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LOW-VOLUME SPRAYING OF THE VINEYARDS WITH UNMANNED AERIAL VEHICLE

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The control of diseases and pests in vineyards and forestry plantations is one of the main measures to ensure a high level of production. The successful application of control measures requires knowledge of both pests, pathogens, substances and the technical means used to carry out the control in practice. Reducing the consumption of insecticides, fungicides and herbicides is a major requirement imposed on modern sprayers and machines from the conception – design – manufacturing phase to the exploitation phase, diminishing the harmful impact of the technical system on the environment and achieving special economic indicators. In many countries, the trend towards using the latest technologies and moving to precision agriculture, sometimes called smart agriculture, is growing. For a long time, planes and helicopters intended for certain mandatory activities in plant-engaged branches (horticulture, forestry, etc.) have been used worldwide. Now, an increasingly important role is played by intelligent aerial drones (UAV, Unmanned Aerial Vehicle), or drones with a high degree of autonomy and accuracy.

Purpose. The aim of the research was to evaluate the effectiveness of low-volume spraying of the vineyards with the help of the Unmanned Aerial Vehicle (UAV), with the support of the Agri Assistant application.

Keywords: *spraying, unmanned aerial vehicle, grapes, plant protection*

Materials and Method. The researches were carried out during 2022, in the central area of the Republic of Moldova, in a typical vineyard, the experimental group of the Institute of Genetics, Physiology and Plant Protection. The shape of the stumps – bilateral horizontal cord on the high stem (1–1.2 m). Support – vertical trellis with 3 tiered wires in one size. Planting scheme 2.75 x 1.5 m. The agro technical phonic corresponds to the requirements of the normal development of the stumps. The white paper was placed at different levels of the crown of the stump, and between the rows of the plantation. The M6E-2 drone (Unmanned Aerial Vehicle) – unmanned aerial vehicle, is a hexacopter with six engines/propellers and six support arms, each arm being connected to an engine. The drone's flight can be controlled remotely with the help of a human pilot on the ground, or it is carried out autonomously with the help of special computers and programs. The spraying system consists of a tank with a volume of 10L, a pump and 4 nozzles with jets of droplets of different sizes. (60-180 μm).

Results: Basically, Agri Assistant allows route planning, programming and visualization of drone parameters. This is programmed on a well-established route, the application edits and changes the flight trajectory in real time, calculates the spray area of the solution. With the support of the Agri Assistant application, the mapping of the vineyard was carried out for the evaluation in terms of splash density, uniformity and coverage degree achieved by spraying a volume of solution.

Most of the sprayings carried out in horticultural plantations fall into the category of treatments with very high volume >600 l / ha and high volume – 150-600 l / ha. However, in certain cases, spraying with small amounts of solution – 5-50 l/ ha – can also be applied. When describing various spraying processes, droplets jets are distinguished both by flow rate and by the finesse of the spectrum resulting from dispersion. Between different types of spraying there are differences in the density of splashes, uniformity and degree of coverage achieved by sprinkling an equal volume of solution. The formed droplets do not have uniform dimensions. For the characterization of the droplet spectrum formed by a sprayer or nozzle, reference sizes such as the average volume diameter (MVD) are used, which is the limit against which half of the volume of the sprayed liquid consists of droplets with a diameter smaller or larger than the MVD. The unit of measurement for volume diameters (MVD) is μm (micron = 1/1000mm). Based on the average volume diameter, the spraying, respectively the spectra of the formed droplets, are classified: very coarse spraying – >500 μm, coarse spraying – 300-500 μm, medium spraying – 200-300 μm, fine spraying – 100-200 μm, very fine spraying < 100 μm. It is considered that in order to achieve a good biological effect, an average of 100 drops per^2 cm of sprayed subject should be provided.

The flight height of the drone was 4 meters from the ground, the flight speed – 5 m/s, the width of the spray – 3 meters. The drone's propellers created a vertical flow of air, thanks to which a fine spraying was made (100-200 μm), very small droplets (60 - 180 μm) very quickly were projected onto the foliar surface. At the same time, it was found that by spraying with low volume, the distribution of the solution on the foliar surface and the degree of coverage was achieved unevenly. Thus, the droplets with diameters below 100 μm, had their own very low displacement speed and their trajectories were influenced by the circulation of atmospheric air currents (wind). It is considered that to achieve a good biological effect, an average of 100 drops per^2 cm of sprayed subject should be provided. Given that with the evolution of the vegetation stage, the foliar mass of the crop is also increased, it follows that the quantities of liquid applied will also increase corresponding to the volume and surface of the treated foliar mass.

Conclusions. As a result of the research carried out, we can find that by spraying with low volume, the distribution of the solution on the foliar surface and the degree

of coverage was achieved unevenly. Thus, the droplets with diameters below 100 μm, had their own speed of travel very low and their trajectories were influenced by the circulation of atmospheric air currents.

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