DISEASE AND PEST CONTROL SPRAYING MACHINES IN GRAPEVINE

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Abstract.*Controlling diseases, pests and weeds in vineyards can be done by several means, of which, agrotechnical means, which are easy to reach for viticulturists, give good results and are relatively cheap, but require a very high volume of works; biological means, which consist in controlling vegetable pests using other insects or birds as enemies; chemical means, which are based on the use of pesticides. The last ones have gained increasing importance because, with minimum efforts and expenses control is achieved more easily than by other means. The application of pesticides to control diseases, pests and weeds can be done in various forms, such as: dry treatments, when powders are used to dusty vine; wet treatments, applied by spraying and involving the use of pesticides in the form of solutions, suspensions or emulsions. Pesticides are classified, depending on their destination, in herbicides, fungicides and insecticides. Herbicides are chemicals that, applied on the ground or plants, cause their death. In relation to the crops on which these herbicides are applied, they must not harm their growth and development, but they have pronounced effects on weeds. Fungicides are pesticides used in controlling diseases. They may be mineral substances (sulphur, copper sulphate, copper oxychloride, mercury chloride, etc.), organic-mineral compounds or organic compounds. Most fungicides are applied preventively, prior to the occurrence of the disease. Insecticides are pesticides used to control pests. They are classified in three groups, according to their main action, namely: ingestion, contact and breathing.*

Keywords*: control spraying machines, grapevine, pesticides*

INTRODUCTION

A retrospective look highlights that the last century will be remembered by mankind primarily as a period of science and technology development, including agricultural development.[MATEOC-SIRB N., T. MATEOC, ANISOARA DUMA- COPCEA, S.GH. SÂRB, G. ȘUSTER, 2013]

Development, i.e., the shift from extensive agriculture to intensive agriculture characteristic of industrialized states and with a high standard of living in the northern hemisphere, is primarily due to the next three factors:

- Mechanization of agriculture;
- Application of chemicals to fertilise and protect the plants;
- Production of biological material of high productivity.

In terms of plant protection, the immense contribution due to chemicals application in increasing agricultural production should be highlighted. FAO specialists consider that more than ⅓ of current agricultural production is due to chemical control of diseases and pests. [ANIȘOARA DUMA-COPCEA, CASIANA MIHUȚ, R. ILEA, CORINA SÎRBU, DANIELA NICOLETA SCEDEI, VALER POP, FEIDI ANUȚA, 2019, I.TRUȚAN, ANIȘOARA DUMA-COPCEA, CASIANA MIHUȚ, DANIELA SCEDEI, 2020]

In the same context, it should be noted that the use of chemicals to control diseases and pests is not completely risk-proof and that their use inappropriately leads to environmental pollution with toxic residues, with repercussions on the health of all organisms in the ecosystem and, finally, on human health.

This is the main reason why those dealing with plant protection must have deep knowledge both in the field of pest biology, phytosanitary products designed to control them, as well as of the apparatus used to apply phytosanitary treatments.

Not knowing the technique used to apply phytosanitary substances attracts the application of inappropriately qualitative treatments, so it can diminish and compromise the biological effect of these treatments.

Compromising treatment or treated crop is always linked to material losses, often unrecoverable and with unfavourable economic consequences for the farmers.

Machines currently used in the world to control diseases and pests are of particular importance in the technological process of plant cultivation. [POPA D., ILEA R., BUNGESCU S., ALEXANDRA BECHERESCU, 2015, ILEA R., BUNGESCU S., POPA D., CABA I., 2013]

The objective of this paper is to implement new technologies for the preparation of the germination bed and the use of new plant varieties that do not lead to the expected results without applying corresponding phytosanitary treatments and, implicitly without the use of performing control machines. In order to have high agricultural productions, it is imperative to carry out these works at high quality indices.

The purpose of this paper is the protection of grapevine against pathogens of particular importance for ensuring high quantity and quality. In the use of control means, protection of the environment, vineyard, harvesting, man, useful entomofauna and animals are also considered.

Due to the ease of application, accuracy in terms of high dosing and productivity, the application of phytopharmaceutical products in the form of "splashes" is still one of the most effective preventive and curative control methods currently used. Increasing spraying efficiency is done by improving spraying systems and using new-generation pesticides, low doses per ha, without retention and low toxicity. Reducing the volume of liquid is based on the increase in spraying. There is a lower limit of the drop size that can be used in this type of spray because, below this size, a large number of droplets have a moment of insufficient impact with the plants and tend to be carried by the "drift" phenomenon. [ILEA R., 2013, DĂNILĂ I, NICULĂIASA V. 1995]

Production losses due to diseases and pests can reach, in our country, even 35%, while direct and indirect power consumption for spraying treatments is, in the case of grapevine, up to 28% of annual technology consumption.

An important role in increasing the degree of efficiency of controlling treatments is that planting systems (surface, distance between rows, lengths, access roads, variety, driving and cutting methods, etc.) to be correlated with production methods. [BUNGESCU S., 2016, VOICEA, I. PIRNA, V. VLADUT, M. MATACHE, S. BUNGESCU, 2011, VLĂDUȚ V., BIRIȘ S.ȘT., BUNGESCU T., HERIȘANU N., 2013]

Reducing environmental pollution and energy consumption in the process of controlling diseases and pests is mainly achieved by reducing the fluid standard per ha using spraying systems that can control the size of droplets, as well as their distribution on plants. The use of spraying machines that comply with these technological requirements is required.

