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OPENING OF COVERED GRAPE BUSHES

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Аннотация. В статье на основе анализа существующих технологий укрытия виноградников и конструкций машин для её осуществления разработана новая конструкция пневмолозооткрывателя, которая сильным воздушным потоком завершает процесс открытия виноградных кустов.

Ключевые слова: виноград, формирование, куст, шпалера, вентилятор, модернизированный, машина, почва, слой, открывка, опыт, глубина, влажность.

Annotatsiya. Maqolada tuproq bilan ko'milgan tok ochishning mavjud texnologiyalari hamda ularni amalga oshirish uchun mo'ljallangan mashinalar



konstruksiyalari tahlili asosida yangi pnevmatik ochgich konstruksiyasi ishlab chiqilgan. Ushbu qurilma kuchli havo oqimi yordamida uzum tuplarini ochish jarayonini to'liq yakunlashni ta'minlaydi.

Kalit so'zlar: *tok, shakllantirish, tup, shpaler, ventilyator, modernizatsiyalangan, mashina, tuproq, qatlam, ochish, tajriba, chuqurlik, namlik.*

Annotation. *In the article, based on the analysis of the existing technologies of shelter of vineyards and designs of machines for its implementation, a new design of a pneumatic opener has been developed, which complete the process of opening of vines to strong air flows.*

Keywords: *grape, formation, bush, trellis, fan, modernized, machine, soil, layer, opening, experiment, depth, moisture.*

INTRODUCTION

Covering grapevines with soil for the winter is currently the main method of protecting them from damage at subzero temperatures. Vineyards are covered in early autumn, shortly before the onset of freezing temperatures, and within the shortest possible time frame [1,2].

Some research results on a serial covering device attached to the MPV-1 vineyard plow for the simultaneous mechanized laying down and covering of grape bushes have shown that the covering body of the device does not meet agrotechnical requirements. Specifically, the thickness of the soil layer above the surface of the bundled vines ranges between 5–7 cm (according to agronomic standards, it should be no less than 10 cm).

At the same time, the soil supplied by the covering body is taken too close to the row axis of the vineyard, which contributes to the exposure of the root system. All this leads to damage to the grapevines and their root system during

the winter period and results in grape yield losses of up to 30% [3].

MATERIALS AND METHODS

The opening of grapevine bushes is one of the important operations in the system of measures for the care of vineyard plantations. The existing machines for this purpose — NYu-39, PRVN-2.5 with the PRVN-74000 attachment, as well as attachments for the MPV-1 vineyard plow — ensure the removal of only 45–55% of the soil from the covering ridge of the vineyard. As a result, the grape bushes remain partially opened.

During manual completion of vineyard opening, significant damage to the bushes is observed, and 15–30 man-days per hectare are required.

To remove the remaining soil from the covering ridge of the vineyard after the passage of the above-mentioned machines that perform partial opening, the Research Institute of Horticulture, Viticulture and Winemaking named after Academician M.M. Mirzaev, together



with BMKB-Agromash, developed the TOM-0.45 pneumatic vine opener. This machine uses a powerful airflow to complete the process of opening grapevine bushes [3].

The pneumatic vine opener consists of a frame, a fan, a gearbox, an overrunning clutch, an air duct, and a loosening working body (Fig. 1). The fan is of the centrifugal type and consists of an impeller with an outer diameter of 800 mm and an inner diameter of 400 mm, equipped with 24 forward-curved blades, a spiral casing with an inlet window of 400 mm in diameter, and an outlet nozzle. The fan impeller rotates at a speed of 2100 rpm. The pneumatic vine opener is arperated with MTZ-82.1 and TL-100 tractors.

The machine completely opens grapevine bushes in a single pass on both light and heavy soils. During operation, the plow bodies remove soil from two half-rows; a flat-cutter moldboard and a loosening disc eliminate the remaining soil from the covering ridges; and the airflow generated by the fan fully clears the vines of soil.

