

## THE EFFECTIVENESS OF GRAPEVINE TRAINING WITH FREE SHOOT GROWTH ON MODERNIZED TRELLIS IN THE REPUBLIC OF MOLDOVA

### EFICACITATEA CONDUCERII VIȚEI DE VIE CU CREȘTERE LIBERĂ A LĂSTARILOR PE SPALIER MODERNIZAT ÎN REPUBLICA MOLDOVA

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**Abstract.** An urgent problem in viticulture is the development of perspective technologies based on modernizing the trellis, improving the bush training system, adapted to the requirements of complex mechanization. The research was carried out on the variety Pinot blanc R7 where two pruning variants were studied comparing agrobiological indicators according to current standards adopted in viticulture. Was established that forming bushes on a high trunk, compared to low standard ones, has some advantages: possibilities to use of mechanization for caring the plantations, including mechanized pruning, reducing the need in manual work, ventilation of the crown of the bush and better lighting of the leaf apparatus reducing the risk of diseases and harmful effects of late spring frosts.

**Key words:** grapevine training, modernized trellis, free shoot growth

**Rezumat.** O problemă stringentă în viticultură este dezvoltarea unor tehnologii de perspectivă bazate pe modernizarea spalierului, îmbunătățirea sistemului de formare a butucului, adaptat la cerințele mecanizării complexe. Cercetările au fost efectuate la soiul Pinot blanc R7, unde au fost studiate două variante de tăiere a coardelor, comparând indicatorii agrobiologici conform standardelor actuale adoptate în viticultură. S-a stabilit, că formarea butucilor pe tulpină înaltă, în comparație cu cele standard pe tulpină joasă, prezintă unele avantaje: posibilități de utilizare a mecanizării pentru îngrijirea plantațiilor, inclusiv tăierea mecanizată, reducerea necesității în lucrul manual și ventilarea interiorului coroanei butucului e mai bună, favorizând iluminarea aparatului foliar, reducând riscul bolilor și efectele nocive ale înghețurilor tardive de primăvară..

**Cuvinte cheie:** conducerea viței de vie, spalier modernizat, amplasarea liberă a lăstarilor

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## INTRODUCTION

Currently, the most labor-intensive and costly agrotechnical processes for grapes production are: pruning bushes and removing vines from the trellis, tied of cane and 3-4 times of shoots during the growing season, harvesting of grapes and other. Reducing labor costs can be achieved by creating plantations on a modernized trellis (posts and wire), which determines the level of mechanization of technological processes. There are known many training systems, which differ in their design. In the last 15-20 years, to support the bushes with high trunk, wooden supports 2500 mm long have been used (fig. 3), which are impregnated with chemicals (for durability) along their entire length, which leads to an increase in cost.

The technology of grapevine cultivation in the Republic of Moldova provides for three main systems of bush management: - *high-trunk training system*; - *mixed training system with combined forms*; - *low training system, without trunk*.

Most of the vineyards for wine varieties are designed in accordance with the high-trunk training system, proposed by Mikhailyuk I.V. (1975), who laid the foundation for the modernization of the trellis by improving the vine training system **at first stage**. The essence of this system consist in a vertical trellis with 3-4 levels of wire, where the cordon's arms are tied to the first wire, canes are tied to the second level, and shoots are tied during the growing season to the next wires (fig. 1). The disadvantage of this system is the deteriorated lighting and aeration inside the crown of the bush, the cost of manual labor increases when performing work such as: - removing the vine from the trellis when pruning, annual adjustment of the wires at the appropriate levels, two or three operations for tying up shoots during the growing season etc. (Mikhailyuk, 1975; Parfenenko, 1983).



**Fig. 1.** Vertical trellis with 3-4 levels of wire; trunk height is 0.8-1.0 m

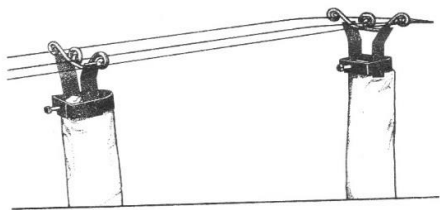


**Fig. 2.** Trellis with one level (two parallel wires) with free development of the canes and shoots; trunk height is 1.3-1.4 m

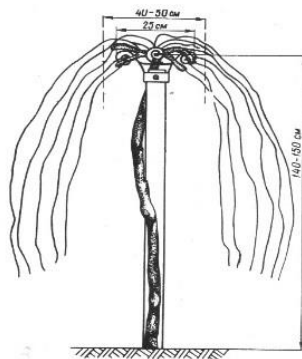


**Fig. 3.** Trellis with one level (one wire) with free development of the canes and shoots; trunk height is 1.3-1.4 m

**The second stage** of upgrading the trellis was carried out by fabricating and installing metal crowns at the top of the posts, which allow the three wires to be installed in one horizontal plane and only multiannual elements of bushes are tied (fig. 4, fig. 5). Due to complicated technological requirements this system was not economically justified (Kuharskii, Botnarenco, 2003).