MATERIAL AND METHODS

Spraying and dusting MC-300P machine is designed to control diseases and pests with insect-fungicides, both in the form of solutions and in the form of powder, in orchards and vineyards with a distance between rows of 1.8-2.5 m. It operates in aggregate with 45 hp tractors, wheeled or tracked, operated from their power socket. The machine is equipped with pneumatic dispersers and hydraulic dispersers (spraying ramp), and can perform spraying treatments by dusting or combined treatments (wet dusting).

During the operating process, the following phases are distinguished:

- Liquid filling;

- Spraying;
- Dusting;
- Wet dusting.

The liquid supply is made by decanting through the tank supply (mandatory by sieve-filter), or by means of own pump when using the suction hose of the liquid power supply.

The spraying operation is performed by passing the three-way valve R3 to the open position between the tank and the pump, and adjusting the working pressure indicated by the pressure gauge at the nominal value. Spraying the liquid in the spray ends is pneumatic using the fan cut air. In contact with the air, the liquid is dispersed in fine drops and transported on the surface of the leaves.

The dusting operation is carried out pneumatically, part of the fan air being inserted by a pipe into the dust hop, so the air-powder mixture reaches the fan and, from there, the spraying devices. Adjusting the dust flow is done by changing the position of the adjustment blade.

The wet dusting operation consists in combining the two operations, spraying and dusting, working in parallel.

The MST-900 trailed spraying machine is designed to control diseases and pests by spraying in classical, intensive orchards, as well as in vineyards. They work in aggregate with 45 hp tractors and are operated from their power socket.

RESULTS AND DISCUSSIONS

The preparation for the work of the machine consists in making the following technological settings and verifications:

- Choosing the work devices;
- Adjusting the machine position on the tractor;
- Adjusting the position of the working devices;
- Adjusting the liquid flow;
- Adjusting the dust flow.

The choice of the work device is based on the destination of the treatment. For low-ranking grapevine treatments, the two-row spraying device (MVL 300/90 - 12.0) is mounted on the machine; for high-ranking grapevine treatments, the circular spraying device is mounted on the machine (MVL 300/90 - 10.0).

The machine must be mounted on the tractor so as to ensure the height of at least 300 mm between the ground and the bottom of the frame. The machine frame in the work must be horizontal. In this position, the tractor installs the hydraulic rack limiter, so that the machine cannot lower below. The required working height is continuously adjusted, from the hydraulic lift, within the limits in which the cardan transmission does not make an angle greater than 15^{o}. The horizontality of the machine in longitudinal and transversal plan is adjusted by stretching or shortening the adjustable tyrants from the tractor's suspension mechanism.

Choosing the corresponding spray heads and the adjustment of the angle that allows the jet's direction on plants is in such a way that the sprayed jet covers the vineyard throughout its height.

Adjusting the liquid flow is done before the start of work by water samples and it aims to provide a flow corresponding to the ha norm required by the agrotechnical conditions, which differ depending on the nature of the solution, the type of work, the type of pesticide, the concentration of the solution, the type of dispersers, etc.

The flow adjustment comprises two stages:

- Stage I, in which all dosage valves belonging to the working devices are attached to the chosen position indicated in the adjustment table;

- Stage II, in which the liquid pressure is adjusted (at the nominal speed of the power socket of 540 rpm) until the value in the adjustment table is set.

The theoretical flow of the machine is calculated, after which the flow test is made. In the case of deviations greater than ±5% of the actual flow rate, the adjustments are restored and the sample is repeated until the actual flow rate is equal to the theoretical one.

The working process and MST-900 machine circuits are similar to the MPSP-3x300 machine equipped for spraying. The power is done by sorb by the centrifugal pump. The machine circuits are as follows: the pump aspires the liquid in the tank and refuses with pressure at the two-way valve, from where part of the liquid reaches the flow control valve and feeds the working circuits, while the surplus returns to the tank where it shakes the solution. The flow control valve is identical to that of the MPSP-3x300 machine, with left-right position adjustments. From the flow control valve, the solution reaches the pneumatic dispersing devices with which the machine is equipped. The liquid reached inside the dispersers falls under the action of the fan air flow and, due to the created depression, is absorbed outside the dispersers and sprayed in fine droplets. At the same time, the high speed of the air flow (over 110 m/s) does the droplet transport and leaf stirring, ensuring uniform treatment.

Machine settings and solution flow rate is similar to those of the MPSP-3x300.

Correlating different using indices of the MST-900 machine when spraying a vineyard can be done with a nomogram.

CONCLUSIONS

When applying modern highly efficient pesticides, particular importance is given to the uniform distribution on the surface of the low amount of active substance. This performance is possible, of course, only with precision machines.

The quality of spraying treatments in grapevine requires that spraying aggregates comply with the following requirements during work:

- Ensuring a high degree of droplet uniformity;
- Ensuring uniform coverage with dispersed liquid of the entire foliar area of the vineyard, including bunches, which are subjected to treatment;
- Ensuring the homogeneous concentration of the liquid throughout the control;
- Ensuring a wide range of fluid rates;
- Ensuring the integrity of grapevine without damaging it.

In order to carry out quality works that comply long-term with the technological requirements imposed, plant protection machines must be regularly adjusted and maintained.

The preparation for work of spraying aggregates consists in checking the technical condition, the tightness of the liquid circuits, the correct operation of the safety valves, manometers, and valves.

In the formation of spraying aggregates, special attention should be paid to the liquid flow rate by dispersers.

Spraying is done at constant working speed and with a constant solution flow, to observe the uniformity of distribution of the solution on the surface unit.

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