Improving spray deposition and reducing spray drift in orchard spraying by multiple row sprayers

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Introduction

The evaluation of the latest data on spray drift in orchard spraying in the Netherlands, and measurements of surface water quality parameters show that the current legislation and measures are insufficient to protect the surface water. This can also have implications for the approval of pesticides in fruit growing. To meet the national and European objectives regarding surface water quality also a reduction of chemical input is required.

New strategies have to be developed to retain chemicals for crop protection and a clean environment. Latest developments showed great perspectives for multiple row orchard sprayers. The use of these types of sprayers has increased dramatically in the Netherlands in the recent years. This is predominantly because they require less time to spray an area, and therefore timeliness is higher and anticipation to weather conditions and disease development is better.

It is proven that multiple row sprayers reduce spray drift significantly. This is due to the spraying system that sprays tree rows from both sides at the same time, in contrast to standard orchard sprayers that spray the tree row only from one side. It is assumed that spray depositions are improved when spraying with multiple row sprayers and dose can therefore be reduced accordingly, without reducing biological efficacy. Further research therefore is necessary to assess spray deposition in the tree canopy.

The objective is to find the optimum combination of application parameters for the full leaf stage of apple trees in order to reduce spray drift while improving spray deposition.

Materials and Methods

Treatments

In this experiment different treatments were compared:

Reference sprayer (Munckhof)

1. standard – conventional cross-flow fan sprayer (Munckhof); Albuz ATR lilac at 7 bar spray pressure (Fine spray quality).
2. standard – conventional cross-flow fan sprayer; Albuz TVI 80015 at 7 bar spray pressure (Coarse spray quality - 90% drift reducing nozzle type).

Multiple row orchard sprayersMunckhof and KWH to spray two tree rows from both sides

1. Munckhof equipped with Albuz ATR Lilac nozzles.
2. Munckhof equipped with AlbuzTVI 80015 nozzles.
3. KWH equipped with Albuz ATR Lilac nozzles.

Also, for the multiple row orchard sprayers spray pressure was 7 bar. Measurements were performed during the full leaf stage of the apple trees. Air settings for the reference sprayer (Munckhof) were a high gear box setting and 540 rpm of the pto. The multiple row sprayers were tested at fan settings of 300, 460 and 540 rpm of the pto.

Spray deposition measurements and sampling procedure were carried out following the ISO22522 standard picking leaves from the different tree compartments and ground deposition. Apple trees were sprayed with a solution containing the fluorescent dye Brilliant Sulpho Flavine (BSF; 0,5-1 g/l) and a non-ionic surfactant (Agral; 7,5 ml/100 l).Spray volume was around 200 l/ha for the used spray techniques.

Figure 1. Munckhof 3-row sprayer (left) and KWH 3-row sprayer (right). Both sprayers were tested as 2-row sprayers spraying the tree rows alongside the sprayer from both sides.

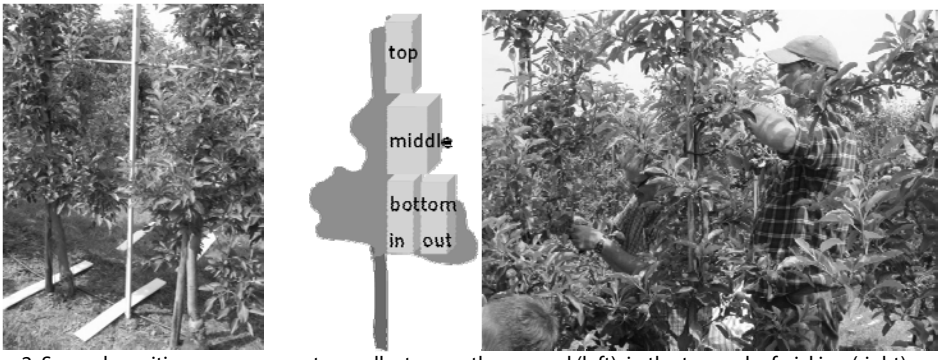

Figure 2. Spray deposition measurement on collectors on the ground (left), in the tree as leaf picking (right) following the sampling scheme (centre).

Four repetitions were made, i.e. spraying 30 m of a single tree row from both sides, and analysing leaves samples from four individual trees. Leaf samples were taken by counting all leaves in seven tree sections: Top, Middle East side, Middle West side Bottom Inside West, Bottom Outside West, Bottom Inside East, Bottom Outside East and putting every 10th leaf in a bag. The picked leaves were analysed in the laboratory for spray deposition of the sprayed fluorescent tracer BSF. The leaf areas were determined, and the spray deposition was calculated.

Results

General conclusions and discussions from these experiments are:

- On all sprayers the coarse spray quality nozzles (TVI) increased spray deposition above the standard fine spray quality ATR nozzles.
- Spray deposition varied depending on nozzle spray quality and fan setting.
- Highest spray deposition for the Munckhof two row sprayer was obtained at 460 rpm (pto) with the ATR nozzles and at 540 rpm (pto) with the TVI nozzles.
- Highest spray deposition of the KWH two row sprayer was obtained at 400 rpm (pto) which was about 25% higher than the standard sprayer with ATR nozzles and higher than the standard sprayer with TVI nozzles.

Acknowledgements

The project was funded by the Dutch Horticultural Board (Productschap Tuinbouw).