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DETERMINATION OF THE FLOW UNIFORMITY AT TARAL 200 PITON TURBO SPRAYING MACHINE FOR PEST AND DISEASE CONTROL IN VINEYARDS, USING TWO TYPES OF NOZZLES

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Abstract

Pest and disease control is one of the most important technological links; otherwise the losses can be very high. Chemical control is the main method used in plant protection and for carrying out this work using specialized machinery. Sprayers are equipped with different construction types of nozzles made of different materials resistant to corrosion hydroabrasive to plant protection products. But with all their strength, their spray hole is decalibreate. Thus, the chemical solution will not effectively combat the diseases and pest, consumption of pesticide will be high. The phytosanitary solution no longer reaches the plant pollute soil, residues having a negative impact on microorganisms. For this reason, it is recommended that before each campaign to combat pests and diseases, nozzles should be tested by measuring powder flow. To this end, on the sprayer for pest and disease control in vineyards TARAL 200 TURBO PITON were mounted two types of hydralic nozzles, one with full cone jet, and other with air absorption and flat fan jet. In this respect has been tested spraying machine, spraying the two ramps for different working pressures (0.2; 0.4; 0.6; 0.8; 1.0; 1.2 and 1.4 MPa). Thus, for one minute, the flow rate of each nozzle was collected in the receptacle and then measured with a graduated cylinder. After determining the flow uniformity was found that the nozzles have recorded over 95% uniformity.

***Key words**: full cone nozzle, flat fan nozzle with air absorption, spraying machine, TARAL 200 PITON TURBO.*

INTRODUCTION

Direct and indirect energy consumption for spray application treatments account for about 28-30% of annual consumption technology (Berca, 2001). Damage caused by diseases and pests among vineyards and orchards causing economic losses by reducing production both quantitatively and qualitatively (Toma et al., 1981).
If the pesticide treatments are not applied effectively and timely production suffers heavy losses or may even be completely destroyed.
For this reason, pest and disease control is a very important technological component, without which production would not be safe and constant year.
Pesticides are the most effective means to combat pests and diseases, and to maintain current yields (Arias-Estévez et al., 2008).
Pesticides are toxic, and non management technology lead to pollution of soil, water and vegetation. Thus, foods lose their flavor, it distorts the content in nutrients and can even traces of pesticide residues (Jităreanu et al., 2007).
Soil is the most important environmental factor, since it is a "living organism". Pesticide residues in soil changes its physical properties, chemical and biological, affects microorganisms, so do not delay its degradation to occur.
Sprayers for pest and disease control must ensure effective treatment with superior quality indices, work to prevent production losses, high consumption of pesticides and reduce environmental pollution (Nagy et al., 2007). To do this, the machines are equipped with different types of nozzles, made of various materials (stainless steel, brass, plastics, ceramics) hydroabrasion resistant to chemical pesticides. However, with time, their spray hole is decalibreate. This will encourage a greater flow spray and spray unevenly, leading to overtreated areas or to other

untreated with increased risks of soil pollution. For this reason, before each campaign zone, it is indicated that the nozzles to be tested by the determination of the flow spray them. In this context, machine spraying in vineyards TARAL 200 PITON TURBO was equipped with two construction types of nozzles which was determined by flow uniformity.

MATERIALS AND METHODS

In order to determine flow uniformity machine for pest and disease control in vineyards type TARAL 200 PITON TURBO, were mounted on the two ramps of its two construction types of hydraulic nozzles, one of the ceramic material with full cone jet, AMT 1.2 from ALBUZ and other plastic with flat fan jet and air absorption, IDK 120-02 from LECHLER (Figure 1).

