single nozzle.

Spray amount of liquid exceeding the canopy was measured using two different methodologies: a) two ad hoc horizontal 10 m length drift test bench were placed horizontally to the last row line at 1.6 and 3.2 m respectively (half and entire row distance, respectively). Petri dishes were disposed over the bench at a distance of 0.5 m in between, in order to catch the amount of sprayer exceeding the canopy; b) LiDAR scan was also placed on the ground close to the drift test bench in order to measure/determine the amount of droplets exceeding the canopy. For this purpose, LiDAR laser beams were directed vertically in parallel to the canopy vegetation, with a range of frequency of 180º. Spray droplets density exceeding the canopy was measured for every field trial (Fig. 1).

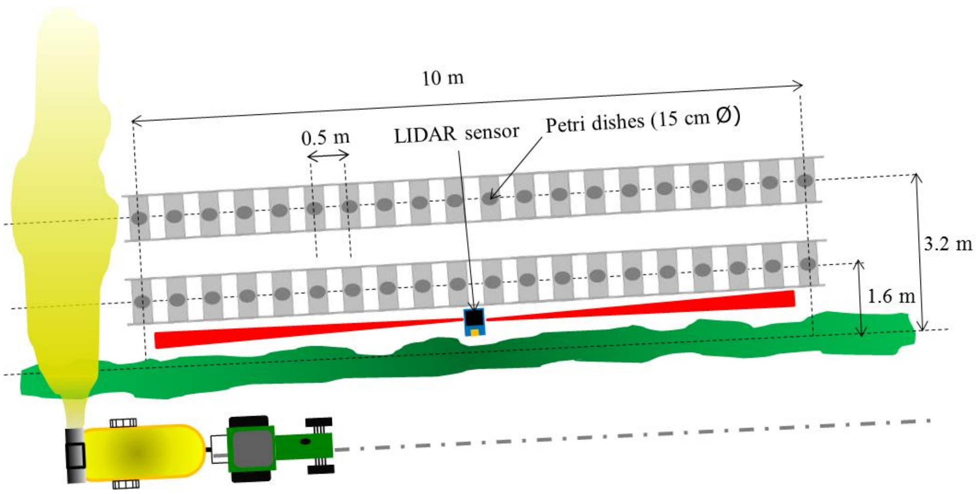

Figure 1. Layout of field trials for drift measurements

All treatments were performed using an IRIS multi-row sprayer (Ilemo-Hardi, S.A.U.) and a conventional mistblower sprayer (Talleres Corbins, S.A.). Spray tanks were filled up to its half capacity with pure water and a certain quantity of a commercial tracer (Tartrazine, E-102, SIGMA) in order to obtain a concentration of around 2 g/l. Deposition of tracer on petri dishes was analysed by spectrophotometry.

RESULTS AND DISCUSSION

Results indicated the great correlation between air settings, canopy density and drift exceeding the target. Values greater than 8,000 m^3/h gave the greatest spray losses away from the target. Also it was interesting to evaluate the positive effect of air injection nozzles on drift reduction. Alternative measurement procedures for drift measurement, as LiDAR sensor, seem interesting to be taken into account.

REFERENCES

Gil, E., Llorens, J., Llop, J., Fàbregas, X., Gallart, M. 2013. Use of a Terrestrial LIDAR Sensor for Drift Detection in Vineyard Spraying. Sensors, 13(1): 516-534