The machine operates on flat terrain and gentle slopes (up to 5°) in trellised vineyards with row spacing of 2.5–3.0 m (Fig. 1).

The loosening disc (2) and the flat-cutter moldboard (11) function due to the

elasticity of springs (4), and their movement beyond the row axis is limited by stops, which prevents damage to the grape trunks. Mounting and removal of the machine from the tractor are carried out quickly thanks to an automatic hitch system. The fan is driven by the tractor's PTO through a single-stage cylindrical gearbox with a gear ratio of 3.7.

To protect the gearbox, the кардан shaft drive, the tractor PTO shaft, and the fan impeller shaft from damage during PTO engagement and disengagement, an overrunning clutch with a maximum torque of 31.5 kg·m is installed on the input shaft of the gearbox.

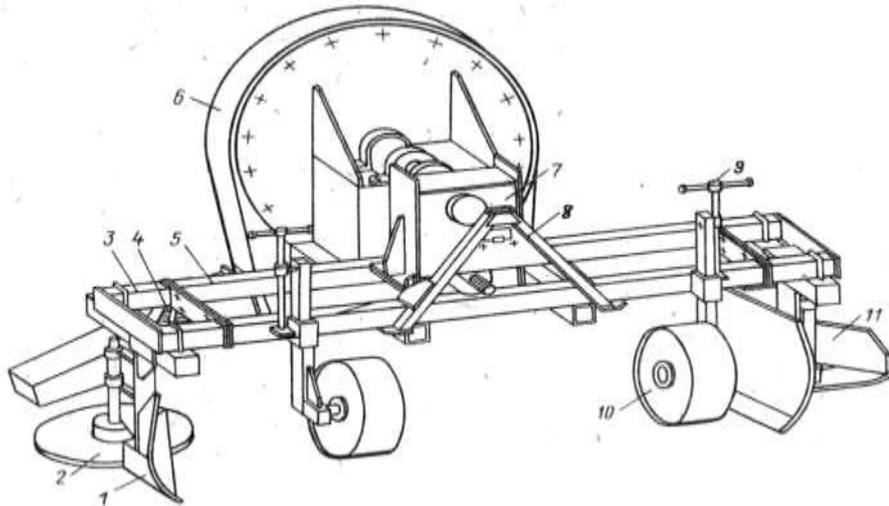
For operation on light soils, the VVD-8 fan is used, with an impeller rotational speed of 1900 rpm and a capacity of 8,352 m³/h. The VVD-9 fan, with an impeller speed of 1960 rpm and a capacity of 10,300 m³/h, effectively destroys the covering ridge even on heavy soils.

In our design, the fan outlet nozzle measuring 100 × 200 mm is installed at an angle of 8–10° relative to the ground surface. The inclination angle of the loosening disc is 6–8° in the direction of travel of the arperate and 4–5° relative to the grape bushes.



Fig. 1. Machine for opening grapevines:

1 — plow body;



2 — soil-loosening disc;

3 — additional machine frame for re-adjustment when operating in row spacings of 3 m;

4 — spring;

5 — main frame made of longitudinal square-section beams for operation in row spacings of 2.5 m;

6 — fan of type VVD-8 or VVD-9;

7 — single-stage cylindrical gearbox (gear ratio 3.7) with overrunning clutch;

8 — automatic hitch;

9 — screw for wheel height adjustment;

10 — wheel;

11 — flat-cutter moldboard for soil.

Results. The opening of vineyard plantations was carried out as follows. After entering the row spacing, the tractor operator shifts the machine from the transport position to the working position using the hydraulic cylinders of the tractor's hitch system. If necessary, the wheel height is adjusted.

As the machine moves forward, the plow bodies cut the covering ridge at its base and turn the soil toward the center of the row spacing.

