Spray drift caused by a mast sprayer adapted to high trees

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Introduction

In high trees it is often difficult to reach the top of the tree when spraying plant protection products. Especially in crops with narrow tree rows and narrow tree spacing in the row and with dense leaf structures. Often high capacity axial fan sprayers are used to blow the fine mist of spray as far up as possible into the air, hopefully reaching the target in the top of the tree. In apple fruit growing, where dwarf trees are more common, often cross-flow fan sprayers are used to target the spray more towards the tree canopy. This concept is thought to be relevant also for high trees, like alley trees in nursery tree growing, but also relevant for other high crops with narrow row spacing and dense leaf structures. The development of a mast sprayer, a tower cross-flow sprayer for high trees (up to 6m), was systematically addressed in a stepwise approach. First step was to evaluate the spray distribution in a static and a dynamic situation (Van de Zande et al., 2007). The next step was the evaluation in the field, for biological efficacy and spray drift. In this paper it is reported what the effect of the mast sprayer is on spray drift, compared to a standard axial fan sprayer.

Methodology

The field measurements of spray drift were done comparing a reference standard sprayer used in high nursery trees and a developed prototype of a mast sprayer. The reference sprayer was a Dragone Athos axial fan sprayer, equipped with 6 hollow cone nozzles (TeeJet TXB 8003), operated at 8 bar spray pressure. With a speed of 4.2 km/h the reference sprayer applied 410-460 l/ha. The mast sprayer (van de Zande et al., 2007) was a prototype built on a Dragone Krümm axial fan sprayer, but with an extended cross-flow air duct with a height of 6 m, to be used in high nursery trees and other high and narrow row space crops. The mast sprayer was equipped with standard flat fan nozzles (TeeJet XR80015) and low-drift venturi flat fan nozzles (Lechler ID90015) of which 22-30 nozzles were used. Depending on the canopy height of the trees, both nozzle types were operated at 3 bar spray pressure. The speed of the mast sprayer during the drift experiments was around 4.0 km/h therefore applying around 540-750 l/ha (depending on row width). The effect of a 5 m spray-free buffer zone (outside 2 rows not sprayed) was also taken into account for both the sprayer setups. Measurements were performed in a nursery tree crop with a row spacing of 1.8-2.0 m. The tree size was around 6 m high with the canopy starting at around 1.6-2.0m, and tree spacing in the row of around 1 m. Tree species were plane, chestnut, lime, and maple. The leeward outside rows of the field were sprayed over a width of 20m, driving through every second path both sides were sprayed and the outside row only from the outside of the field inward. The spray drift measurements were made by spraying the fluorescent tracer Brilliant Sulpho Flavine (BSF) and measuring spray drift deposit on a bare soil surface strip next to the field to a distance up to 25 m from the last tree row. The collectors used were filter material cloths (Technofil TF-280) of 0.50 x 0.10 m in a continues line up to 10 m from the last tree row and of 1.00 x 0.10 m at points 15 m, 20 m and 25 m. At 10 m distance from the last tree row a 10 m high measuring mast was placed, with double lines of ball shaped collectors (Siebauer 00140) at 1 m interval, up to 10 m height. The drift measurements were repeated 10 times during the full leaf stage of the trees.

Results

The results of the spray drift measurements for the standard situation and the situation with a 5 m spray-free buffer zone are for the standard axial fan sprayer and the mast sprayer presented in Figure 1. The effect of standard flat fan and venturi flat fan nozzles are presented for the drift sedimentation to the soil surface next to a 6 m high nursery tree crop field.

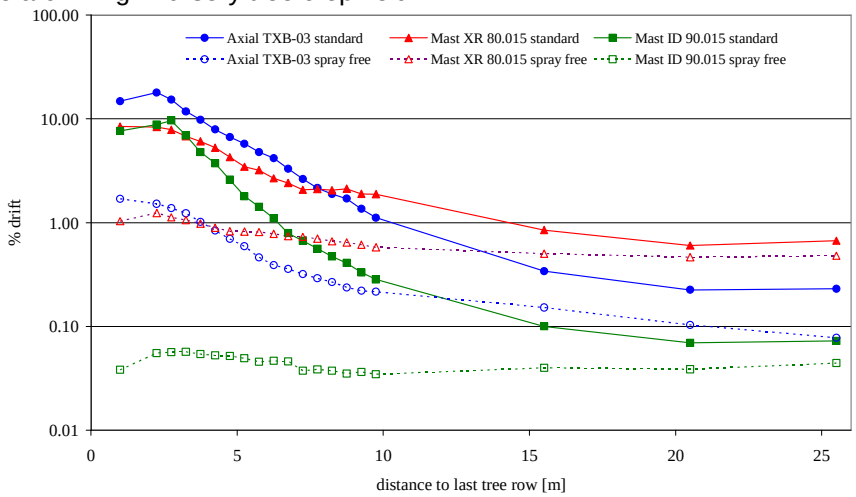

Figure 1. *Spray drift deposition on soil surface next to a nursery tree field when spraying with a standard axial fan sprayer equipped with hollow cone nozzles (TXB-03) and the mast sprayer equipped with standard flat fan (XR80015) and low-drift venturi flat fan (ID90015) nozzles in a standard situation and with a 5 m spray-free buffer zone*

The effect of a 5 m spray free buffer zone was obvious for all spray techniques; it reduced spray drift deposition at 5-9 m by 71% with mast sprayer XR110015 by 89% with axial fan sprayer TXB03 and by 96% with mast sprayer ID90015. In the standard situation the mast sprayer equipped with the standard flat fan nozzles reduced spray drift deposition at 5-9 m from the last tree row by 25% and when equipped with the venturi flat fan nozzles (ID90015) by 71%. The results showed that, despite the high output points of the spray on the mast sprayer, spraying sideways towards the trees canopy could reduce spray drift compared to that obtained when spray was blown into the air with an axial fan sprayer. However further optimization of the spray towards the tree canopy can be obtained by sensors detecting the green leaf area which is a point for further research and development.

References

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