Section 3

Efficacy of standard and low drift nozzles for insecticide applications against Aonidiella aurantii (Maskell) in citrus

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Introduction

The use of low-drift nozzles (LDN) is the cheapest and easiest method to reduce drift. However, use of LDN may affect the efficacy of plant protection products for controlling targeted pests. Studies characterizing LDN efficacy in apples have been described (Heinkel et al., 2000; Frießleben, 2004; Lešnik, 2005; McArtney & Obermiller, 2008), but none have been published in citrus. This is significant because in contrast to apples, citrus trees have a globular shape and a very dense canopy. For these reasons, the aim of this work was to investigate the efficacy of insecticide applied using LDN or standard cone nozzles for the control of California red scale (CRS) (*Aonidiella aurantii* (Maskell) (Hemiptera: Diaspididae)) in citrus.

Materials and Methods

A season-long trial was conducted during 2014 on a commercial Clementine cv. Clemenules orchard, located in Valencia (Spain). Trees were planted at 6.5 x 3.5 m spacing and averaged 2.7 m in height, with a crown projection of 3.7 x 4.7 m. Three treatments, one with standard hollow cone nozzles TeeJet D6-DC23, another with LDN Albuz TVI 80 02 and a control treatment of no insecticide application, were performed. All applications were made at a volume rate of around 2500 l/ha. Treatments were applied by an axial fan air-assisted sprayer (model Futur 3000, Pulverizadores Fede S.A., Cheste, Spain) operating at 1 Mpa, 1.45 km/h, 490 rpm at PTO, and maximum air flow of 14.1 m^3/s. Treatments were applied three times during the season, when peaks of susceptible stages of each CRS generation were identified. In spring, a mixture of Reldan® E (Dow AgroSciences Ibérica S.A., Madrid, Spain) and Atominal® 10 EC (Sumimoto Chemical Co. Ltd., Tokyo, Japan) was applied; in summer Reldan® E was used straight, and in autumn a paraffinic oil (Agroil. Sipcam Inagra, S.A., Valencia, Spain). All products were used at the registered label rate.

The trial was performed in a randomized complete block design with four replicates. In each replicate, the 8 central trees were used as the sample trees, and the outer trees were used as a buffer between treatments. Treatments were assigned to four replicated plots based on densities of CRS at harvest time in the previous season (2013), so that there were no statistically significant differences in the initial infestation between treatments.

The biological efficacy of each treatment was evaluated by estimating the level of infestation 45 days after the treatment (DAT) against the first generation and the second generation and just prior to harvest. The level of infestation was obtained by counting the scales present in 30 fruits around the canopy of each sample tree (30*8= 240 fruits sampled per replication). The percentage of fruits with more than 10 scales was calculated. Fruits were selected from two heights (top and bottom) and five locations per height, corresponding to the four faces and the interior of the tree. The distribution of CRS infestation over the canopy at harvest time was studied.

Results

No statistical differences between treatments with standard and low-drift nozzles were found on the number of scales present on the fruit and on the percentage of infested fruits with more than 10 scales (Figure 1) in any of the samplings carried out. However, they differed significantly from the Control treatment in the second and third sampling. These differences increased with time showing a very fast CRS infestation over the control fruits.

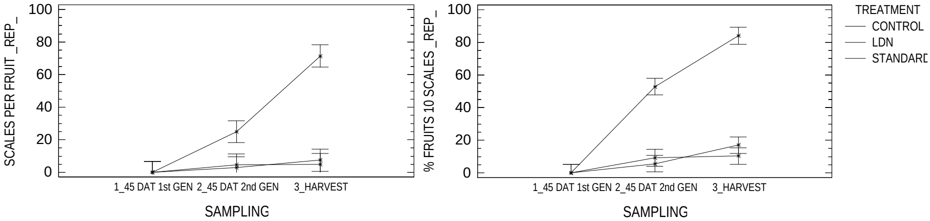

Figure 1. Number of scales/fruit (Left) and percentage of fruits with more than 10 scales (Right) for the Control, Standard and Low-drift treatments in each sampling. Mean ± 95% LSD interval. Means whose LSD Intervals do not overlap are significantly different.

At harvest, the distribution of the pest inside the canopy was similar for standard and low drift treatments but different from the Control treatment (Figure 2). Control treatment showed the highest infestation in the southern face of the trees, both in the top and the bottom of the canopy. The sides between trees within the row (East and West) showed the second highest infestation. Treatments with standard and low-drift nozzles achieved the higher reduction of infestation in the outer sides of the tree (between the rows), which faced the sprayer (North and South) (97%). In the centre of the canopy the reduction was 88% and in the sides between trees 90%. Comparing CRS distribution in height, it was observed that in the bottom of the canopy, infestation was the lowest, for any treatment, and this part of the canopy achieved the highest reductions of infestation with both nozzles (90% in the top vs 95% in the bottom).

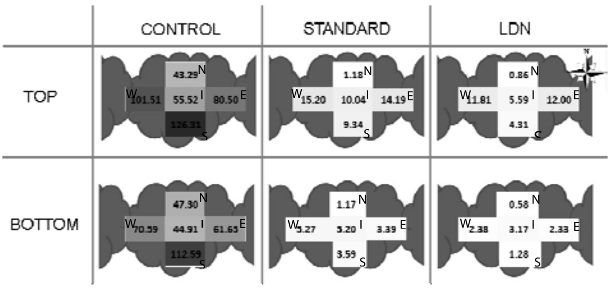

Figure 2. Cross section view of the distribution of the pest at two canopy heights (Top and bottom) for the Control, Standard and Low-drift treatments at harvest time number of scales/fruit. The intensity of red color indicates the level of infestation, the higher the intensity, the higher the infestation. N: North, S: South, E: East, W: West, I: Inner

This work concludes that low-drift air-injection nozzles are the solution to reduce drift when applying insecticides against CRS in citrus with no efficacy comprise.

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