Evaluation on savings of plant protection product (PPP) due to optimized gap detection and switching system

T. Pelzer[1], J. Huhs[2], J.-P. Ralfs[2], C. Kämpfer[1]

[1] Julius Kühn-Institut (JKI), Institut für Anwendungstechnik im Pflanzenschutz, Messeweg 11/12, 38104 Braunschweig, at@jki.bund.de
[2]ESTEBURG - Obstbauzentrum Jork, Moorende 53, 21635 Jork, zentrale@esteburg.de

The application of plant protection products (PPP) with sprayers in vertical crops is usually conducted with active air support. The air-assistance implies that the droplets are transported by the air onto the target the leaf/canopy area. In case of gaps in the canopy or missing trees there is no target area in place and therefore the PPP can spread out unwanted into the ecosystem. A good assistance system is the automated nozzle switch off (f. e. by installation of a sensor system) followed by gap detection. Especially in regions with a high population density and/or surface waters these technical devices can ensure a proper application of PPP. One aim of this project is to determine the resulting savings of PPP due to the use of such equipment, as this is an important fact for the grower to buy it. In addition, the approval authorities favor the development of innovative technologies which further protect the environment.

In the project LADUS, funded by the innovation program of the German Federal Institute for Agriculture and Nutrition (BLE), a sprayer (NH 63) with a radial fan was equipped with new optical infrared sensors. Currently, sensor equipped sprayers typically run with axial fans and a limited amount of sensors and therefore are subjected to limitations. The radial fan with air tubes supplies a rather horizontal air stream which corresponds well to the sensor´s field of view. In the project, also the number of sensors was increased and the optical scanning improved. By the optimized sensor system, target surfaces and gaps can be detected more precisely compared to available products (at the market). Consequently, the associated nozzles can be switched as required for the application to reduce the amount of applied PPP. Especially in the leafless stages commercial sensor systems with high sensitivity detect the next row of trees, while at low sensitivity thin branches at close range are mostly not detected. With the new sensors, however, individual leafless thin branches can be reliably detected without scanning into next row. As a result, the gap detection in the canopy is more accurate.

In spring 2014,trials according to the JKI Directive 2-3.1 (April 2013) were carried out in Jork ("Altes Land"), to determine PPP savings. The PPP saving is strongly influenced by the computer-controlled switching operations (on/off) of the nozzles. The experiments were performed with a software-controlled switch-on (SON) and switch-off (SOF) of 0 cm. By spraying the target exactly [- 0 cm; + 0 cm],the application is sharp-edged/precise with high accuracy. Moreover, in a second set of trials both switching operations were shifted[- 20 cm; + 20 cm] to illustrate a treatment with an advanced safety. This set-up is usually used with equipment with f. e. Eco-Reflex under practical conditions. These two different sets of trials were conducted in different development stages of an orchard (dense foliage stock; plant with smaller gaps; younger plants).

Tab. 1: Saved amount of PPP [%] by the use of the gap detection and switching of the LADUS- system

	PPP saving* (SON and SOF[- 0 cm; + 0 cm])	**PPP saving*** (SON and SOF[- 20 cm; + 20 cm])
Dense foliage stocks	41%	0%
Orchard with small gaps	48%	2%
Young plants	69%	30%

*Saving is calculated in relation to a treatment without gap detection and switching system

As expected, these experiments (Tab. 1)demonstrated that the PPP saving depended on the density of foliage. In young plants with sharp-edged application [- 0 cm; + 0 cm], a saving of almost 70% could be achieved. Compared to the strategy of advanced safety application[- 20 cm; + 20 cm], the savings could be increased significantly.

Our goal is to develop a product with a market maturity for new sprayers and for retrofitting of sprayers in use. Therefore, the equipment has to be extremely reliable and robust as well as affordable.

Acknowledgements

This research was founded by the German Federal Institute for Agriculture and Nutrition and carried out by the Institute for Application Techniques in Plant Protection and the Research and Extension Centre for Fruit Growing.