

Development of a software for supporting the adjustment of vertical spray pattern of air-assisted sprayers

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Introduction

One of the key aspects related to an appropriate adjustment of sprayers for pesticide application in orchard is the correct choice of the vertical spray profile, which should always be adapted to the geometric characteristics of the target. Nevertheless the research of the most appropriate spray profile is normally an empiric activity, based on the registration, using ad hoc vertical patternators, of the different spray patterns that one can obtain from a sprayer modifying different operating parameters (e.g. number and position of active nozzles, liquid flow rate, orientation of spray jets, amount and direction of the air flow, etc.). This operation requires time and usually does not allow to examine all possible sprayer adjustment options, but just some of them.

Objective of the present work was therefore to build a software tool enabling to rapidly foresee the geometry of vertical spray profiles generated by any type of sprayer just on the basis of some information about the operating parameters adopted (number and position of active nozzles, flow rate, air flow amount and orientation, etc.).

Methodology of work

The software was developed on a web platform using the PHP5.0 language. It is possible to access the software from the web page of DiSAFA – Crop Protection laboratory.

The tool consists of two main databases: one concerns the information about the sprayer, the second one contains the data referred to the spray profile generated by the nozzles. About the sprayer, the position of each single nozzle (expressed in Cartesian coordinates having their origin on the ground in correspondence of the center of the sprayer, with transverse X axis and vertical Y axis), the air velocity and the air direction measured in proximity of the nozzle (positive numbers for the air addressed upwards and negative numbers for the air addressed downwards) were considered. Concerning the spray profile, for each nozzle the data related to the spray profile measured on a horizontal test bench at 0.50 MPa pressure, expressed in ml/degree, were stored in the database.

The software user selects the sprayer type, then provides the size characteristics of the vineyard/orchard to apply (e.g. inter-row distance, minimum and maximum height of the vegetation, eventual transverse slope of the rows). The software draws a graphical representation of the system sprayer/orchard (or sprayer/vineyard) with a set of boxes to be filled in with the active nozzles and with the operating parameters (pressure and forward speed). For each box related to nozzles it is possible to select from a list the type and size of the nozzle to be mounted on the sprayer, if nothing is selected it means that the nozzle is not active.

At the end of the selection of active nozzles and operating parameters the software user press the button “process” and it appears the spray profile overlapped to the scheme of the trees with the calculation of the corresponding volume rate.

The user may repeat several attempts until when he obtains a spray vertical profile adequate to his needs.

After this simulation it is necessary to check directly on the sprayer conveniently setup that the real spray profile corresponds to the intended one.

At the moment it is not possible the web update of the database.

Results and discussion

To validate the diagrams resulting from the calculation tool a comparison was made with the corresponding spray profile really measured using an air-assisted sprayer and a vertical patternator. Thanks to the assessment of an Index of Similarity (IS), ranging from 0 to 100, it was possible to state if the diagram virtually obtained was similar or not to the one measured at the test bench.

Results were good (IS always higher than 60) and therefore a user friendly software was realised. It could be used by farmers and technicians to easily foresee the vertical spray distribution profile obtained from an air-assisted sprayer in function of the operative parameters selected.

The software will be available in several languages.