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BIOMASS FROM VINEYARD OBTAINED BY WINTER PRUNING

Violeta Dimovska, Faculty of agriculture, Goce Delcev University, Krste Misirkov bb, 2000 Stip, Republic North Macedonia
Fidanka Ilieva, Faculty of agriculture, Goce Delcev University, Krste Misirkov bb, 2000 Stip, Republic North Macedonia
Contact author: violeta.dimovska@ugd.edu.mk

ABSTRACT

During vineyard management, an essential agrotechnical practice is winter pruning. It is carried out once a year with the aim of maintaining the training system and keeping yields at an optimal level, resulting in the production of a large amount of plant biomass in the form of pruning residues. The obtained biomass represents a burden and makes movement through the vineyard more difficult, but on the other hand, it is also a significant source of energy. Biomass energy can be transformed in several ways or returned to the vineyard through mulching. In vineyards in our country, the most common practice is to collect and burn the biomass obtained from pruning within the vineyard itself, while mulching and returning it to the vineyard is less common. In this way, large quantities of biomass are lost both in terms of energy value and as an important source of thermal energy. Our research included 17 varieties, of which 12 were wine grape varieties (red and white) and 5 were table grape varieties, cultivated at two vineyard locations (Lepovo and Dolni Disan). The results of our research showed that the biomass obtained from grapevine pruning depends on the variety, the age of the vineyard, and the growing conditions. In the vineyards at the Lepovo vine locality, it ranges from 890 kg/ha for the Petit Verdot variety to 2,087 kg/ha for the Traminer variety, and from 1,176 kg/ha for the Smederevka and Muscat Hamburg varieties to 2,789 kg/ha for the Cardinal variety at the Dolni Disan vine locality.

Keywords: grapevine, variety, biomass

INTRODUCTION

Viticulture is an important economic sector, with approximately 7.300.000 ha of total area worldwide, more than half of which (4.881.000 ha) is located in Europe [1]. The Republic of North Macedonia has 21.776 ha of vineyards (2024), representing 4.4% of the total arable land (State Statistical Office of R.N.M., MakStat database).

The grapevine is a perennial crop with a productive lifespan of 25–30 years. During vineyard exploitation, in addition to the application of numerous necessary agrotechnical practices (soil cultivation, protection, green pruning, irrigation, etc.), dormant pruning is obligatorily carried out during the resting period (December, January, February, March). Pruning mainly removes one-year-old mature canes, and to a lesser extent two-year-old and older parts of the vine. The resulting mass (biomass) is referred to as vegetative potential and is expressed as: kg/vine, kg/ha, or kg/m².

The amount of biomass per unit area obtained through pruning depends on several factors, including:

- the vigor of the variety and rootstock, and the age of the vineyard
- the physical and chemical properties of the soil
- average annual temperatures
- the quantity and distribution of precipitation during the year and growing season
- methods of soil cultivation and maintenance within and between rows
- irrigation practices
- pruning intensity
- plant protection and fertilization
- the number of vines per unit area, etcI

Under the conditions of Spain [2], the biomass obtained from pruning depends on the grapevine training system, ranging from 0.257 kg/vine (1.142 kg/ha) in low-trained systems (trellis) to 0.454 kg/vine (1.532 kg/ha) in high-trained systems (pergola). From vineyards in Radmilovac (experimental field of the Faculty of Agriculture – Belgrade) and Niš (experimental field of the Center for Viticulture and Enology [3]), the biomass obtained after pruning by varieties is as follows: 2.075 kg/ha for Riesling, 2.416 kg/ha for Pinot Noir and 3.000 kg/ha for Prokupac.

RESULTS AND DISCUSSION

As a representative sample, vineyards of VV Bovin from Negotino covering an area of 52.6 ha, and vineyards of Venec AD with an area of 237 ha. The results for biomass obtained from the vineyards grown in the Lepovo locality are given in Table 1.

