ENERGY ANALYSIS OF WORK low volume sprayers in the vineyards

KM Syera, Ph.D.

The paper presents an analysis of power sprayer succinct introduction to the vineyards. Considered comparison volume and low volume spraying from a position of energy and resources, calculated environmental impact of their use.

Sprayer, energy, resources, environment, pesticides, vineyard.

Problem. Chemical protection of vineyards from pests and diseases is an important and necessary Agrotechnological method that prevents damage to crops. However, spraying pesticides is a major source of pollution vineyards toxic chemical substances. On contact with the biosphere, plant protection drugs able to stay unchanged for a long time, contaminating soil and groundwater, and plants. Most pesticides are carcinogenic, causing a potential threat to public health.

Analysis of recent research. The use of indicators to assess the value of agricultural technologies in terms of inflation leads to bias results display. However, economic, energy, environmental, social or any other resource with their system performance and practice often used independently.

So to compare the effectiveness of two technologies not only to conduct cost analysis resulted in monetary units. Determining the cost-effectiveness of chemical protection technology vineyards in cash not ignore many important factors, namely the level of the negative impact of mechanized agriculture on soil (environmental factor) and non-renewable energy consumption (power factor) [3].

Enerhootsinka operations process vineyard spraying calculated by the method that proposed in [1, 2, 4], on the basis of reference data the energy equivalent of mechanization and other components of the technology in light of the harvest energy.

The purpose of research. Submit energy analysis results from the introduction of volume and low volume fan spraying the vineyards of energy and resursozberzhennya position.

Results. Energy analysis conducted for 9 sprays on 30 hectares of vineyards in SE "Alushta" (m. Alushta) the results of tests of the modernized low volume sprayer OVN-300M with adjustable hydraulic fan. Control when testing was carried out relatively batch spray OVN-300, which is set to drive the fan Single reduction.

Adjusting modes depending on the size of the vine minimizes losses and better use of pesticides in the vineyards. So when spraying OVN-300M was proposed to replace the volume on low volume spraying. In the control treatment options held by the accepted norm in the household of a working fluid in the vineyards - 1000 l / ha. Complete energy technologies vineyards chemical protection from pests and diseases defined as the amount of energy expended in the performance of each technological operation, that is, [4]:

$$E_{вход} = \sum_j E_{вход.j}\ , \tag{1}$$

where j - Number of technological operations.

The energy of one spray consists of the sum of the energy intensity of the tractor and sprayer, a mass of metal, fuel, pesticides and labor machine operators. Number of non-renewable energy expended per 1 ha for spraying $E_{вход.j}$ is, MJ / ha:

$$E_{вход.j_{опр}} = E_{тр} + E_{обпр} + E_{ДП} + E_{п} + E_{люд}\ , \tag{2}$$

where $E_{тр}$ - Energy of the tractor as mass of metal, MJ / ha;

$E_{обпр}$ - Energy of the sprayer as mass of metal, MJ / ha;

$E_{ДП}$ - Fuel energy consumed, MJ / ha;

$E_{п}$ - Pesticides energy expended, MJ / ha;

$E_{люд}$ - Energy work machine, MJ / ha.

The energy of mechanization (UMZ-6AKL and sprayers) per unit of work is given by [1]:

$$E_{см} = E_{тр} + E_{обпр} = \frac{\alpha_{тр} m_{тр} + \alpha_{обпр} m_{обпр}}{W_{год}}\ , \tag{3}$$

where $W_{год}$ - Unit operating time per hour, ha / h;

$\alpha_{тр}, \alpha_{обпр}$ - The energy equivalent of mechanization, MJ / (kg × h);

$m_{тр}, m_{обпр}$ - Mass mechanization, kg.

The energy equivalent UMZ-6AKL $\alpha_{тр} = 0{,}0243$ MJ / (kg × h); sprayers $\alpha_{обпр} = 0{,}246$ MJ / (kg × h) [2, 4]. The weight of the tractor $m_{тр}$= 3890 kg dry mass constructive sprayer OVN-300 $m_{обпр1} = 280$ kg dry mass constructive OVN-300M with adjustable hydraulic $m_{обпр2} = 250$ kg [1, 4]. Power consumption of diesel fuel $E_{ДП}$ Spent during spraying, determined by a formula MJ / ha:

$$E_{ДП} = \frac{\alpha_{ДП} G_{ДП}}{W_{год}}, \quad (4)$$

where $\alpha_{ДП}$ - The energy equivalent of diesel fuel $\alpha_{ДП}$= = 52.8 MJ / kg; $G_{ДП}$ - Rate of fuel consumption, kg / h.

