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Welcome to the symposium

This 14th Workshop on Spray Application in Fruit Growing offers the floor for presenting the scientific results and for discussing the societal context of the application of plant protection products in orchards and vineyards. As science evolves by open minded discussions and by exchanging results and opinions, we hope to offer you in this workshop an optimal scene for fruitful discussions.

The principal organiser of this conference is the Research Station for Fruit npo, mostly abbreviated as 'pcfruit npo'. Pcfruit was started in 1997 as a coordinating structure of three former research institutes and demonstration gardens, all specialized in fruit growing and located in Sint-Truiden, the heart of the fruit growing area of Belgium. The oldest of these comprising institutes was founded in 1943. Pcfruit is recognized as a reliable, neutral and science-based partner active in various domains of fruit growing. Pcfruit covers applied scientific research, demonstration activities to growers, co-development programs with various kinds of industries and services for fruit growers. All these activities are centralized at one central location with suitable infrastructure like labs, greenhouses, storage facilities, plastic tunnels, shelters, warehouses and orchards. High level of specialism and understanding of the fruit practices have over time been developed in areas as crop protection, biological control, IPM, plant nutrition, application technology, variety evaluation, precision agriculture.

Co-organizers of the 14th Workshop are the University of Louvain with a Faculty of Bio-engineering and ILVO, the Flemish Institute for Agricultural and Fisheries Research, which both have a specialised research team working on spray application technology.

The Workshop is taking place in the former prison of Hasselt, which serves now as the faculty of Law of the University of Hasselt. Hasselt is the capital of the Belgian province of Limburg, of which the south offers the most suitable soil and climate for fruit production. More than 50% of the Belgian fruit is growing in this area. Hasselt is a relatively small city of about 80.000 inhabitants. Today Hasselt traditionally welcomes a lot of short stay tourists and shoppers.

Inge Moors
Deputy of the Province of Limburg for Agriculture
Chairman of pcfruit

www.pcfruit.be
www.ilvo.be
http://www.biw.kuleuven.be/m2s/biosyst/mebios
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Picture: pcfruit vzw

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Program

Tuesday May 9th, 2017	
16:30-18:30	Registration Hasselt University - Aula Louis Roppe Martelarenlaan 42, 3500 Hasselt
19:00-20:00	Welcome reception at the Gouverneurshuis of Hasselt (we walk (+/- 15 min) together from the registration desk)

Wednesday May 10th, 2017	
Opening Session	Hasselt University - Aula Louis Roppe Martelarenlaan 42, 3500 Hasselt
08:00-09:00	Registration
09:00-10:00	Welcome to the Symposium

Oral Session 1 : Pesticide dosing			**Wed May 10**
Time	**Oral Abstract Number**	**Title**	**Presenter**
10:00-10:20	1	Harmonization of pesticide dose expression is a key to dose adjustment	Doruchowski, Grzegorz
10:20-10:40	2	Towards a new model of dose expression in viticulture: Presentation of an experimental approach based on deposition measurement to test the relevance of different scenarios	Codis, Sébastien
10:40-11:00		Coffee and snack break	
11:00-11:20	3	Pesticide dose in persimmon orchards: Bases for its adjustments	Chueca, Patricia
11:20-11:40	4	Adjusting spay volume rates to the canopy vigour from aerial images in a vineyard	Román, Carla
11:40-12:00	5	Effect of formulation and spray application characteristics on the biological efficacy of a contact fungicide	Bakache, Adel
12:00-13:30		Lunch	

Oral Session 2 : Spray coverage			**Wed May 10**
Time	**Oral Abstract Number**	**Title**	**Presenter**
13:30-13:50	6	Spray deposition and distribution of a cross-flow fan orchard sprayer in spindle apple trees	Michielsen, Jean-Marie
13:50-14:10	7	First results of a campaign for the optimization of spray patterns of orchard sprayers by a moving test bench	Claes, Ruben
14:10-14:30	8	Improving spray deposition in orchard spraying by a Munckhof multiple row sprayer	Wenneker, Marcel
14:30-14:50	9	Basic experimental investigations of different influencing parameters on the quality of the vertical distribution of sprayers	Pelzer, Tanja
14:50-15:10		Coffee and snack break	
15:10-15:30	10	PulvArbo: a French project to improve spray application in fruit growing	Verpont, Florence
15:30-15:50	11	Sprayer classification in viticulture according to their performance in terms of deposition and dose rate reduction potential	Vergès, Adrien
15:50-16:10	12	Spray deposits from a recycling tunnel sprayer in vineyard; effects of the forward speed and the nozzle type	Carra, Mathilde
16:10-16:30	13	Leaf surface topography affecting the dynamic impact behaviour of spray droplets	Delele, Mulugeta Admasu
16:30-16:50	14	Assessment of aerial spray deposition on banana crop based on flight conditions	Cotteux, Eric