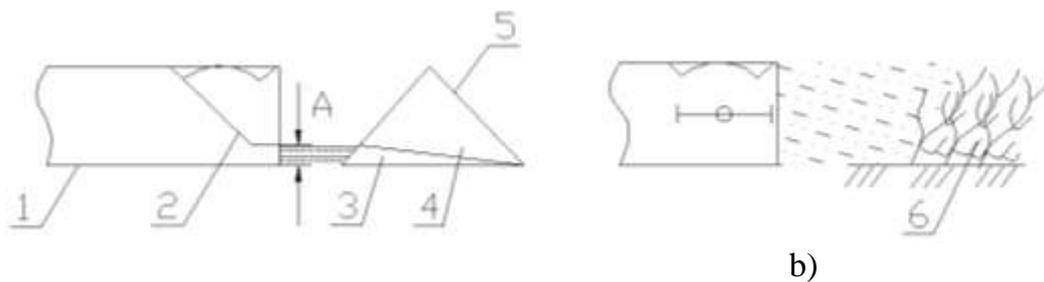
The flat-cutter moldboard and the loosening disc penetrate into the covering ridge, loosen the soil, and move part of it into the inter-row space, while another part is directed into the furrows formed by the plow bodies.

The airflow through the fan nozzle, installed behind the loosening disc, breaks up and blows away the remaining soil of the covering ridge, completely freeing the vines from it. A strong airflow generated by the fan exits through the



nozzle and, striking the soil of the covering ridge, throws the remaining soil from the bush into the inter-row space. The final opening process is accompanied by the action of an airflow from a centrifugal fan on the piled soil. To modify the characteristics of the airflow leaving the fan, a plate (2) with a rotational axis was installed at the outlet

of the discharge pipe (1) (Fig. 2a). At the beginning of the soil blowing process, a slot of thickness A is formed, and the air escaping through it creates a flat jet that destroys the base of the ridge (3). When the cross-section of the outlet pipe is fully opened, a compact jet is formed to blow away the remaining soil (Fig. 2).



a)

a — destruction of the base of the ridge:

1 — discharge pipe;

2 — plate;

3 — base of the ridge;

4 — grapevine cane;

5 — covering ridge;

6 — grapevine bush;

b — blowing soil away from the grapevine bushes.

b)

Fig. 2. Diagram of the pulsating device installed inside the fan discharge pipe.

CONCLUSION

The studies we conducted in a плодonoсящий vineyard (varieties Nimrang, Taifi Rozovy, Black Kishmish, and Asyl-Kara) located on typical sierozem soil with row spacings of 2.5 m and 3.0 m showed that, after a double pass on soils with 10–22% moisture content, the pneumatic vine opener removed 94–97% of the soil remaining in the covering ridge after the passage of the TOM-0.45 machine used for opening grapevine bushes.

The quality of grapevine opening by means of an airflow depends on several factors: the preliminary plowing of the covering ridge by the opening bodies; the degree of soil loosening in the covering ridges by disc or knife-type working organs; soil moisture, structure, and weed contamination in the covering ridge; the fan model; the nozzle shape and its angle relative to the horizontal plane; and the forward speed of the arperate.

The performance quality of the pneumatic vine opener is characterized by



the degree of soil pulverization and its discharge by the air jet into the inter-row space. Our analysis of the soil aggregate composition showed that in the soil removed by the pneumatic opener there was a slight decrease in aggregates larger than 2 mm and an increase in aggregates of 0.5–2 mm by 3%, 0.25–0.5 mm by 2.1%, and less than 0.25 mm by 1.2%.

Thus, the above data indicate that soil pulverization by the air jet is insignificant.

When completing the opening of vineyards using the pneumatic vine

opener, the total amount of damage to the bushes is lower than with manual opening.

After the operation of pneumatic openers, no additional leveling of the inter-row spaces is required.

The widespread adoption of pneumatic vine openers for completing the opening of vineyard bushes in spring makes it possible to significantly reduce the time required for vineyard opening and completely eliminate manual labor in this operation.

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