Infrared sensors for gap detection in orchards – possibilities and limits

Verena Overbeck[1], Johannes Günther[2], Jens Karl Wegener[1] and Tanja Pelzer[1]
[1] Julius Kühn Institute, Institute for Application Techniques in Plant Protection, Braunschweig
[2] Technische Universität Braunschweig, Institute of Mobile Machines and Commercial Vehicles, Braunschweig
E-mail of corresponding author: verena.overbeck@julius-kuehn.de

In agriculture, the use of modern sensor technology becomes popular to detect pathogens and diseases, water and nutrient status of plants and to improve the precision of use of plant protection products (PPP). In the three-year project OLSVA, different sprayers were equipped with infrared sensors for gap detection to adapt the application of PPP on heterogeneous orchards. The heterogeneity is determined by different age of the trees, growth of the tree crown during vegetation, pruning and natural gaps.

During the project term, first results of the gap detection spraying system showed that the quality of leaf coverage was worse compared to conventional spraying. Furthermore, more pathogens could be found in gap area and the top the trees. The first infrared sensors (IRS01), which were used, had detection faults by driving speeds >6 km/h and this could be an explanation of the results. Therefore, a second generation of sensors (IRS02) were developed and used. These sensors had a better detection quality at higher driving speeds. Generally, it is not clear, which parameters (colour, size) of the object the sensors detect but it`s necessary in order to improve the sensor system.

Main focus of the study was on the evaluation of the detection performance of different infrared sensors and the suitability to detect gaps in orchards. Therefore, measurements were done under laboratory conditions to find out which influence driving speed, colour of the object, the distance to the object and sleeves against sunlight on the detection quality had. Especially for IRS01, results showed that faults in detection occurred by increasing distances between sensor and the object and increasing driving speeds. Results of IRS02 were constant during all measured driving speeds and distances. Sleeves against sunlight increased the noise floor of the sensors but did not influence the object detection during driving. The summarized assessment of the results showed that IRS02 is suitable for a gap detection. The biggest disadvantage is the fact that the sensors can´t collect some information about the tree crown volume which could be used for application models depending on the amount of leaves in the different areas of the tree crown.