RESEARCHES REGARDING THE USE AS A BIOMASS OF VINES RESIDUES RESULTING FROM THE DORMANT PRUNING

CERCETĂRI PRIVIND UTILIZAREA CA BIOMASA A COARDELOR DE VIȚĂ DE VIE REZULTATE DE LA TĂIEREA ÎN USCAT A PLANTAȚIILOR VITICOLE

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Abstract. *At the global level, biomass is considered one of the main forms of renewable energy, as it ensures the conservation of the sun's energy in chemical form, being one of the most popular and universal resources on Earth, used for energy purposes since the discovery of fire by man. Today, biomass can be used for different purposes from room heating to the production of electricity and fuel for cars. Biomass is the biodegradable part of agricultural products, waste and residues, including plant and animal substances, forestry and related industries, as well as the biodegradable part of industrial and urban waste. Considering these elements, we can consider that vine plantations can make a significant contribution to the development of the biomass source, by using the vine ropes resulted from the cuts in the land. The research aimed the determination of the biomass potential of vine plantations, were harvested ropes from wine varieties and at different dates during plant rest to determine the evolution of their humidity. The samples were taken from the didactic resort farm "Vasile Adamachi" plantation of the University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad" of Iasi. The varieties studied were: Busuioaca de Bohotin, Cabernet Sauvignon, Feteasca Alba, Feteasca Neagra, Feteasca Regala, Muscat Ottonel, Pinot Noir and Sauvignon Petit.*

After the research carried out, it was found that the humidity of the strings is different, depending on the variety and the date of harvest.

Key words: vines residues, humidity.

Rezumat. *Pe plan mondial, biomasa este considerată una dintre principalele forme de energie regenerabilă, întrucât asigură păstrarea energiei solare în formă chimică, fiind una dintre cele mai populare şi universale resurse de pe Pământ, utilizată în scopuri energetice din momentul descoperirii focului de către om. Astăzi, biomasa poate fi utilizată în diferite scopuri, de la încălzirea încăperilor până la producerea energiei electrice şi combustibililor pentru automobile. Biomasa este partea biodegradabilă a produselor, deşeurilor şi reziduurilor din agricultură, inclusiv substanțele vegetale şi animale, silvicultură şi industriile conexe, precum şi partea biodegradabilă a deşeurilor industriale şi urbane. Având în vedere aceste elemente, putem considera că plantațiile de viță de vie pot contribui semnificativ la dezvoltarea sursei de biomasă prin folosirea cordelor de viță de vie rezultate de la tăireile în uscat. Cercetările au vizat determinarea potențialului de biomasă al plantațiilor de viță de vie. S-au recoltat coarde de la soiurile pentru vin, şi la diferite date, pe*

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durata repausului plantei, pentru a stabili evoluția umidității acestora. Probele au fost preluate din plantația din cadrul Stațiunii Didactice a Universității de Ştiințe Agricole „Ion Ionescu de la Brad” din Iaşi, ferma „Vasile Adamachi”. Soiurile luate în studiu au fost: Busuioacă de Bohotin, Cabernet Sauvignon, Fetească Alba, Fetească Neagră, Fetească Regală, Muscat Ottonel, Pinot Noir şi Sauvignon Petit. În urma cercetărilor efectuate s-a constat că umiditatea coardelor este diferită în funcție de soi şi data recoltării.

Cuvinte cheie: coarde de viță de vie, umidități.

INTRODUCTION

Reducing greenhouse gas emissions by 20% (compared to 1990 levels), increasing the use of renewable energy by 20%, improving energy efficiency by 20%, and achieving a share of 10% from renewable sources in the transport sector, represents some of the major objectives of the European Union in terms of energy production and environmental issues by 2020 (European Union. Directive 2009/28 / EC of the European Parliament and of the Council of 23 April 2009 on the Promotion of the Use of Energy from Renewable Sources; European Union: Brussels, Belgium, 2009). In the same idea, in order to stimulate the development of second generation biofuels for transport, and to minimize the impact on the climate, the European Commission has proposed limiting the use of food biofuels from 10 to 5% (European Commission. New Commission Proposal to Minimize the Climate Impacts of Biofuel Production; European Commission: Brussels, Belgium, 2012). This has led to an increase in interest for raw materials from agricultural and industrial processes that do not directly interfere with food production (Psomopoulos *et. al.*, 2014).