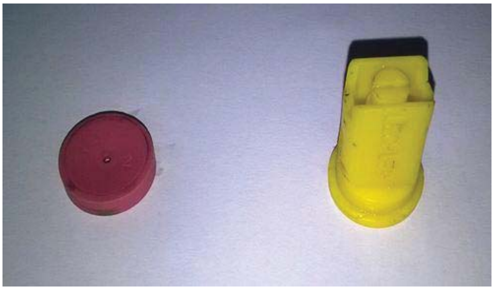

Figure 1. AMT 1,2 nozzle from ALBUZ (left) and IDK 120-02 nozzle from LECHLER (right)

Machine for pest and disease control PITON 200 TARAL TURBO presents the following parameters: tank capacity - 200 l, fan airflow - 7920 m³/h, maximum pump flow rate of 55 l/min, pump working pressure adjustable to 4.0 MPa, two ramps spraying with 4 nozzles each.
For experimental tests has been on idle tractor and PTO speed to asicron to 540/1000 rev/min.
Each flow spray nozzle spraying the two ramps was determined after installation of hoses at the end of each nozzles and collection solution (water) in containers (Figure 2).
The collected solution for one minute, was measured using a graduated cylinder, the working pressure of the spraying machine: 0.2; 0.4; 0.6; 0.8; 1.0; 1.2 and 1.4 MPa.

Figure 2. Collection of each nozzle spray solution on the two ramps spraying machine for pest and disease control in vineyards TARAL 200 PITON TURBO

After determining the flow rate of each nozzle spray (q_i) mounted on the two ramps spraying in three repetitions, average flow was debited liquid nozzle (q_m). The average flow rate of the liquid sprayed by each nozzle (q_m) was calculated with the following formula:

$$q_m = \frac{\sum_{i=1}^{i=n} q_i}{n} \text{ (l/min)},$$

in which:
q_i – spray rate of each nozzle;
n – number of determinations (repetitions).
According to FAO recommendations, the deviation from the average values must not be greater than ± 10%.
The uniformity of flow nozzle (C_d) for each type of nozzle and each pressure of the two ramps spraying was determined by the relationship:

$$C_d = \left[1 - \frac{\sqrt{\frac{\sum_{i=1}^{i=n} (q_i - q_m)^2}{n(n-1)}}}{q_m} \right] * 100 \text{ (\%)},$$

in which:

q_i – spray rate of each nozzle;

q_m – average flow liquid nozzles;

n – number of determinations (repetitions).

The uniformity of the fluid flow nozzle (C_d) should not exceed 95%.

RESULTS AND DISCUSSIONS

The uniformity of flow hydraulic nozzle with full cone jet was optimal for all 8 nozzles mounted sprayer TARAL 200 PITON TURBO and all working pressures, the lowest value being 99.44% for the nozzle 3, at pressure 0.2 MPa (Table 1).

Deviation of average flow nozzle on both ramps their mean was ± 10% for all pressures. The smallest deviation was obtained at pressure 1.4 MPa, is ± 2.98%.

Table 1. The uniformity of flow full cone jet nozzle, AMT 1.2 from ALBUZ

Pressure (MPa)	Right ramp				Left ramp				$\overline{X} \pm s_{\overline{X}}$ *
	Nr. nozzle	q_i (cm³/min)	q_m (cm³/min)	C_d (%)	Nr. nozzle	q_i (cm³/min)	q_m (cm³/min)	C_d (%)	
0.2	1	1236.66	1249.16	99.71	5	1256.66	1260.83	99.90	1255.00±5.00
	2	1240.00		99.78	6	1273.33		99.71	
	3	1273.33		99.44	7	1250.00		99.75	
	4	1246.66		99.94	8	1263.33		99.94	
0.4	1	1513.33	1521.66	99.84	5	1520.00	1532.50	99.76	1527.08±4.19
	2	1523.66		99.90	6	1543.33		99.79	
	3	1510.00		99.77	7	1530.00		99.95	
	4	1536.66		99.92	8	1536.66		99.92	
0.6	1	1784.00	1772.66	99.81	5	1783.33	1767.50	99.74	1770.08±6.35
	2	1773.33		99.98	6	1776.66		99.85	
	3	1743.33		99.52	7	1766.66		99.98	
	4	1790.00		99.60	8	1743.33		99.60	
0.8	1	2033.33	2060.00	99.62	5	2036.66	2072.50	99.50	2066.25±7.62
	2	2056.66		99.95	6	2083.33		99.84	
	3	2080.00		99.71	7	2086.66		99.80	
	4	2070.00		99.84	8	2083.33		99.84	
1.0	1	2236.66	2234.16	99.96	5	2226.66	2228.33	99.97	2231.25±3.82
	2	2223.33		99.86	6	2210.00		99.76	
	3	2233.33		99.98	7	2240.00		99.84	
	4	2243.33		99.89	8	2236.66		99.89	
1.2	1	2356.66	2376.66	99.75	5	2340.00	2376.66	99.55	2376.66±7.50
	2	2373.33		99.95	6	2396.66		99.75	
	3	2403.33		99.67	7	2393.33		99.79	
	4	2373.33		100.00	8	2376.66		100.00	
1.4	1	2559.33	2560.33	99.98	5	2563.33	2572.50	99.89	2566.41±2.98
	2	2553.33		99.92	6	2573.33		99.99	
	3	2565.33		99.94	7	2576.66		99.95	
	4	2563.33		99.95	8	2576.66		99.95	

