8TH WORKSHOP ON SURFACE ENGINEERING

02.06.2019 to 08.06.2019, Koszalin University of Technology, Poland

METHODS FOR MEASURING THE QUALITY OF SPRAYING ON TREES IN ORCHARDS

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SUMMARY

Examples of methods of testing the deposition of the sprayed plant protection product on the surface of leaves of fruit trees are presented. The main methods of measuring spray quality are samplers attached to the leaves. The evaluation of the droplet coverage is performed by computer image analysis.

INTRODUCTION

Methods of proceeding in the technique of plant protection in orchards is the appropriate selection of equipment for spraying and its working parameters to the shape and size of crowns sprayed trees. Trees require an appropriate technique to perform treatments that will ensure that spray liquid is applied evenly throughout the entire volume of the crown and reduce losses of the plant protection product to a minimum. The best measure of spray quality in plant protection is biological evaluation. It is a laborious method, requiring several years of multi-repeat experiments. Therefore, the tests use only methods of measurement of technical quality indicators of spraying (application, number of drops per 1 cm^2, degree of coverage). Coverage assessment consists in determining the number of droplets per unit area of the probe and the degree of coverage, expressed as the ratio of the total area covered with the agent to the total surface subject to spraying. The most common methods used to measure the coverage are based on computer-assisted image analysis of droplets deposited on artificial samplers attached to leaves in the crown of the tree [2,3,5].

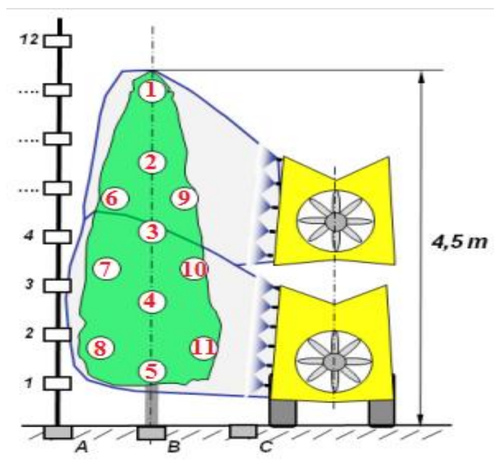

Fig. 1. Distribution of testers for measuring coating in a tree crown and losses of spray liquid [3,6]

Tab. 1. Summary of the applied samplers, markers and methods of analyzing the deposition of drops on the leaf surface

Method	Samplers	Marker	Method of analysis	Test material
Samplers placed on the leaves of the tree [2,3]	filter paper (Filtrak 132) 20 x 40 mm size	aqueous solution of fluorescein sodium ($C_{20}H_{10}O_5Na_2$) (SIGMA Chemical Co. – USA) concentration 0,04%,	digital fluorometer Sequoia Turner 450 (USA)	apple orchard Lobo/M26
Samplers placed on the leaves of the tree [1]	Ciba Geigy - Water Sensitive Paper® 26 x 50 mm size	water	computer image analysis kit (KAO) with Lukas software	apple orchard Lobo/M26
Samplers placed on the leaves of the tree [5]	water-sensitive paper cards WSPs Spraying System Co.35mm×55mm size	water	scanned into a digital image with a high pixel resolution (600 dpi×600 dpi), evaluated via DepositScan software	mandarins (*Citrus reticulata* Blanco ‘Shantanju’) grafted on the rootstock of *Citrus nobilis* Lour
Samplers placed on the leaves of the tree [4]	the targets made of white polyvinyl chloride and covered with a silicone coat	a 2,5% iron chelate solution	collectors were analysed using a machine vision system, images of the droplets were digitized using a scanner	orange orchard (variety Navelina)
Samplers placed on the leaves of the tree [7]	white pulp paper cards 76mm×50mm size	the spray solution 300 times Ponceau 2R (99.5% purity)	the image processing software named Image J	Tarocco blood orange (*Citrus sinensis* cv. Tarocco) grafted on Carrizo Citrange (*Citrus sinensis* × *Poncirus trifoliate*)

CONCLUSION

Determining the distribution of spray liquid in a plant canopy allows to obtain answers to the following questions: whether spray liquid has reached a specific place of crop, whether it is possible to obtain good leaf coverage, what is the quality of spray liquid reaching the tested place and whether there is drift outside the spray zone. The use of leaf-mounted samplers allows the analysis of droplet marks [1,2,3,]. The quality of the coverage is significantly affected by the recorded drop diameters. Droplet size is important for two basic reasons. The first is that there is a correlation between the droplet size and the effectiveness of the spray application in controlling a specific hazard or disease. The second reason is that fine droplets are more susceptible to drift, especially in windy weather. Methods based on computer-assisted image analysis of sampler images with droplet marks allow precise determination of the diameter of each drop, measurement of the surface area occupied by the droplets on the sampler, as well as the density of droplets - their quantity per unit area [4,5]. The advantage of using computer image analysis is also data archiving, which allows you to return to the data and make corrections or combine them with other data, which creates a wider range of possibilities. Many researchers point to this instrument of computer-visional evaluation and analysis as the area of engineering that is becoming the most promising branch of application science.

LITERATURE

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