Oral Session 3 : Air support of sprayers for three dimensional crops - Part 1			**Wed May 10**
Time	**Oral Abstract Number**	**Title**	**Presenter**
16:50-17:10	15	Lidar vs. test bench for measurement of drift as affected by sprayer type, air flow, nozzle type and density of vine canopy	Gil, Emilio
17:10-17:30	16	Characterization of the air-flow and liquid distribution of orchard sprayers	van de Zande, Jan

Thursday May 11th, 2017	
Field day	
08:00	Departure in Hasselt by bus Kattegatstraat 1, Hasselt (in front of the Holiday Inn Hotel)
09:00-12:00	Visit Proefcentrum Fruitteelt, SintTruiden
12:00-13:30	Lunch at Proefcentrum Fruitteelt, Sint-Truiden
13:30-18:30	Visit BAB Bamps, Sint-Truiden Orchard visit, Wamoss bvba, Hakendover Vineyard visit, Kluisberg, Assent
19:30-22:30	Symposium dinner at Holiday Inn, Kattegatstraat 1, Hasselt

Oral Session 3 : Air support of sprayers for three dimensional crops - Part 2			**Fri May 12**
Time	**Oral Abstract Number**	**Title**	**Presenter**
08:30-08:50	17	2D CFD simulations of the air profile of three sprayers adapted to tomato crops in greenhouse conditions	Salcedo, Ramón
08:50-09:10	18	Adjustment of vertical spray pattern of orchard sprayers with Ve.S.Pa. 2.0 application	Tamagnone, Mario

Oral Session 4 : Spray drift / Spray loses			**Fri May 12**
Time	**Oral Abstract Number**	**Title**	**Presenter**
09:10-09:30	19	Potential spray drift evaluation of airblast sprayers	Grella, Marco
09:30-09:50	20	Spray drift of a cross-flow fan sprayer with wind-dependent variable air assistance	Stallinga, Hein
09:50-10:10	21	First assessments of spray drift in poplar plantations	Marucco, Paolo
10:10-10:30		Coffee and snack break	
10:30-10:50	22	Increasing droplet size in pneumatic cannon-type nozzles to reduce spray drift	Miranda-Fuentes, Antonio
10:50-11:10	23	Spray quality, droplet velocity and spray drift potential of sprays sprayed with additives through standard and venturi nozzles	Rodrigues da Cunha, João Paulo
11:10-11:30	24	Development of a National Spray Application Work Group	Hoheisel, Gwen-Alyn
11:30-11:50	25	Perceptions on how to reduce the risk of Plant Protection Products (PPP) losses to water in fruit production. Results from the European TOPPS stakeholder survey 2016	Roettele, Manfred
12:00-13:30		Lunch	

Oral Session 5 : New technologies on spray applications			**Fri May 12**
Time	**Oral Abstract Number**	**Title**	**Presenter**
13:30-13:50	26	Measuring canopy density in orchards and vineyards	Landers, Andrew
13:50-14:10	27	Crop characterization by Lidar sensor in different French orchards: preliminary results at early stages	Douzals, Jean-Paul
14:10-14:30	28	Variable rate orchard sprayer based on Lidar sensor	Xiongkui, He

