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Laboratory Test Experience of Small Volume Fan Spray Triple Device

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Abstract – The article presents the results of theoretical research on the structure, operation and some technological parameters of the working section of the machine, which is intended for laboratory testing of small-volume fan sprayer triplet device.

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I. INTRODUCTION

The technological process of a certain part of a small-volume fan sprayer is carried out by pneumatic operation. In the working chamber of the fan, it provides air flow at a certain speed, conditionally corresponding to the operating mode of the spray composition, using a fan. In the steady-state operation of the sprayer, at a certain interval, the sprayed liquid is collected using a flow collector.

At the end of the work cycles, when the measuring cups are filled with liquid under laboratory conditions, the distribution of the liquid across the width of the spray flow of the ventilator is determined.

II. MATERIALS AND METHODS

Review of the results of theoretical research on the structure, operation and some technological parameters of the working section of the machine, intended for laboratory testing of small-volume fan sprayer triple device.

III. RESULTS AND THEIR ANALYSIS

Today, in the fight against plant diseases and pests, agricultural sprayers ONM-600, OP-200, OVX-600, OVX-28 and chemical processing machines according to the field processing process and taking into account their technical characteristics, the device reduces the air flow in the working chamber. The speed is set from 6 to 7 km / h (1.66 to 1.94 $m.s^{-1}$) relative to the leaf of the cotton plant.

Reducing the air flow rate from the working chamber at the back of the sprayed liquid stream is accomplished by injecting the exhaust air between them, using a grid housing device as in the case of the sprayer in real operating conditions.

The dimensions of the grille body, the diameter of the holes, their size and the size of the sheath are taken into account to ensure a decrease in the air flow rate behind the chamber from 1.66 to 1.94 m.s^{-1}. In this case, the total area of the grate body holes, for example, $S_{hole} = G_{air} / V_{med.air.hole}$ is 0.02 m in diameter or 10.5 m^2. When the distance between the centers of the holes is 0.03 m, the total area of the lattice body is 26.25 m^2. The radius and height of the lattice body is 0.5x1.0 m. The distance between the sheath and the grille body can be assumed to be 6 caliber of the body holes.

