RESEARCHES REGARDING THE USE AS A BIOMASS OF THE BRANCHES RESULTING FROM ORCHARD PRUNING OF DIFFERENT SPECIES OF TREES

CERCETARI PRIVIND UTILIZAREA CA BIOMASA A RAMURILOR REZULTATE DE LA TĂIERILE DE FRUCTIFICARE DE LA DIFERITE SPECII DE POMI FRUCTIFERI

DUMITRACHI P.E. [1]*, CORDUNEANU Raluca Oana[1], BĂETU M.[1], CÂRLESCU P.[1], ȚENU I.[1]

*Corresponding author e-mail: dumitrachi.emanuel@yahoo.com

Abstract. *Biomass is the most abundant renewable resource on the planet. This includes absolutely all the organic material produced by the metabolic processes of living organisms. Biomass can be used in the form of solid or liquid fuels, being used both for direct combustion, for space heating, and for liquid biofuel (bioethanol) for supply the thermal engines. The research carried out had as an objective the collection of the branches resulting from the fruiting cuts from the varieties of apple, hair, cherry and plum, located in the plantations of the Experimental resort from the USAMV Iaș i, Farm "V. Adamachi", and the determination of the calorific power for each category of fruit trees. From the analysis of the results it appears that the calorific power is different from one species to another, as well as depending on the variety of the respective species. Also, the energy value of the harvested branches is high, being close to that of firewood, which allows us to specify that they can be valued as biomass, constituting an important renewable source of solid biofuel, which can be used in the form of pellets and lighters.*

Key words: fruit trees, calorific power.

Rezumat. *Biomasa reprezintă resursa regenerabilă cea mai abundentă de pe planetă. Aceasta include absolut toată materia organică produsă prin procesele metabolice ale organismelor vii. Biomasa poate fi utilizată sub formă de combustibili solizi sau lichizi, fiind folosită atât pentru arderea directă, la încălzirea spațiilor, cât şi ca biocombustibil lichid (bioetanol) pentru alimentarea motoarelor termice. Cercetările efectuate au avut ca obiectiv colectarea ramurilor rezultate de la tăierile de fructificare de la soiurile de măr, păr, cireş şi prun, aflate în plantațiile de la Stațiune Experimentală din cadrul USAMV Iaşi, Ferma "V. Adamachi", şi determniarea puterii calorifice pentru fiecare categorie de pomi fructiferi. Din analiza rezultatelor reies că puterea calorifică este diferită de la o specie la alta, precum şi în funcție de soiul speciei respective. De asemenea, valoarea energetică a ramurilor recoltate este ridicată, fiind apropiată de cea a lemnelor pentru foc, ceea ce ne permite să precizăm că acestea pot fi valoricate ca biomasă, constituind o sursă regenerabilă importantă de*

[1]University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

biocombustibil solid, care poate fi utilizat sub formă de pelete şi brichete.
Cuvinte cheie: pomi fructiferi, putere calorifică

INTRODUCTION

Biomass is the third largest source of primary energy in the world after coal and oil, being the main source of energy for more than half of the world's population and providing approximately 1.25 billion toe (tones of oil equivalent) of primary energy, or about 14% of the world's annual energy consumption (Purohit, 2006; Zeng, 2010).

The main sources of biomass are agricultural and forestry residues, energy crops and organic waste. These sources have been relatively widely used in the EU for a long time, and future growth in biomass production should be linked to more intensive use of energy crops (van Dam *et al.,* 2007). Lately, biomass has been used more and more in energy production, in cogeneration plants, that is in combined heat and energy production. Combined heat and energy generation represents a very valuable potential for significant improvements in overall fuel efficiency. There are different estimates of the potential and role of biomass in the global energy policy of the future, but all current scenarios give biomass an increasing role in energy consumption and predict its significant growth.

MATERIAL AND METHOD

In 2018, biomass samples were taken from the branches obtained from the dry cutting of fruit trees from the didactic resort of the University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad" of Iaşi, the Horticultural Farm "Vasile Adamachi" ". The aim was to determine the humidity of the varieties studied.

The plantation of fruit trees, from which *biomass was harvested, is located on a land that is characterized by the following pedoclimatic* parameters:

• the relief and the micro-relief of the terrain are differentiated by positive and negative forms formed by large plateaus;

• the soil is a slope chernozem, clayey, formed on loessoid clay;

• the texture is different in profile, in the horizon up to 30 cm it is clay or clay-clay, in the horizon 30-50 cm it is only clay and in the depth it is sandy;

• the structure is good due to the high content in humus, being medium glomerular, well developed in the horizon up to 30 and with moderate development in the other horizons not being present specific structural aggregates;

• the climate has a pronounced temperate-continental character, due to the geographical position, the characteristics of the relief and the influences of the Atlantic and Siberian anthropic, which integrate it between the moderate-continental climate of the Central Moldavian Plateau and the excessively-continental one of the Moldavian Plain.

