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THE USE OF ULTRASONIC SENSORS FOR PRECISE SPRAYING TREES IN ORCHARDS

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SUMMARY

Research is carried out to adjust the dose of liquid to the shape and volume of the crown. Research works are conducted on equipping the equipment for applying plant protection agents with devices for detecting the target objects of application and their shapes and dimensions, i.e. ultrasonic sensors.

INTRODUCTION

In conventional orchard spraying, the same application rate is applied evenly over the entire row of trees. This application rate is optimal for the central part of the crown, in the outermost parts of the tree the spray volume is excessive. In addition, the liquid is also sprayed into the spaces between the trees, which causes loss of the agent and pollution of the environment. One of the solutions used in orchards to reduce soil contamination and to apply pesticides more effectively is the use of ultrasonic sensors in spraying systems. This technology enables precise application of plant protection products on trees without spraying the space between them. Because orchards are characterized by a uniform spatial arrangement of trees, the use of ultrasonic sensors allows to adjust the dose to the detected presence of trees [3,4].

Research is being conducted on a system based on electronic control of a conventional hydropneumatic sprayer system (with air support) designed for pesticide application in relation to the volume of leaves located directly before the sprayer. By measuring the distance between the rows of trees and the crowns, it was possible to estimate the instantaneous number of leaves directly in front of the nozzles. The measurement of leaf distance using an ultrasonic sensor made it possible to determine the tree gap when the measured value of the distance exceeded a certain threshold [1,2,3,4,5].

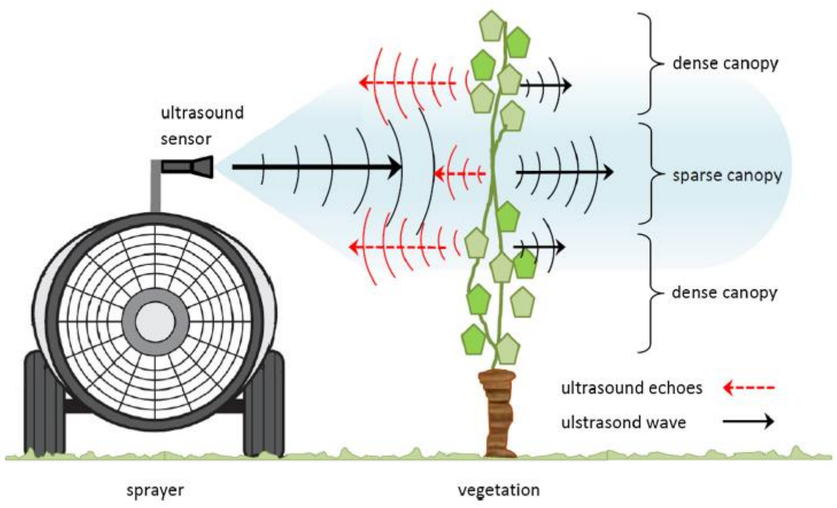

Fig. 1. Diagram of ultrasound sensors operation on a orchard sprayer [5]

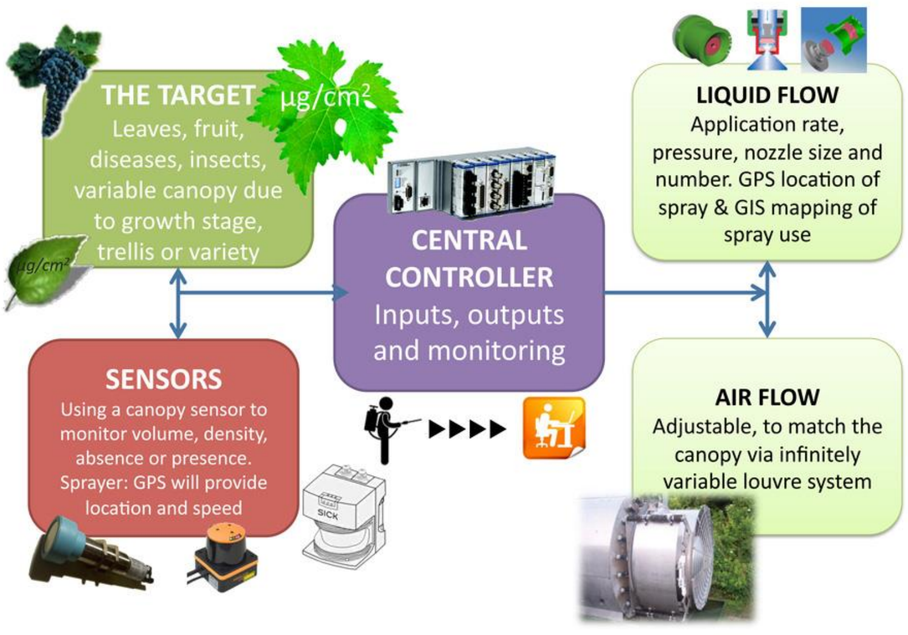

Fig. 2. Diagram of the fully automatic precision orchard sprayer [5]

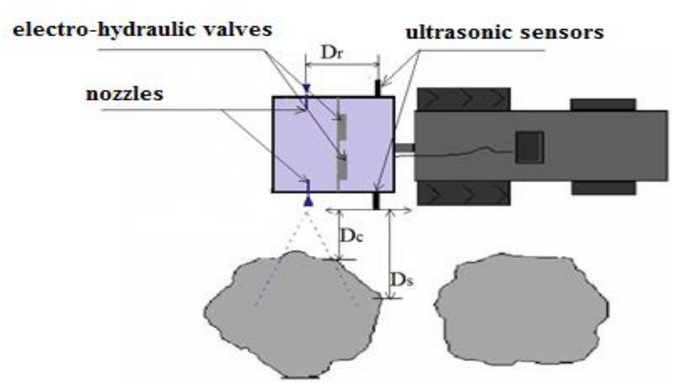

Fig. 3. Installation diagram of the components on the field sprayer: Dc - distance from ultrasonic sensor to tree where there is high pressure of liquid in the installation; Ds - distance from ultrasonic sensor where there is low pressure of liquid in the installation; Dr – distance from ultrasonic sensor to nozzles [4]

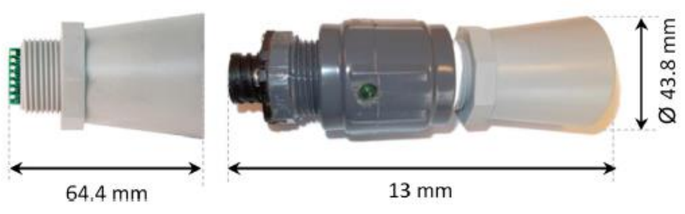

Fig. 4. XL-MaxSonar MB7092 ultrasound sensor plus protection waterproof case [1]

CONCLUSION

Application of a precise dose of pesticides based on the detection of a protected object becomes a direction of development of plant protection techniques in horticulture for economic, ecological and occupational safety reasons. The main technologies of detecting objects, which are the subject of research in modern horticulture, is the use of ultrasound sensors. The ultrasonic sensors are mounted and configured for an accurate reading of vegetation in fruit trees. The proposed technologies can be used as complementary tools to improve the efficiency of the use of plant protection agents. Work is still needed to refine the systems for greater precision. The most important factor determining the usefulness of these systems is the adjustment of the working fluid flow rate to the variations in tree crown parameters using ultrasonic sensors [1,2,5].

All the described technologies ensure satisfactory effectiveness of action in protection of fruit trees and vineyards with significantly reduced use of chemical agent and reduced droplet drift, so that they do not cause as much pollution of the environment as conventional methods.

LITERATURE

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