Energy consumption mechanics, MJ / ha:

$$E_{люд} = \frac{n_{мех}}{W_{год}} \alpha_{мех}, \quad (5)$$

where $\alpha_{мех}$ - The energy equivalent of basic workers $\alpha_{мех}$= = 43.4 MJ / (nation. × h); $n_{мех}$ - The number of mechanics, $n_{мех}$= 1 person.

To determine the energy intensity of pesticide application rate based on 1 hectare formulas, MJ / ha:

$$E_n = \alpha_n H_n, \quad (6)$$

where H_n - Rate of pesticides on 1 hectare, kg / ha; α_n - The energy equivalent of the active substance, MJ / kg.

The results of total energy costs for spraying vineyards are summarized in Table. 1.

1. Specific consumption of total energy for spraying vineyards, MJ / ha.

Number of spraying, j	PRODUCTION Production of fixed assets $E_{см}$		Fuel, $E_{ДП}$		Labor resources $E_{люд}$		Pesticides, E_n		Total, $E_{вход}$	
	OVN-300	OVN-300M	OVN-300	OVN-300M	OVN-300	OVN-300M	OVN-300	OVN-300M	OVN-300	OVN-300M
1.	39.68	34.90	129.51	106.29	10.54	9,71	730,00	328.50	909.74	479.41
2.	39.68	34.90	129.51	106.29	10.54	9,71	34.98	15.74	214.72	166.65
3.	39.68	34.90	129.51	106.29	10.54	9,71	260.04	130.02	439.78	280.93
4.	39.68	34.90	129.51	106.29	10.54	9,71	433.40	216.70	613.14	367.61
5.	79.37	69.80	259.02	230.81	21.08	19.42	109.04	54.52	468.51	374.55
6.	79.37	69.80	259.02	230.81	21.08	19.42	140.45	70.22	499.92	390.26
7.	79.37	69.80	259.02	230.81	21.08	19.42	780.12	468.07	1139.6	788.10
8.	79.37	69.80	259.02	230.81	21.08	19.42	109.04	65.42	468.51	385.46
9.	79.37	69.80	259.02	230.81	21.08	19.42	216.70	130.02	576.17	450.05
Together	555.58	488.61	1813.2	1579.2	147.56	135.94	2813.8	1479.2	5330.1	3683.0

Analysis of total energy cost structure to perform a chemical process to protect vineyards variants showed reduction in fuel costs by 12.9% or 233.91 MJ / ha reduction in pesticide costs by 47% or 1334.55

MJ / ha.

Annual energy effect determined by the formula [3]:

$$Э = (E_{вход1} - E_{вход2}) \cdot A, \quad (7)$$

where E - Shows the energy consumption per unit of machines that are compared, MJ / ha; A - Volume introduction, ha.