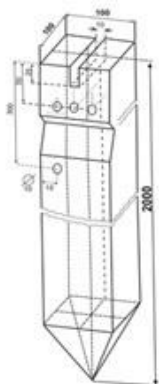


**Fig. 4.** General view of the bracket with installation of trellis wires

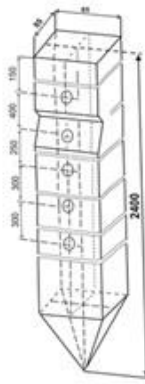


**Fig. 5.** General view of the bush

For these reasons, in order to exclude mentioned disadvantages, at **the third stage** of modernizing the trellis, three variants of new reinforced concrete posts were developed, which embodied some elements of the metal support (fig. 6, fig. 7). Thus, after experimenting with these types of pillars it was found that they are quite durable and it is recommended to promote two universal types of posts for implementation (Brevet MD G2 2571 , BOPI no. 10/2004): **Variant 1** - for all forms with free shoots growth (patent no. 803, BOPI no. 8/97) and **Variant 2** - for all forms with vertical - oblique training of shoots and for rootstock plantations (Botnarenco, 2003; Botnarenco 2019).



**Fig. 6.** Variant 1. Reinforced concrete pillar 2000 mm long



**Fig. 7.** Variant 2. Reinforced concrete pillar 2400 mm long

## MATERIAL AND METHOD

The research was carried out on the Pinot blanc variety (clone R7) in the experimental sector of the "Vierul" agricultural enterprise. Two pruning variants were studied on trellis system with 2 parallel wires, free arrangement of shoots: *first variant* - imitation of mechanized pruning to 2-3 buds with manual adjustment of the bush's load using the biological method and *the second variant* - pruning for a fruiting element – spur to 2 buds and cane to 7-8 buds (2+7-8). The same pruning variants were studied in the case of trelling system with 4 wires at different levels and vertical training of shoots (variant 3 and 4). A comparative study of experimental variants was carried out by taking into account agrobiological indicators and observations, according to current standards adopted in viticulture.

## RESULTS AND DISCUSSIONS

As a result of the researches carried out on the Pinot blanc R7 variety, during the research period, it was established a good development annually of shoots from the central buds of the vines cutted to 2-3 buds. A weaker development of shoots from the central buds was observed when pruning according the variant (2+7-8). This led to the conclusion that Pinot blanc R7 responds positively to short pruning.

In variant 1, with cutting to 2-3 buds, the average weight of the grape was 200 g, compared to 181 g in variant 2, with cutting at the fruiting element to 2+7-8 buds. In variant 3, with cutting to 2-3 buds and vertical management of the shoots, the number of grapes per bush was 119%, in relation to the average number of buds left at the bush, and in variant 4, with cutting to 2+7-8 eyes - only 95%. According to the production quality indicators (must content in sugar and titratable acidity), no essential differences between variants were observed.

Forming bushes on a high trunk, compared to low ones, has some advantages:

- widespread use of mechanization for caring for grape plantations, including mechanized pruning of fruit vines;
- reducing the need for manual work by eliminating the removal of the vine from the trellis during pruning;
- tying of fruit vines and shoots during the growing season;
- better ventilation of the crown of the bush and lighting of the leaf apparatus reduces the risk of diseases and reduces the harmful effects of late spring frosts;
- powerful development of grape bushes on a high trunk has increased frost resistance, due to the fact that at a height of 1.3-1.4 m temperature fluctuations are less than at the soil surface.

The data presented in table 1 show that labor costs per hectare are 172 man-hours less in the variant of training bushes with free growing shoots. Also, the number of trellis wires is reduced from 5 wires, placed at different levels in a system with vertical training to 2 wires, placed at one level in a system with free

growing shoots. Also, there is a decrease in costs per hectare or per unit of production, which is expressed in economic indicators (Botnarenco, 2003; Botnarenco 2019).

Table 1

**Comparative economic effectiveness of two systems of bush training  
calculated per 1 ha (planting scheme 3.0 x 1.5 m)**

Expenditure items	Unit	Trellis system with 4 levels of wire and vertical training of shoots		Trellis system with 2 wires at the same level and free growth of shoots		Difference
		production costs	part of total costs, %	production costs	part of total costs, %	
Total labor costs:	man-hour	903	100	685	100	-218
including:	man-hour					
- mechanized works	man-hour	35	3.9	35	5.1	0
- handmade	man-hour	868	96.1	650	94.1	-218
of which: bush care work	man-hour	468	51.8	250	36.5	-218
including:	man-hour					
- removing the vine from the trellis	man-hour	45	5.0	-	-	-45
- tying of canes and shoots (2 times)	man-hour	173	19.1	-	-	-58
Production costs - total	lei	37632	100	31800	100	-5832
including:	lei					
salary with additions and contributions	lei	11030	29.3	7100	22.3	-3930
wear, maintenance and repair of the trellis	lei	3382	9.0	2310	7.3	-1072
total cost of materials	lei	11500	30.6	10670	33.6	-830
of which:	lei					
material for tying	lei	830	2.2	-	-	-830
Productivity	lei	8,0		8,0		-
Labor costs per 1 t	man-hour	112.9		85.6		-27.3
prime cost of 1t	lei	4704		3975		-729

## CONCLUSIONS

1. In the variant with imitation of mechanized pruning, there was no decrease in the grape yield and its quality during manual processing, taking into account the optimal load of eyes on the bush (according to Mikhailyuk's biological method).

2. Growing bushes of wine grape varieties with free placement of shoots has demonstrated the possibility of obtaining high yields of better quality compared to the system of training with vertical growth of shoots.

3. The system training grape bushes with free growth of shoots allows reducing labor costs by 218 man-hour, which is an important circumstance when there is a lack of resources for manual work.

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