Drift reduction of low drift nozzles in spraying citrus orchards

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Introduction

Drift is especially critical when spraying fruit, vine and citrus orchards where pesticides are intensively used. In this context, cone low drift nozzles (LDN) intended for spraying tree crops, have been evaluated relating to cone standard nozzles (STN) in laboratory and deciduous fruit orchards (Van de Zande et al. 2012); (Planas et al., 2013).

In citrus orchards, it has been shown that drift depends on several variables like sprayer design and spraying volume (Salyani et al., 2013). But the potential benefits of the LDN are yet unknown. This is, probably, because citrus orchards are mainly located in regions where, for the time being, the use of LDN is just beginning. A set of field trials have been carried out to evaluate LDN (spray drift and efficacy) when spraying citrus. In this publication only the results on drift are reported. LDN have been also tested in insecticide applications for the control of California red scale (CRS) *(Aonidiella aurantii)*. Efficacy of the treatments is equivalent for STN and LDN. These results are reported in a complementary communication (Garcerá et al., 2015).

Materials and Methods

Trials were carried out in two orchards of Clementine cv. Clemenules (*Citrus clementina* Hort. ex Tan.), located respectively in Roquetes (Tarragona, Spain) and Montserrat (Valencia, Spain). Nozzles were fitted to air-blast sprayers (Figure 1). Five replications for each nozzle were conducted. Experimental conditions are reported in Table 1.

The percentage of volume of drops having a diameter smaller than 200 µm, V_{200}, was calculated by dimensioning droplet spectrum for each nozzle at the experimental work pressure by means of a Phase Doppler Particle Analyzer (57X10 Dantec Dynamics A/S. Skovlunde, Denmark).

Following ISO 22866 methodology, drift was measured for the LDN Albuz TVI 8003 vs. STN Albuz ATR 80 grey and vs. STN Teejet D3DC35.

Airborne spray deposition onto horizontal surface collectors placed outside of the treated area was measured and expressed as the percentage of the spraying volume. Moreover, drift reduction with each LDN tested was calculated.

Results and conclusions

Drift values were higher for both STN and LDN in Trial 1, which could be explained through the factors determining drift (Figure 2). In Trial 1, drift was favoured by the lower canopy volume (crop interception), counteracting the theoretical reduction effect on drift due to the lower fan air volume rate. This fact points out that, besides nozzles, these factors must be taken into account to prevent drift.

However, regardless the operating conditions, LDN significantly reduced drift in both trials (Figure 2). Drift reduction in each trial was 35.5% and 22.8%, respectively. In consequence, LDN can be clearly recommended in order to reduce spray drift in citrus orchards. Nevertheless, before its wide adoption, LDN should be progressively validated according to the efficacy of the treatments against the main pests and diseases of citrus.

		Trial 1 Roquetes		Trial 2 Monserrat	
Orchard	Tree spacing (m x m) (between rows x between trees)	6.00 x 4.00		5.00 x 3.50	
Canopy	Height (m)	2.85		2.75	
	Width along row (m)	2.80		2.90	
	Width crossing row (m)	2.50		3.70	
	Volume (ellipsoid) (m^3)	10.4		14.6	
	Volume occupied* (%)	15.2		30.3	
Sprayer	Operating nozzles (number)	20		16	
	Forward speed (km h^{-1})	2.02		1.58	
	Spraying volume rate (l ha^{-1})	2400		2600	
	Fan air volume rate (m^3 h^{-1})	29700		69700	
Nozzles	Type	Albuz TVI 8003 Blue	Albuz ATR 80 Grey	Albuz TVI 8003 Blue	Teejet D3DC35 Brown
	Work pressure (MPa)	1.3	1.5	1.0	1.0
Wind	Velocity (m s^{-1})	1.91 ± 0.46	2.17 ± 0.52	2.37 ± 0.85	2.72 ± 0.78
	Direction (º to spray track)	-20.22	-20.83	8.42	14.4

*volume of the canopy (ellipsoid) related to the orthogonal volume (tree spacing x canopy height).

Table 1. Experimental parameters and operating conditions

Figure 1. Operating sprayer on Trial 1

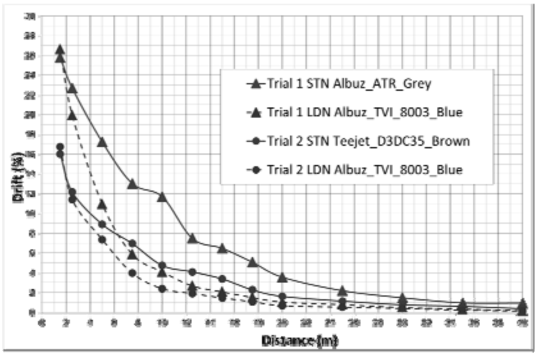

Figure 2. Sedimenting drift at each downwind distance from the last tree row

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