Fixed spraying system: a future potential way to apply pesticides in an apple orchard?

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Introduction

The traditional use of airblast sprayers to apply pesticides in fruit growing creates a vast cloud of spray with a variable proportion that reaches the target. The result is often more or less poor distribution within the canopy leading to more or less effective disease or insect control, off-target drift leading to environmental pollution and economic inefficiency. The application of pesticides by a Solid-Set Canopy Delivery System could have several advantages, such as: the short application time, the application of the product at the most appropriate time, the economics in labor and fuel, the reduction of soil compaction, the minimal drift and also the quieter operation. In 2012, a fixed spraying system was installed in an apple orchard at the Technical Institute for fruits and vegetables (Ctifl – Centre technique interprofessionnel des fruits et légumes). This abstract presents the main results obtained in 2013 and 2014 on biological efficacy of this technique on the major pests and diseases of apples compared to conventional nozzles and also the results obtained on the quality application in our trial conditions.

Material and methods

The experiment is carried out in a Brookfield®Baigent/Pajam1 orchard with a planting distance of 4 m × 1.25 m planted in 2004/2005. Micro-sprinklers are installed above the canopy, one sprinkler per tree (2000 micro-sprinklers/ha). This type of sprinkler (SUPERNET™ from NETAFIM) maintains a constant flow rate on a pressure range from 1.7 to 4.5 bar. After different control tests, the selected model delivered in our trial condition 35,5 l/h. To obtain an application volume of 400 l/ha they were turned on for 20 seconds. A check valve is installed on each sprinkler to allow filling and rinsing the pipes at a low pressure. The injection of the product is done via a pump, DOSATRON®.

The first objective was to study the effectiveness of this technique on pests (rosy apple aphid, mites) and diseases, especially apple scab, compared to a conventional application with an airblast sprayer equipped with conventional nozzles. The choice was made to use conventional products. The applications are all carried out on a basis of 400 litres / ha, whether with the airblast sprayer or a fixed overhead system, under the same conditions (same day, same hour). The assessments are made, in each case, on 3 replicates of10 trees (30 trees for each application technique).

The second objective was to study the quality of application using two approaches: the quantification of deposits into different areas of the canopy, made under the existing normalized methodology ISO 22522 (use of a food tracer and artificial collectors placed at different levels in the canopy), and the evaluation of the coverage using water sensitive cards.

Biological efficacy: first results

In our climatic conditions, scab is the main disease. In 2013, scab pressure was very high: 99% of shoots and 98.5% of fruits affected in the untreated block (control). In 2014, the scab pressure was lower with 24% of shoots and 11% of fruit affected at harvest in the untreated block. Results are very promising with a fixed spraying plot providing scab control equivalent (no significantly differences) to an airblast sprayer plot (Table 1). At the harvest in august 2013, 3% of fruits had scab damages in the airblast and fixed spraying system against 98.5% in the untreated block.

	2013 (assessment of July 31)			2014 (assesment of July 23)		
	Untreated	Airblast sprayer	Fixed spraying system	Untreated	Airblast sprayer	Fixed spraying system
% scab damage on shoots	99,0	0,3	0,3	23,9	0,3	0,3
% scab damage on fruits	98,3	0,8	2,2	10,5	0,2	0,2

Table 1: Average % scab damage on shoots and fruits at the last assessment before harvest in 2013 and 2014.

Spray quality: first results

Figure 2 presents the comparison of the results of the spray deposit quantification obtained in the fixed spraying system plot and in the airblast sprayer plot (trials carried out after harvest in autumn 2013). And Figure 3 presents the coverage obtained with water sensitive cards (left: airblast sprayer, right: fixed spraying system).

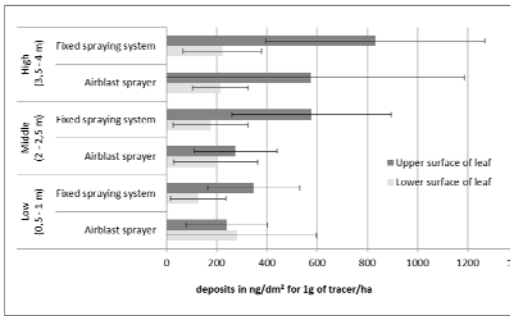

Figure 2: deposit quantification

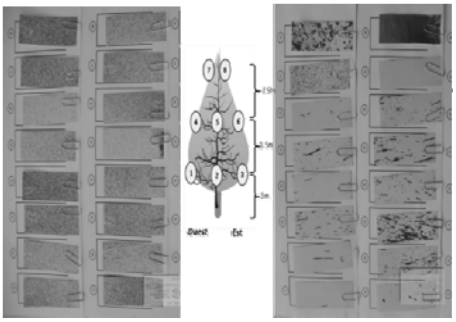

Figure 3 : spray coverage (left : airblast sprayer, right : fixed spraying system)

The results show a very strong variability on average deposits of product regardless of the technique: conventional spray, or the fixed system. Deposits on the upper leaf surface are more important than on the lower leaf surface whatever the application technique: the ratio between upper and lower surface ranges between 1 and 3.8.Finally, the fixed spraying system improves the deposits, especially in the middle and the top of the canopy. Concerning the coverage, the impacts obtained with micro-sprinklers are very heterogeneous and coarse. If we stick to the accepted reference, we could say that the distribution of droplets is not satisfactory. However, quantitative measurements of deposits show that fewer and coarser impact don't mean that there is less active substance per leaf area unit. The fact that the measured efficiency does not match the qualitative ranking reference observed on water sensitive cards leads us to question the relevance of this assessment method for this application technique. It is possible that in addition to the big impacts, there are also small impacts that, even if they do not lead to discoloration of the paper, may have a biological effectiveness.

A lot of future research…

The efficacy results obtained in 2013 and 2014 with the fixed spraying system are very encouraging, even though the quality of application is far from the generally accepted references in terms of recovery of vegetation and type of drops (size and distribution). This application system has been the subject of several demonstrations during field days in 2014. In view of the interest of producers, it is now necessary to optimize the system and to quantify the advantages of this technique using environmental, technical and economic indicators.

References

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