14:30-14:50	29	ICT platform for fruit growing sector in Belgium	Ruysen, Kris
14:50-15:10	30	Field testing and monitoring of newly designed airblast sprayers in traditional olive orchards	Miranda-Fuentes, Antonio
15:10-15:30		Coffee and snack break	
15:30-15:50	31	Optimization of the fogging application of biological control organisms in fruit cold stores	Dekeyser, Donald
15:50-16:10	32	How to stimulate the installation and use of on farm bioremediation systems to avoid point pollution?	Koopmans, Kim
16:10-16:30	33	The electronic measurement of spray coverage	Landers, Andrew
16:30-16:50	34	CFD modelling of spray applications in cool rooms	Delele, Mulugeta Admasu
16:50		End of Symposium	

Saturday May 13th, 2017	
Werktuigendagen SOLV Tuinbouwschool, Diestersteenweg 146, Sint-Truiden	
09:30	Departure in Hasselt by car Kattegatstraat 1, Hasselt (in front of the Holiday Inn Hotel)
10:00-18:00	Visit Open Field Fair for Fruit Growing Equipment (Werktuigendagen), Sint-Truiden

Oral Session 2
Spraycover

Session Chairs: Paolo Balsari & Marcel Wenneker

Oral Abstract 6
Spray deposition and distribution of a cross-flow fan orchard sprayer in spindle apple trees

J.M.G.P. Michielsen, H. Stallinga, P. van Velde, P. van Dalfsen, M. Wenneker & J.C. van de Zande

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INTRODUCTION

To improve the current practice of spray application in fruit crops a research programme was setup assessing spray and liquid distribution of nowadays often used single- and multiple-row orchard sprayers and spray deposition and distribution in orchard trees. Potential pathways of improvement are; air amount, air distribution, nozzle type and therefore liquid distribution as the spray is transported by the moving air into the tree canopy. Improved spray deposition can lead to reduced use of agrochemical and therefor reduced emission to the environment while maintaining high levels of spray drift reduction and biological efficacy. In this paper results are presented for a single row cross-flow fan sprayer.

MATERIALS AND METHODS

Spray deposition measurements were performed in an apple orchard (Randwijk, The Netherlands) to quantify the effect of a reference cross-flow fan orchard sprayer (Munckhof) in a full leaf situation (June-October 2016). Apple trees (Elstar) are of the spindle type spaced at 1 m in the row and at 3 m row spacing. The sprayer was equipped with standard hollow cone nozzles (Albuz ATR lilac) and a 90% drift reducing venturi hollow cone nozzle (Albuz TVI8001) both operated at 7 bar spray pressure and a forward speed of 6.7 km/h. Eight nozzles were used on both sides of the sprayer resulting in a spray volume of resp. 200 l/ha and 290 l/ha. Air setting during the experiments was in the high or low setting of the fan gear box. To measure the spray deposition in the apple tree a single row was sprayed with a fluorescent tracer (BSF 0.3 g/l) from both sides spraying consecutively from the left and right hand side of the sprayer (same driving direction). To sample the spray distribution the tree was divided in 7 compartments: top, middle-east, middle-west, bottom-east-outside, bottom-east-inside, bottom-west-outside and bottom-west-inside. From four trees the leaves in each compartment were counted and every tenth leaf was picked and put in a sample bag. Number of leaves per compartment were recorded and in the laboratory 10 leaves were taken from the sample and washed with a fixed amount of deionised water to recollect the tracer from the leaf surface. The surface area of the individual leaves was measured (Li-cor). Tracer amount in the solution was measured using a fluorimeter (Perkin-Elmer LS50) and expressed as µl/cm^2 and % of applied spray volume per tree compartment and for the whole tree. Specific parameters as mean, median, CV of leaf samples per compartment of 40 leaves, CV per compartment in the tree and CV between mean total deposition in the trees can be presented.

RESULTS AND DISCUSSION

The average liquid and air speed distribution at the left and right hand side of the crossflow fan sprayer is presented in figure 1 for the full air fan setting and the Albuz ATR lilac nozzles (7 bar). Liquid distribution over height is different for both sides and not similar. Air

speed distribution is also not similar on the left and right hand side and shows a gap at 2-3 m height.