$$Э = (5330{,}1 - 3683{,}0) \cdot 30 = 49411{,}5 \text{ MJ}$$

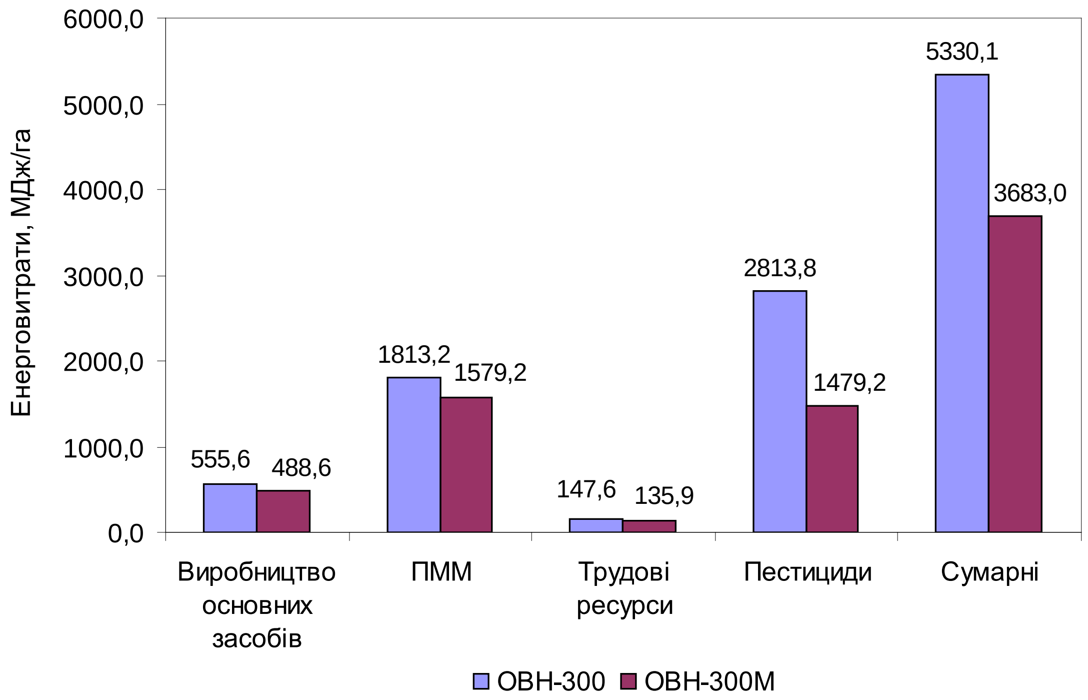


Fig. 1. Structure of the total unit cost of energy to spray vineyards.

Savings total energy consumption amounted,%

$$K = \left(1 - \frac{E_{вход2}}{E_{вход1}}\right) \cdot 100, K = \left(1 - \frac{3683{,}0}{5330{,}1}\right) \cdot 100 = 31\% \quad (8)$$

Thus, the introduction of low volume spraying possible to reduce the total energy unit costs by 31%.

Compare the structure of unit costs in cash (Fig. 2a) and energy units (Fig. 2b), the results are presented as a percentage.

The analysis shows that the largest share of the costs for the purchase of fuel and pesticides. The structure of the unit cost of chemical defense vineyards cost of purchasing pesticides account for 71%, and in terms of energy 40%, which is 1.8 times less. This supports the use of cash performance bias when assessing processes. The environmental damage caused by burning fuel in the vineyards, was higher than that of the introduction of pesticides in the structure of energy consumption was

43%. Determine the level of environmental technologies grape production by the formula [4]:

$$K_{эк} = \frac{E_{вход}}{П_{эк}}, \qquad (9)$$

where $П_{эк}$ - Environmentally acceptable limit enerhonasychenosti process of production.

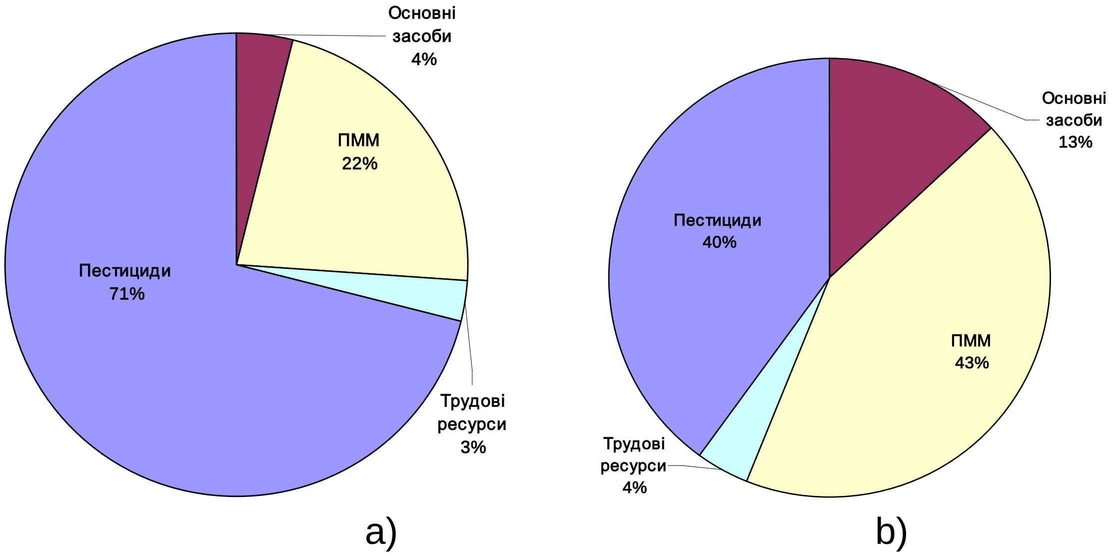


Fig. 2. The cost structure means and energy in chemical defense vineyards: a) currencies; b) power units.