* Values represent mean and standard deviation of the mean flow ($\overline{X}$).

The nozzles with air absorption and flat fan jet obtained lower flows. The uniformity of the flow rate thereof was optimal also for all the eight nozzles at all operating pressures. The lowest flow uniformity was 98.98% for the 6 nozzle at a pressure of 0.2 MPa (Table 2).

The standard deviation of the mean flow nozzles on both ramps had values of ± 10% at all working pressures. The slightest deviation from the mean was obtained at 0.8 MPa pressure, is ± 3.50%.

Table 2. The uniformity of flow flat fan jet nozzle and air absorbtion, IDK 120-02 from LECHLER

Pressure (MPa)	Right ramp				Left ramp				$\overline{X} \pm s_{\overline{X}}$ *
	Nr. nozzle	q_i (cm³/min)	q_m (cm³/min)	C_d (%)	Nr. nozzle	q_i (cm³/min)	q_m (cm³/min)	C_d (%)	
0.2	1	683.33	680.00	99.85	5	676.66	689.16	99.47	684.58±4.95
	2	676.66		99.85	6	713.33		98.98	
	3	683.33		99.85	7	696.66		99.68	
	4	676.66		99.18	8	670.00		99.19	
0.4	1	950.00	956.66	99.79	5	943.33	960.83	99.47	958.75±6.04
	2	960.00		99.89	6	983.33		99.32	
	3	943.33		99.59	7	976.66		99.52	
	4	973.33		99.37	8	943.00		99.37	
0.6	1	1080.00	1091.66	99.69	5	1063.33	1082.50	99.48	1087.08±5.05
	2	1086.66		99.86	6	1100.00		99.53	
	3	1110.00		99.51	7	1090.00		99.79	
	4	1090.00		99.84	8	1076.66		99.84	
0.8	1	1303.33	1311.66	99.81	5	1313.33	1305.00	99.81	1308.33±3.50
	2	1326.66		99.66	6	1310.00		99.88	
	3	1313.33		99.96	7	1303.33		99.96	
	4	1303.33		99.74	8	1293.33		99.74	
1.0	1	1403.33	1393.33	99.79	5	1423.33	1401.66	99.55	1397.50±4.86
	2	1380.00		99.72	6	1403.33		99.96	
	3	1403.33		99.79	7	1393.33		99.82	
	4	1386.66		99.68	8	1386.66		99.69	
1.2	1	1520.00	1506.66	99.74	5	1503.33	1502.50	99.98	1504.58±5.43
	2	1503.33		99.93	6	1523.33		99.59	
	3	1506.66		100.00	7	1473.33		99.43	
	4	1496.66		99.85	8	1510.00		99.85	
1.4	1	1576.66	1572.50	99.92	5	1560.00	1563.33	99.93	1567.91±4.03
	2	1580.00		99.86	6	1566.66		99.93	
	3	1563.33		99.83	7	1580.00		99.69	
	4	1570.00		99.69	8	1546.66		99.69	

* Values represent mean and standard deviation of the mean flow ($\overline{X}$).

CONCLUSIONS

The uniformity of flow of the two types of nozzles has optimum of over 95% at all operating pressures.

The standard deviation of the mean flow to the eight nozzles mounted on both ramps had values of more than ± 10% at all operating pressures.

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