• the distance between the rows is 3.4 m and 1-1.5 m between the trees in a row.

The actual cutting was done with the manual scissors and the folding saw (occasional).

After cutting the branches were labeled (fig. 1) according to the varieties and their assembly in turn. After completing the cutting of the branches for each variety, they were transported and stored in the hall within the mechanization department.

Fig.1 Labeled branches

Immediately after the ropes of fruit trees were transported to the protected space within the machining department, they were chopped with the help of a ram chopper, CARAVVAGI BIO 90 (fig. 2). In order to take as finely chopped samples as possible, a prior screening of the chisel was performed using a screen with small holes (fig. 3).

Fig.2 CARAVVAGI BIO 90

Fig.3 Sieve with small holes

After sifting, the thin chisel distributed in aluminum capsules inserted into 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 (fig. 5) followed with a chop, the last 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.

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

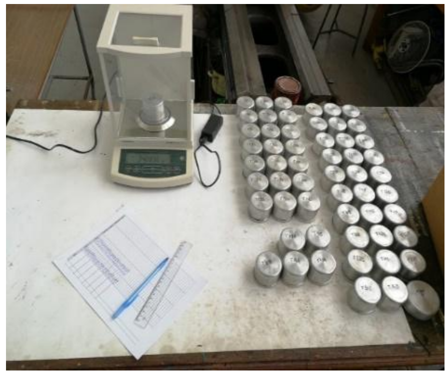

Fig. 5 Analytical balance Kern ABJ 220-4NM, 220 g

The calorific power (the heat of combustion) superior and the inferior of the collected samples was determined in the specialized laboratory of ICIA Cluj-Napoca. Higher calorific power is the amount of heat developed by combustion, when all the water vapor produced in the combustion process is condensed and condensation heat is recovered. The lower calorific value of a solid fuel unit represents the amount of heat developed by combustion, without considering the condensation of water vapor produced in the combustion process. The two components of combustion heat were determined using standard methods.

The gross and net calorific value of the samples were performed using a Parr 6200 Isoperibol calorimeter according to DIN 51900-1: 2000 (Determining the gross calorific value of solid and liquid fuels using the calorimetric pump and calculating the net calorific value) and DIN 51900-2: 2003 (Determination of the gross calorific value of solid and liquid fuels).

For each analysis, 1.0 g pellets were used. A nickel ignition wire was contacted with the pellet. The pump was filled with oxygen at 25 ° C and 1.0 cm3 of distilled water was added. The calorimeter was placed in an isoperibol coating with a distance of 10 mm between all surfaces. The calorimeter pump was immersed in a calorimeter and filled with distilled water. The calorimeter casing was maintained at a constant temperature by circulating water at 27 ° C. The gross calorific value of the samples was calculated from the corrected temperature increase and the actual thermal capacity of the calorimeter.

The net calorific value differs from the gross calorific value by the amount of water in the samples prior to combustion, and that formed during the combustion of hydrogen-containing compounds in the gaseous sample at 25 ° C after combustion.

RESULTS AND DISCUSSIONS

To assess the energy level, by harnessing the biomass resulting from the dry cutting of the trees, the amount of dry matter harvested from the surface of one hectare was calculated and the upper and lower calorific values were determined (tab. 1).

Table 1

Calorific power of samples from dry cutting of payments for fruit trees

Nr. crt.	Variety	**Calorific power** [MJ/g]	
		Upper	Lower
1	Idared 1a	18.10	16.56
2	Idared 2a	17.94	16.44
3	Generos 1a	18.25	16.75
4	Generos 2a	12.34	10.84
5	Jonagold 1a	18.02	16.52
6	Jonagold 2a	18.05	16.61
7	Williams R 1a	16.05	14.62
8	Williams R 2a	17.31	15.86
9	Cure 1a	18.38	16.92
10	Cure 2a	17.05	15.59
11	Rivan 1a	19.01	17.61
12	Rivan 2a	14.05	12.62
13	Van 1a	17.27	15.72
14	Van 2a	18.44	16.94
15	Stanley 1a	15.66	14.16
16	Tuleu 1a	18.71	17.23
17	Centenar 1a	15.12	13.55

The upper and lower heat power of the tree branches depends on the variety, having values between 10.84 MJ / kg for the lower heat and 19.01 MJ / kg for the higher heat.

When comparing the calorific value of the fruit tree branches with that of dry firewood, which is between 12.56 MJ / kg and 16.75 MJ / kg, it is found that the values are very close. This fact determines us to appreciate that the biomass resulting from the dry cutting of the fruit tree plantations is very valuable and can constitute an important energy potential for renewable energy resources.

CONCLUSIONS

If we compare the calorific value of the ropes of fruit trees with that of dry firewood, which is between 12.56 MJ / kg and 16.75 MJ / kg, the values are very close.

From the data obtained we observe that the calorific power is different from one especially the other.

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