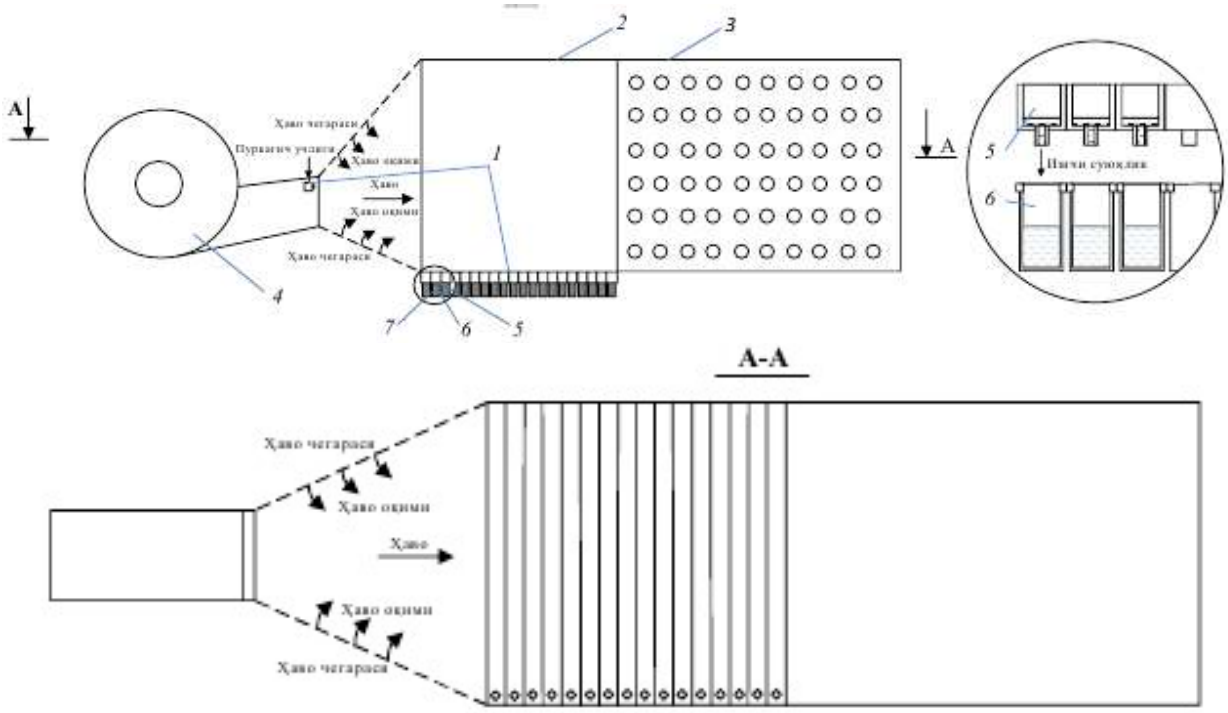

Figure 1. The scheme of the technological work process of the fan sprayer: 1 - spraying liquid collection device, 2 - working chamber, 3 - grid housing, 4 - fan, 5 - fan, 6 - cup, 7 - colicator.

The spray machine tester consists of a nozzle movement and a spray liquid collection device 1, a working chamber 2, a nozzle 5 with measuring cups 6 in its design, a grille housing 3, a fan 4, and a flat nozzle of the fan to create air flow.

The technological process of processing this device is carried out as follows. In the working chamber 2, the working height above its tarnov 5 is provided and adjusted to create the forward and reverse motion of the sprayers by means of the device 1. Using a fan 4 equipped with a flat nozzle, the working chamber 2 is supplied with air flow to model the mode of movement speed of the sprayer using the fan 4. The speed of the spraying working fluid at a distance x from the air flow path from the center of the fan is equal to the speed of the spraying machine. The airflow consumption in the fan nozzle G_{air}.s.m^3/s is calculated according to the following formula.

$$G_{air.c}=V_0*S_0, \quad (1)$$

here V_0 is the air velocity at the initial section of the fan nozzle, m/c

S_0 is the surface area of the initial section of the fan flat nozzle, m^2

The velocity of the air flow in the liquid flow axis in the area where the sprayer is located is determined by the formula V_{max}, m/s (equal to the speed of the spraying machine, m/s).

$$V_{max} = \frac{1{,}2\,V_0}{\sqrt{\frac{ax}{\delta_0}+0.41}} \quad (2)$$

here α is the structural coefficient taking into account the output section of the flow, α=0,09÷0,12;

$\delta_0$is half of a flat thread cut, m;

x is distance from the center of the sprayed working fluid fan to the air flow path, m

At a distance x from the air flow path from the center of the sprayed working fluid fan, the half-height of the liquid flow equal to half of the initial section of the working chamber 2 of the liquid sprayer is calculated according to the following formula $\delta_{gr,}$ m.

$$\delta_{gr} = \left(2{,}4 * \frac{ax}{\delta_0} + 1\right)\delta_0 \quad (3)$$

In (3), the value of the distance x from the airflow path of the sprayed working fluid fan center at a given design dimension of the working chamber 2 starting section in front of the sprayer sprayer is determined by the method of sequential approximation by giving the value δ_0.

In this case, the distance along the axis of the fan 4 fluid flow and the initial cross-sectional area of the fan 4 flat nozzle are determined. The air flow in the initial section of the nozzle, which describes the performance of the fan, is determined by multiplying the initial velocity of the flow by the surface of the nozzle.

$$G_{air.c}=V_{0*}\ (2\delta_0)^2 \quad (4)$$

here $(2\delta_0)^2$ is fan nozzle cross-sectional area, m^2

The relative consumption of air flow through the working section 2 of the working chamber mounted on the working chamber of the fan sprayer is calculated according to the following formula.

$$q_{nis} = \sqrt{\frac{ax}{\delta_0} + 0.41} \quad (5)$$

The air consumption in the spray area passing through the initial section of the working chamber 2 of the sprayer is $G_{air\ sprayer}$., m^3/s is the product of the ratio of the air consumption in the section of the fan nozzle to the product q_{ratio}.

$$G_{air\ sprayer} = G_{air.c*}\ q_{ratio} \quad (6)$$

In the correct operating mode and at a certain time interval mounted on the sprayer, the sprayed liquid is collected using the device 1. In the design of the working chamber 2, the measuring cups 5 are placed on the racks 6 to allow information on the transverse location of the air flow. At the end of the work cycle on the time of filling of measuring cups 5 with liquid droplets, the following is determined for each technological mode in the laboratory:

The surface on which the liquid droplets fall from the fan is S, cm^2

$$S=M*L \quad (7)$$

here M is distance between fan sprayer, cm;

L is moving distance of the sprayer per second in the operating mode of the fan sprayer, cm;

IV. Conclusion

This ventilated spraying device allows plant and food producers to obtain the necessary information about the rational technology of application of sprayers in comparison with known sprayers.

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