From the vineyards of VV Bovin, the average amount of biomass is 1.259 kg/ha, which amounts to a total of 66.590 kg to 52.6 ha in vineyards. When measuring the biomass from grapevine pruning residues, significant differences in biomass yield were observed between the Shiraz and Petit Verdot and Cabernet Sauvignon and Gewurztraminer varieties. The Petit Verdot variety has a lower biomass yield compared to the other ten varieties. In Serbia [4], different amounts of biomass have been obtained, primarily depending on the variety. These range from 1.650 kg/ha (Muscat the Frontignan), 2.075 kg/ha (Gamay), 2.740 kg/ha (Cardinal), to 3.300 kg/ha (Vranac). Under the conditions of the Skopje vine-growing region [5], the authors determined that the amount of biomass in the Regina variety grown on a trellis depends on the vigor of the rootstock. It ranges from 1.406 kg/ha (0.407 kg/vine) for the Teleki 5C rootstock (low vigor) to 2.913 kg/ha (0.839 kg/vine) for the Rupestris du Lot rootstock (high vigor). Table 2 shows the results for biomass from the vineyards in the Dolni Disan locality.

The highest average biomass was recorded for the Cardinal variety, amounting to 0.664 kg/vine, followed by the Michele Palieri variety, whose mass was 0.413 kg/vine. The lowest average biomass of pruned vines was recorded for the Muscato the Hambourg variety, with 0.230 kg/vine. From the vineyards of VV Venec, the average amount of biomass is 1.603 kg/ha, which amounts to a total of 372.418 kg to 237 ha in vineyards. At the national level in Spain [2], vineyards produce an average of 1.000 kg/ha of biomass, which accounts for 13% of the total biomass from plant production.

Based on the obtained average values, a simulation was made for the total amount of biomass on an area of 21.300 ha of vineyard plantations in the Republic of Macedonia (Table 3). On an area of 21,300 ha of vineyards, winter pruning yields 30.459.000 kg of biomass as a source of energy.

CONCLUSION

►Based on the research, it was concluded that pruning residue yield mostly depends on biological features of the grapevine variety.
► Climate and soil conditions also have a great influence, as well as the agro-technical measures used during vineyards exploitation.

Table 1 The biomass by varieties from vineyards in V.V. Bovin (Lepovo locality)

	Variety	Vineyard (ha)	Biomass (kg/vine)	Numper of vine/ha	Biomass Kg/ha	Total biomass (kg)
1	Vranac	13	0.285	4.444	1.267	16.471
2	Merlot	11	0.164		728.5	8.013
3	Cabernet sauvignon	10	0.437		1.942	19.420
4	Cabernet frank	2.5	0.263		1.169	2.923
5	Shiraz	2	0.220		979	1.958
6	Petit Verdot	1.8	0.200		890	1.602
7	Tempranillo	1.6	0.300		1.333	2.133
8	Sangiovese	2.1	0.242		1.075	2.258
9	Muscato de Frontignan	3	0.233		1.035	3.105
10	Gewurztraminer	1.6	0.470		2.087	3.339
11	Charodnay	4	0.302		1.342	5.368
Average			**0.283**		**1.259**	
Total		**52.6**				**66.590**

Table 2 The biomass by varieties from vineyards in AD Venec (Dolni Disan locality)

	Variety	Vineyard (ha)	Biomass (kg/vine)	Numper of vine/ha	Biomass Kg/ha	Total biomass (kg)
1	Vranac	80	0.395	4.200	1.638	131.040
2	Smederevka	70	0.281		1.176	82.320
3	Regina	30	0.410		1.722	51.660
4	Cardinal	20	0.664		2.789	55.780
5	Muscato the Hambourg	12	0.280		1.176	14.112
6	Gewurztraminer	10	0.347		1.457	14.574
7	Michele Palieri	6	0.413		1.735	10.410
8	Ribier Noir	5	0.370		1.554	7.770
9	Pinot gris	4	0.283		1.188	4.752
Average			**0.382**		**1.603**	
Total		**237**				**372.418**

Table 3 The total biomass from vineyards in R. N. Macedonia

Vineyards (ha)	Biomass (kg/ha)	Total biomass (kg)
21.300	**1.430**	**30.459.000**

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