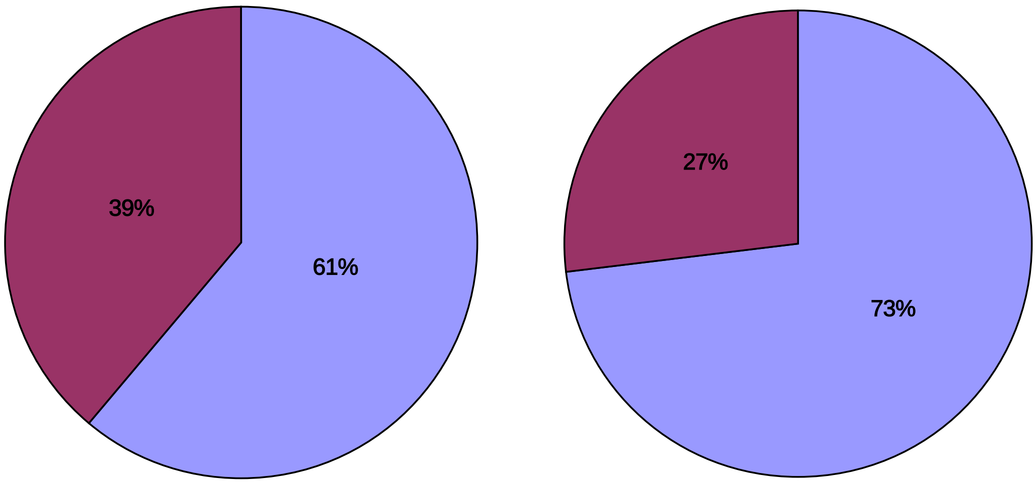
Limit energy consumption, for which a further increase in anthropogenic pressures in agricultural ecosystems is threatening the ecological balance of the environment, is 20 ... 30 GJ / ha per calendar year [1, 2, 4]. However, in modern terms as these limits are exceeded, the total enerhonavantazhennya should be no more than 13.6 GJ / ha [4].

$$K_{эк1} = \frac{5330{,}1}{13600} = 0{,}39;\ K_{эк2} = \frac{3683}{13600} = 0{,}27.$$

Graphs in Fig. 3 show that human pressure chemical protection sprayers for vineyards, which are compared, was 39% and 27% of the allowed level.

As a result of low volume spraying was a decrease of anthropogenic impact on the vineyards by 12%. Thus, the priority for energy balance is to reduce non-renewable energy costs.

Conclusion. Low volume spraying possible to reduce the total energy unit costs by 31% and ensure 12% reduction of environmental threats grape plantation chemical protection from pests and diseases. The structure of the unit cost of energy when spraying the vineyards most energy is spent on fuel and pesticides. This loss caused by burning fuel in the vineyards was higher than that of making pesticides. Therefore, further attention should be given to the introduction of energy saving technologies and machines. Introduction to design low volume sprayer ventilator hydraulic drive for adjusting the air-liquid feed stream will minimize losses of pesticides and fuel consumption and therefore lower energy costs pursuant spraying.



a) b)

Fig. 3. These pressures chemical plant protection: a) OVN-300; b) OVN-300M.

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In this article presented analysis Introduction maloobъemnoho power machinery oprыskyvtelya the vineyards. Rassmotreno Comparison obъemnoho and maloobъemnoho oprыskyvanyya with pozytsyy energy and resursosberezhenyya, rasschytan ecologically effect from s Introduction.

Oprыskyvatel, Energy, resources, ecology, pestytsydы, vineyard.

The paper presents a result of energy supply analysis. Energy consumption was compared for volume and low-volume airblast sprayers

at vineyards. Ecological efficiency was measured.

Sprayer, energy, resource, ecology, pesticides, vineyard.

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CLASSIFICATION OF TECHNOLOGICAL PROTECTION MEASURES IN THE DESIGN OF MOBILE AGRICULTURAL MACHINERY

OV Voinalovych, Ph.D.
VP Hunger, a graduate student*

We describe the classification of technological protection measures in the design of tractors and combines agricultural land as a defining link in security work. The basic requirements for the design and installation of technological protection measures on mobile agricultural machinery.

Technical data protection, mobile agricultural machinery, protective fencing, emergency stop devices.

Problem. Safety technology system "man-machine-environment" on mechanized agricultural production depends on the dangers inherent in each of its subsystems and related to the operation of the machine, machine operators and activities of the working environment. Each subsystem includes a large number of industrial dangerous and harmful factors whose effects can reduce the use of means of safety [1].

In the context of modern agricultural production mechanized works almost always a risk of an accident [2] through participation in the technological process rights of its emotional, physiological and psychological traits. Because labor involves the study of behavior of the operator, as a potential source of danger because of his fatigue, the error performance of business operations, lack of knowledge of safe methods of work and so on. However, hardware safety should play a crucial role in solving the complex problems of reducing the risk of injury to mechanized agriculture, which can be considered as a given problem and a new date.

Analysis of recent research. Now study the impact of the availability, functionality, serviceability and technical security measures to ensure the level of safety standards not pay enough attention [3]. Following statistics on causes of occupational injuries in agriculture that point as decisive (70%) organizational causes injury to plants agricultural

*** Supervisor - Ph.D. OV Voinalovych**