Metrological and methodical support of evaluation of quality of spraying of fruit plantations

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Abstract. The crossing to intensive gardening development requires continuous improvement and deepening of sectoral and cross-sectoral specialization, development of innovative technologies and devices of mechanization in major technological processes. In the technological process of cultivating fruit stands, a special role is given to chemical methods of pest and disease control, which is realized by the use of various sprayers. To obtain high-quality fruit products, a significant amount of chemical means of protection is currently used due to the fact that 30 or more sprayings are carried out during one growing season. Bad spraying of plant protection products leads to environmental defilement. Therefore, the qualitative assessment of the technological and technical characteristics of the sprayer is an urgent problem.

1. Introduction

At the present time, environmental protection problems are becoming especially urgent in the development of sloping lands for fruit plantations use. So far, on the one hand, fruit crops are pesticide (intensive chemical protection is required), and on the other, specific features of mountain landscapes [1, 2].

Used in modern intensive horticulture technical means for chemical protection of fruit trees have low productivity, high consumption of chemicals and so forth. [3-8].

Therefore, it is necessary to improve the existing and develop innovative technologies of chemical protection of fruit plants and means for their implementation. In this regard, metrological and methodological support for assessing the quality characteristics of the sprayers also requires improvement.

2. The results of the study

To make the dimensional characteristics of liquid droplets is most effective immersion method based on capturing the liquid droplets with the use of the slide. Previously, the slide is covered with a liquid that has a lower density compared to sprayed.

As a working fluid, it is recommended to use an aqueous solution of writing ink, like "Rainbow (Raduga)".

The procedure for measuring droplets of a sprayed liquid using a microscope is as follows: The slide with the caught drops mounted on the microscope stage. Drops are measured continuously. From
150 to 200 drops are measured on each slide. Air pressure is taken equal to: 0.05; 0.1; 0.15; 0.2; 0.25 and 0.3 MPa. Water pressure 0.08 MPa. For study the quality of processing fruit stands, it is recommended to use coated white sheets of 50 × 70 mm in size (density 90 g / m² or more).

The method of fastening surfaces catching on the leaves of fruit plantations is shown in figure 1, their placement on the fruit tree can be found in figure 2. The experiments were repeated three times.

**Figure 1.** Attaching cards to the handle of the leaf.  
**Figure 2.** The layout of the registration cards on the fruit tree.

In order to establish high-quality spray performance offered private method [9]. The scanned TIFF image is processed according to the original computer program, which gives out qualitative spraying indicators - density and coverage area, distribution of liquid droplets in size intervals. Using this program provides a significant simplification and acceleration of the sprayer testing procedure and processing of results, improving the quality of sprayer efficiency assessment.

Before using this program, a capture surface is selected. In case of presence in it of various inclusions, stains and stains, such catching surface discarded. Next step is the software configure. In order to reduce errors in the process of establishing the number of liquid droplets, first they scan an unprocessed catching surface, the TIFF file is fixed on the computer’s hard drive and sensitivity is setting. The initial sensitivity is 202 units (“Auto tuning” is on). In the case of manual settings (“Auto tuning” is turned off), it is possible to change the brightness of the print.

After the processing, the capture surface is placed in the scanner, which digitizes the image stored in the computer memory as a single TIFF file. Then, the program performs determination dimensional characteristics of the liquid droplets and droplet distribution by size ranges builds frequency curve showing the percentage of total droplets contained in a specific range. I the end, the covering area is calculated by drops of the catching surface, and the area treated by the drops in the context of dimensional intervals is established.
To study the dispersion of the decay of liquid droplets during spraying, is recommended the developed laboratory setup (fig. 3), the process of which the next one:

The pneumatic-hydro-accumulator 2 is filled with water and by the booster system increase the pressure to the desired value. Water under the pressure is provided through a hydraulic hosepipe 4 to the valve 9. Turn on the compressor 1, forcing air through the pneumatic hosepipe 3 into the receiver 6, and then to the closed valve 8. When the pressure in the receiver 6 reaches the desired value, the valves 8 and 9 open at the same time. As a result, air and water are placed to the sprayer 7 through the hosepipes 3 and 4 and the spraying process begins.

To control the pressure of water and air are used the pressure gauges 5 with a division value of 0.6 and 1.0 MPa. A drop hook (fig. 4) is used to select the droplets.

![Figure 3. The developed laboratory setup: 1 – Compressor; 2 – Pneumatic-hydro-accumulator; 3 – Pneumatic hosepipe; 4 – Hydraulic hosepipe; 5 – Pressure gauges; 6 – Receiver; 7 – Sprayer; 8 – Air valve; 9 – Water valve.](image)

Calculation the number of droplets and the establishment of the droplet size produced microscope MBN-1. Process microphotography liquid droplets carried photomicrography MPP-1,2 together with a film camera, the film frame size 24x36 (fig. 5).

![Figure 4. A drop hook](image)  ![Figure 5. Microscope MBN-1.](image)
3. Conclusion
Proposed metrological and methodological support will provide reliable information on the technological and technical characteristics of sprayers to substantiate their effectiveness and sustainability.

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