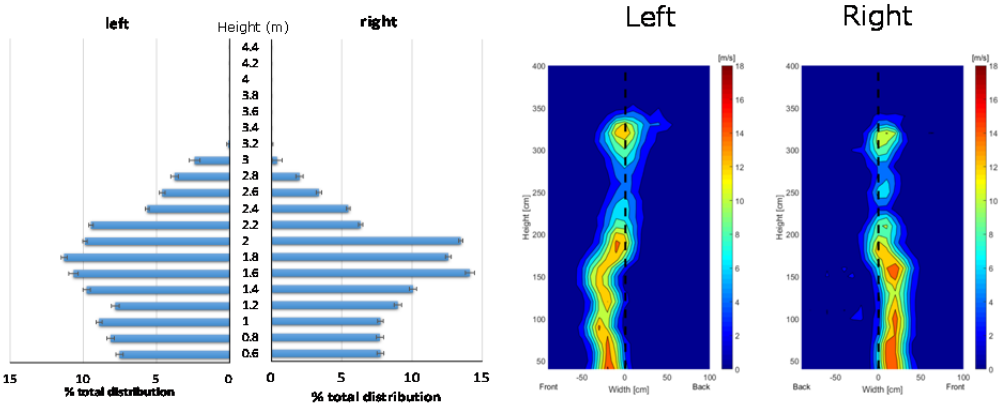

Figure 1. Liquid (left; % of total spray volume) and air speed (right; m/s) distribution over height (m) at 1.5 m distance from the centre line of the sprayer of the left and right hand side of the cross-flow fan sprayer (Munckhof ATRlilac@7 bar; full air).

The result of the liquid and air distribution (fig. 1) is the input for the measured spray deposition in tree canopy of an apple orchard. As an example the results of June 9th 2016 (fig. 2) are given for the Munckhof ATR lilac (7 bar) at full air setting presented as the average spray deposition per compartment of the four sampled trees (10 leaves per compartment). Spray deposition was between 0.45 µL/cm^2 in the top of the tree and 0.20 µL/cm^2 in the bottom-inside compartment of the tree. Average spray deposition for all compartments of the four trees was 0.31 µL/cm^2 with a coefficient of variation (CV) between the 4 trees of 7%. Variation in spray deposition between the compartments of the four trees varied between 7% in the top of the tree and 26% in the bottom inside part of the tree. Within a compartment the variation between spray deposition at individual leaves was large. CV for the 40 leaves per compartment picked was between 39% in the bottom outside compartment to 79% in the top of the tree. Spread in spray deposition in the top of the tree was between 0.06 and 1.49 µL/cm^2, which is a 25-fold difference. On average only 30-40% of applied spray volume was traced back in tree canopy.

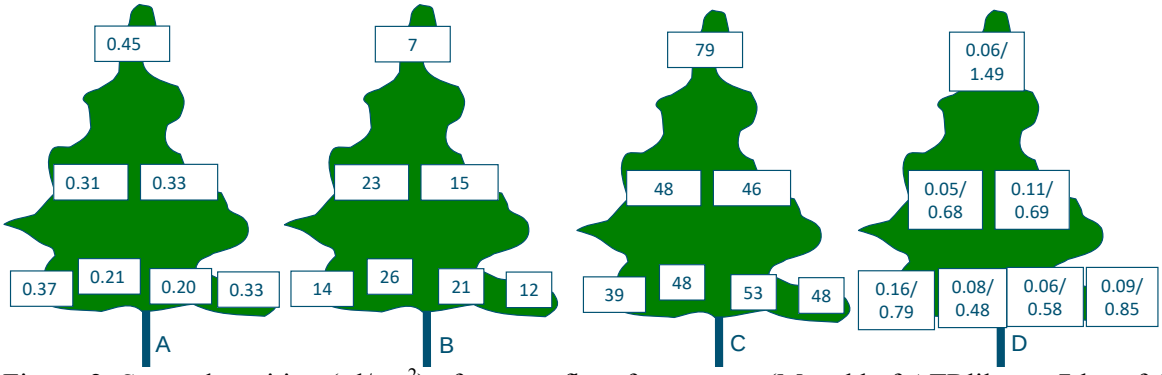

Figure 2. Spray deposition (µl/cm^2) of a cross-flow fan sprayer (Munckhof ATRlilac at 7 bar; full air) in full leaf apple tree (9 June 2016); distribution in compartments (A), coefficient of variation per compartment of 4 trees (B), coefficient of variation inside a compartment (C) and min/max per compartment of 4 trees (D).