Section 5

Technical performance of fogging applications of biological control organisms in fruit cold storage rooms

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Introduction

In the control of storage diseases of pome fruit, several methods are available for the fruit grower. The available pre- and post-harvest treatments, however, all have their limitations. Biological control of storage diseases using biological control organisms (BCOs) may provide a safer and more environmental friendly alternative. The objective of this work was to develop an appropriate application technique using cold fogging devices. The results will also be used as input for computational fluid dynamics (CFD) models to investigate the interaction between storage room, equipment and BCOs.

Materials and Methods

Characteristics and performances of the machines were measured. Four commercially available cold fogging devices were tested using different settings as presented in Table 1.

Table 1. Selected fogging application techniques.

Brand	Type	Air support	Settings
Veugen	Coldfogger	compressed air	3.5 bar
Arend-Sosef	Cyclomatic	turbine	
Swingtec	Fontan Starlet	turbine	LV nozzle 74
			LV no nozzle
			ULV nozzle 74
Veugen	Turbofogger	turbine	nozzle 1.0
			nozzle 2.0

The produced spray plume of each fogger was fully characterised by measuring droplet sizes, droplet velocities and spray angle using a PDPA laser at distances of 0.10, 0.30 and 0.50 m from the outlet opening. At the same distances, the air flow velocities, produced by the devices, were measured using a 1D hotwire anemometer. Liquid flow rate was determined by measuring the weight difference of the solution in the tank before and after spraying. The spraying was for a predefined duration.

Secondly, the performance of the foggers in terms of spray distribution and deposition was measured in a cold storage room loaded with 33 bins filled with apples. Nine bins were sampled, 3 layers (top, middle and bottom) per bin. In each sampling layer, three filter-paper wrapped apple fruits were placed. Mineral chelates were applied as tracer liquid.

Results

The measuring results reflect important differences in spray characteristics between the different techniques. Figure 1 for example, shows the droplet size distributions, measured at 0.50 m from the nozzle for the different application techniques.

The relation between application technique and sample position was investigated in the cold storage room. Figure 2 shows the effect of application technique on average spray deposition on the apple fruit surfaces in the 9 sampled bins. In general, foggers producing a finer droplet spectrum, resulted in a higher deposition on the fruits than devices producing a coarser spray plume. However, devices producing a similar droplet size showed also different deposition levels, suggesting that other factors than droplet size are also important.

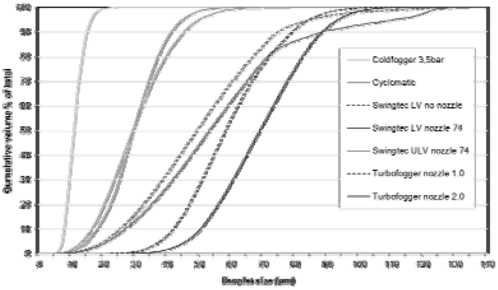

Figure 1. Cumulative volumetric droplet size distribution of the four foggers and different settings used. Measured at 0.50 m from the nozzle outlet.

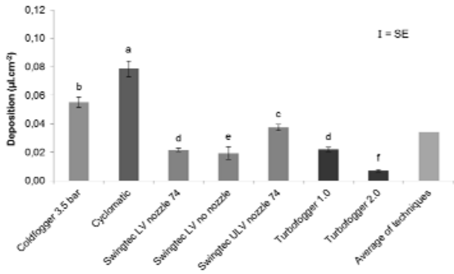

Figure 2. Spray deposition on the apples for the 7 spray techniques. Average of the 9 sampled bins. Letters denote statistical differences.