The use of these agricultural residues (straw, hay, branches from cutting trees and vines, waste eco-friendly green etc. can bring huge benefits, including reducing greenhouse gas emissions, increasing energy efficiency, or lower overall costs of biofuel production (Pari *et al.*, 2014; Neri *et. al,* 2016).

To achieve these goals, the use of biomass waste is aimed at. At the global level, biomass is a primary carbon source alongside other renewable energy sources. It can be used as a raw material to produce energy, solid biofuels with high energy value or biochemical fuels, necessary for carrying out economic activities. Thus, at present, biomass contributes about 12% to the primary energy production in the world, and in the developing states it occupies 40-50% of the energy supply needed. Recent statistics have shown that in 2017 global primary energy consumption increased to 13.5 billion tons of oil equivalent, which represents about 565 EJ, with an increase of 1.7% per year (Pradhan *et al.,* 2018).

In this context, the demand for renewable energy becomes unavoidable, biomass representing an inexhaustible reserve and an important energy resource. The vine is a liana that, without the intervention of the horticulturist, has the tendency to climb from year to year to the top, fading to the base, the undesirable consequence being the excessive development to the detriment of the fruit, the production being thus affected. Cutting the cords keeps the vineyards healthy and productive, this physical process influencing the taste and quality of the wine. Due to the large areas of vines present in Romania, every year a large amount of plant residue is represented by ropes and stubs. They are suitable for burning due to their high cellulose and hemicellulose content. Advanced studies already show that the use of other vegetable residues during the production of wine with high fuel potential is worth considering, and here we refer to the pulp, bark and seeds of pressed fruits. These are characterized by a high concentration of residual oil, an important criterion that can positively influence the calorific value of the fuel produced (Brunerova and Brozek, 2016).

Cutting residues, generally, do not represent a resource for farmers, but on the contrary, an additional cost because the elimination of the residues of vines usually consists of crushing and burying them or burning them (Duca *et al.,* 2016). Regardless of the solution chosen, the implications are negative, burial of the residues affecting a crop of vines already damaged by pathogens in the trunk (aging culture), and the burning of the residues affects the environment through emissions released into the atmosphere or the increased risk of fires. The remains of cuts of the vine ropes can be used in the form of chips or pellets for burning in small, medium and large boilers (Duca *et al.,* 2016).

The term biomass is a generic term attributed to biodegradable and non-fossilized organisms, usually produced directly or indirectly through photosynthesis and used as raw materials for the production of fuels and chemicals.

MATERIAL AND METHOD

In 2018, biomass samples were taken from the ropes obtained from the dry cutting of vines from the old plantation, from the didactic resort of the University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad" of Iasi. Horticultural Farm no. 3 "Vasile Adamachi". The aim was to determine the humidity of the varieties studied.

The vineyard plantation covers an area of 12 ha. The distance between the rows is 2.3 m and between the rows 1.2 m. The plant management system is semi-high, the production elements are located on 60-80 cm high stems, and the cutting system is mixed, the production and replacement elements are being placed on bilateral unilateral cords.

To fulfill the stages necessary for the experiences, vine ropes were cut, depending on the variety (Busuioaca de Bohotin, Cabernet Sauvignon, White Feteasca, Black Feteasca, Royal Feteasca, Muscat Ottonel, Pinot Noir, Sauvignon Petit.

The actual cutting was done with the manual scissors and the folding saw (occasional) removing approximately two strings of wood from each cuttings on each row. After cutting it was done the labeling of the chords according to the varieties and their assembly in turn. After completing the cutting of the strings for each variety, they were transported and stored in the hall within the mechanization department.

The laboratory experiments aimed to determine the percentage of moisture of the chop obtained from the biomass from the vines. Immediately after the ropes of vines were transported to the protected space within the mechanization chair, they were chopped with the help of a ram chopper, CARAVVAGI BIO 90 (fig. 1). In order to obtain as finely chopped samples as possible, in order to determine the percentage of humidity, a prior screening of the chisel was performed using a screen with small holes (fig. 2).

Fig. 1 CARAVVAGI BIO 90

Fig. 2 Sieve with small holes

After sifting, the fine chop was evenly distributed with the aid of a balance (fig. 3) and inserted into the aluminum capsules that we placed in a forced ventilation oven (fig. 4). The drying was carried out at a temperature of 1050 C, for about 12 hours, without being influenced by factors from the environment (temperature, atmospheric pressure and humidity of the ambient air, etc.). Initially, each capsule was weighed without content (country) and the obtained data recorded in a personal database. The capsule weighing was also performed with a chop, a final weighing being done after drying the sample, in order to determine the humidity. After each weighing, the data obtained were recorded for further processing and determination of humidity. The moisture content in dry basis represents the ratio, expressed as a percentage, between the mass of water present in the solid biofuel and the mass of the same sample in the dry state.

$$U= (m-m_0) /m_0 \times 100 \ (\%)$$

wherein: m is the mass of the sample before drying (in the natural state), g; m0 - mass of the same sample after drying to a constant value, g.

