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Nozzle classification for drift reduction in orchard spraying; implementation in regulation

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Introduction

In fruit crop spraying spray drift is still high compared to field crop spraying. Searched is for cheap and effective solutions that are easy to use for growers. Drift reducing nozzles is an option but no classification system for use on orchard sprayers is available. A system was setup based on laboratory measurements of drop sizes and spray drift measurements in the field to verify expected drift reduction. The system consists of classes of 50%, 75%, 90% and 95% drift reduction compared to a reference situation.

Methodology

Based on earlier spray drift measurements a relation between spray drift deposition and the volume fraction drops smaller than 100 µm (V_{100}) was found. In the laboratory a selection of nozzles used in fruit crop spraying was measured for drop sizes in the spray fan. The nozzles were ranked on percentage of V100 and nozzles were identified with potential spray drift reduction of 50%, 75%, 90% and 95% compared to the reference nozzle: Albuz ATR Lilac at 7 bar spray pressure (Fig. 1).
With those identified threshold nozzles and the reference nozzle spray drift measurements were done spraying an orchard in the dormant situation (before 1st May) and in the full leaf situation (after 1st May). Sprayer used was a Munckhof cross-flow fan sprayer. In the dormant situation air settings of the sprayer were low and no air and in the full leaf situation low and full air.
Spray drift deposition was measured up till 25 m downwind on soil surface outside the orchard. Spray drift to the air at 7.5 m distance from the last tree row up to 10 m height.

Results

Field measurements of spray drift in the dormant situation of the orchard spraying without the use of air assistance on the sprayer showed that spray drift deposition next to the orchard can be decreased using the identified drift reduction class threshold nozzles (Fig. 2).

Figure 1. Threshold nozzles for drift reduction classes 50%, 75%, 90% and 95%.

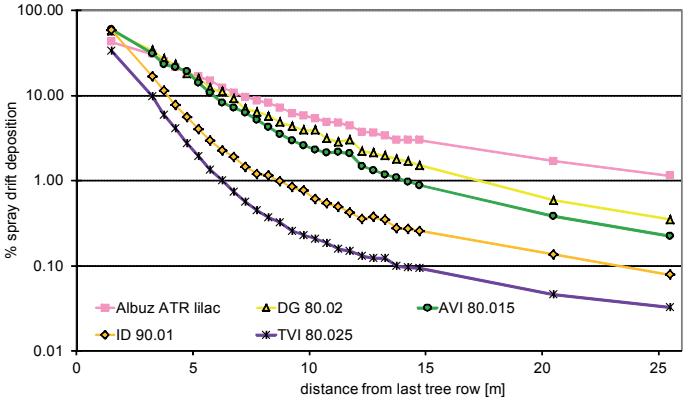

Figure 2. Spray drift deposition in dormant situation, no air assistance.

With the use of air assistance the spray passes through the tree canopy and spray drift reduction starts from 8 m onward. Evaluated at 10.5-11.5 m from the last tree row drift reduction was 64%, 72%, 90% and 91% for the threshold nozzles compare to the Albuz ATR lilac nozzle.
Introducing one-sided spraying of the last tree row showed that for a standard growing situation of fruit crops in the Netherlands with a crop-free buffer zone the drift reduction at surface water (4.5-5.5 m from last tree row) was 77% for the Albuz AVI80015 (75 class threshold) and 91% for the Albuz TVI80025 (95 threshold nozzle). With a 4.5 m crop-free buffer zone drift reduction at surface water (6-7 m) was 81% and 95% for respectively the AVI80015 and TVI80025 nozzles.

Conclusions

Based on the laboratory measurements of drop size and the results of the spray drift field measurements about 30 nozzle types can be classified and are offered for certification as drift reducing nozzle types in the indicated classes 50%, 75%, 90% and 95% drift reduction (Table 1).
The drift reducing effect of the threshold nozzles was effective from 8 m with two-sided spraying and from 3 m from the last tree row with one-sided spraying of the last tree row.
In the full leaf situation drift reduction class nozzles up to 90% drift reduction can be used in combination with one-sided spraying of the outside tree row with the use of 3 m crop-free buffer zones. With 4.5 m and wider crop-free buffer zones also the 95% drift reduction class can be used.

Table 1. Nozzles used in orchard spraying classified in drift reduction classes (50%, 75%, 90%, 95%) based on the volume fraction of drops smaller than 100 um in the spray fan.

50%		75%			90%		95%	
nozzle	press (bar)	nozzle	press (bar)		nozzle	press (bar)	nozzle	press (bar)
BCPC M/C	2	Lechler ID90015	7	TeeJet AI6503	7	Lechler IDK9001	2	Albuz TVI80025	7
TeeJet DG8002	7	BCPC VC/XC	2	TeeJet AI80015	7	Lechler IDK90015	2		
		Lechler ID9001	7	TeeJet AI8002	7	Lechler IDK9002	2		
		Lechler IDK90015	5	Lechler IDK9001	7	Albuz TVI8003	7		
		TeeJet AI80025	7	BCPC C/VC	2.5	Albuz TVI8001	7		
		Lechler IDK9002	5	Lechler IDK90015	7	Albuz TVI80015	7		
		TeeJet AI8003	7	Lechler IDK9002	7	Lechler ID9001	5		
				Albuz AVI80015	7				

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