Fig. 3 Analytical balance Kern ABJ 220-4NM, 220 g

Fig. 4 Samples subjected to drying in the oven FD 53 model with forced ventilation

RESULTS AND DISCUSSIONS

From the obtained data (tab. 1) it follows that the humidity of the strings is different, depending on the variety and the date of harvest. We note that the lowest percentage of humidity in January was obtained in the Fetească Neagră variety of 43,141%, and the highest in the Fetească Albă variety of 49,272%. In February, the lowest percentage of humidity was recorded in the Cabernet Sauvignon variety of 48,468%, and the highest in the Fetească Albă variety of 51.603%. For March, the lowest percentage of humidity was registered in the Sauvignon Petit variety of 46.928%, and the highest in the Feteasca white variety of 54.198%.

Regarding the determination of the chemical composition, a comparative analysis was followed between the eight varieties of vines (Busuioaca de Bohotin, Black Feteasca, White Feteasca, Royal Feteasca, Savignon Petit, Muscat Ottonel, Pinot Noir and Cabernet Sauvignon) determined in within the specialized laboratory of ICIA Cluj-Napoca.

Table 1

The percentage of moisture of the vine ropes resulting from the cutting in the dry

Varieties	JANUARY (%)	FEBRUARY (%)	MARCH (%)
BUSUIOACĂ DE BOHOTIN	47.810	49.827	53.736
CABERNET SAUVIGNON	45.184	48.468	51.796
FETEASCĂ ALBĂ	49.272	51.603	54.198
FETEASCĂ NEAGRĂ	43.141	49.351	53.199
FETEASCĂ REGALĂ	47.515	49.419	51.990
MUSCAT OTTONEL	47.152	49.587	52.405
PINOT NOIR	48.741	51.019	53.046
SAUVIGNON PETIT	43.217	50.754	46.928

Table 2

Protein content of biomass samples

Biomass samples	N (%)	C (%)	H (%)	O (%)	S (%)	Protein (%)
Sauvignon Petit	1.60	43.1	6.23	45.6	<0.01	10.0
Pinot Noir	0.85	43.9	5.83	46.0	<0.01	5.3
Fetească Regală	0.87	44.0	5.66	46.2	<0.01	5.5
Busuioacă de Bohotin	0.84	43.6	5.89	45.9	<0.01	5.2
Muscat Ottonel	0.90	44.1	6.05	45.6	<0.01	5.6
Cabernet Sauvignon	0.90	43.9	5.98	46.2	<0.01	5.6
Fetească Neagră	1.00	43.8	5.84	45.3	<0.01	6.2
Fetească Albă	1.00	44.6	6.14	45.2	<0.01	6.3

Carbon, hydrogen and sulfur content was determined using a Flash EA 2000 CHNS / O analyzer (Thermo Fisher Scientific, USA) according to ISO 10694: 1995 (Soil quality - Determination of organic and total carbon after dry burning (elemental analysis), ISO 13878: 1998 (Soil quality - Determination of total nitrogen content by dry combustion ("elementary analysis") and ISO 15178: 2000 (Soil quality - Determination of total sulfur by dry combustion) (Tenu *et al.* 2018). The results presented in table 2 show that all samples contained high carbon (C) and oxygen (O), which are in accordance with data reported by El (Achaby *et al.* 2018) for elementary analysis of vines in the SupAgro region of

Montpellier (France). Elemental analysis showed that carbon varied from 43.1% in Savignon Petit to 44.6% in Feteasca Alba, while the hydrogen content ranged from 5.66% in Feteasca Regal, to 6.23% in the sample Sauvignon Petit. Biomass is rich in organic carbon, but low in nitrogen.

All samples contain protein (Sauvignon Blanc has the highest protein content (10%). The S content was below the detection limit in all analyzed samples.

CONCLUSIONS

1. The moisture obtained from dry cutting depends on the variety of vines.
2. Humidity differs depending on the harvesting period.
3. Plant biomass is the most valuable component of renewable energy resources due to the carbon cycle process.

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