Results of the First Energetic Willow Crop in Romania

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Abstract *The paper presents the results of the first crop of the energetic willow in Romania: productivity, harvesting, energetic characteristics and utilization possibilities. The culture of the energetic willow in Romania has beginning in 2008-2009. Today the total surface cultivated is about 1000 ha, with a great territorial dispersion. The first mechanical harvesting was made in Poian village, Covasna County, in February 2013, under a 40 ha, using John Deere high yield technology. The culture was a 4 years old and was obtained a production of 50t/ha, with a high humidity of (50-51)%. The chopped willow was storage up in the open air in order to be taken by the customers. The chopped willow obtained by partial harvesting was burned until 2012 in ERPEK boilers with a thermal power of (24÷1000) kW.*

Key words: *Energetic willow, Biomass, Combustion*

INTRODUCTION

In Romania, the energetic willow growing has started in 2008 as an alternative to the forests protection. Over 600 hectares are cultivated in Covasna, Hargita and other Romanian counties. In Harghita was developed a culture of cuttings for seeding. In 2013, February, was performed the first mechanical harvesting with John Deere equipment, 7050 series, in Covasna county, Poian village. The willow of Viminalis species, Tordis variety, was harvested after 4 years due to the economical reasons [1]. The total harvested area was 20 hectares and the average quantity was about 50 t/ha. The harvesting has involved an important truck support doe to the low bulk weight. Figure 1 shows the willow crop before the harvesting.

Fig. 1. *Willow crop*

The willow height was 6-6.5 meters after 2-3 years of growth and about 9 meters after 4 years. The space between two willow rows was imposed by the harvesting equipment. The harvesting equipment was a Klass multifunctional harvester equipped with a harvesting head, John Deere type, designed especially for willow. In the first phase, the John Deere equipment has had a productivity of 1 hectare to 1 hour of work. The willow was leaned first by a fork and then was chopped by a horizontal and vertical knives system, as is shown in Figure 2.

Fig. 2. *Aspect of harvesting willow*

After chopping the willow was loaded by means of a pneumatic system. Usually the harvesting is done in the winter months, when the willow vegetation is stopped, and the frost contributes to the wood drying. The willow chopped aspect is shown in figure 3 during the drying period. The chopped dimensions were characterized by the following scalpers: 10% on the 20 mm and 0 on the 30 mm shakers

Fig. 3. *The chopped willow*

WILLOW PHYSICAL AND ENERGETICALLY CHARACTERISTICS

The wet willow sample was analyzed in the Classical and Nuclear Thermo Mechanical Equipment Department laboratory of the Politehnica University of Bucharest. The average moisture of harvested material was about 51-50 % and the amount of ash was between 0.6 - 0.8 %. Dry periods are the most recommended for harvesting.

Large amount of material harvested (wood chips) imposed the storage on an open platform. However, a small amount was deposited on a covered platform. The analyses performed in the laboratory revealed the variation of the energetically characteristics of willow chips, as are shown in figures 4, 5 and 6. The drying process was made in enclosure space. In comparison with the harvesting density of 250 kg/m^3 the density has decreased to a value of 160 kg/m^3, corresponding to an admissible wetness of 20-22% for burning process. The density is also very important for transport equipments and storage volume. The low heat value was for this wetness, 16500-17000 kJ/kg.

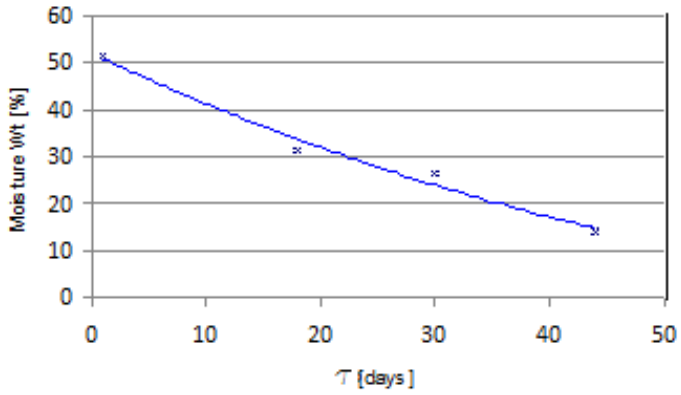

Fig. 4. *Variation of the wetness in time*

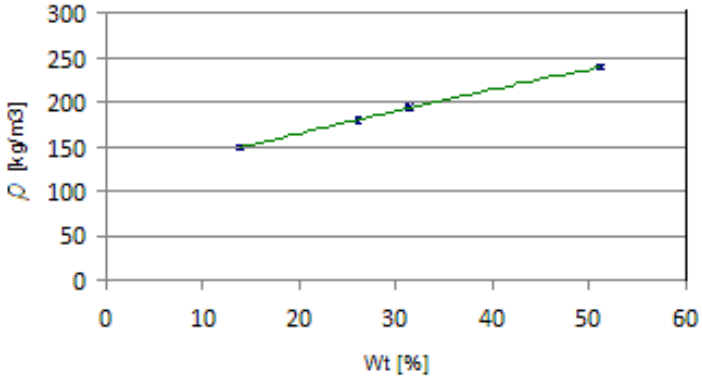

Fig. 5. *Density variation in function of moisture*

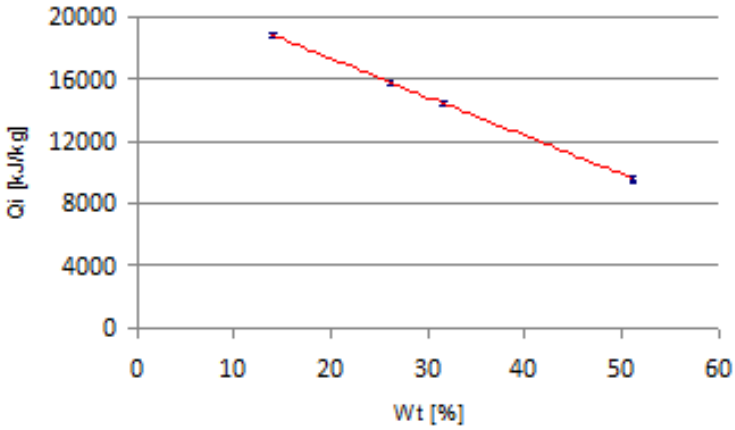

Fig. 6. *Low heat value vs. moisture*

The willow chips are valorized in appropriate combustion installations (boilers). In Covasna county is located a boiler manufacturing company (ERPEK Company) which manufacture thermal boilers (power between 30-1000 kWt). These boilers can burn wood chips and energetic willow with smaller moisture, obvious (usually, between 14 and 22 %). First experience with energetic willow was done in 2013 with willow chips manually harvested in 2011. The combustion part of the boiler is equipped with mobile grates for burning chips willow.

Burning chopped willow tests were accomplished in Politehnica University of Bucharest laboratory, equipped with low thermal power boilers of 40 kW made in Romania by ERPEK (figure 7). The boiler has an integrated system for fuel fluidizing. Two serial feed screws ensure the boiler feeding, as is shown in figure 8. The chopped willow

wetness was 14% and the LHC 17500 kJ/kg. The burning process was very intensive; in figure 9 is presented the image of the flame inside the boiler furnace. The pollutant emissions were under the regulated limits.

Fig. 7. *The 40 kW thermal boilers view*

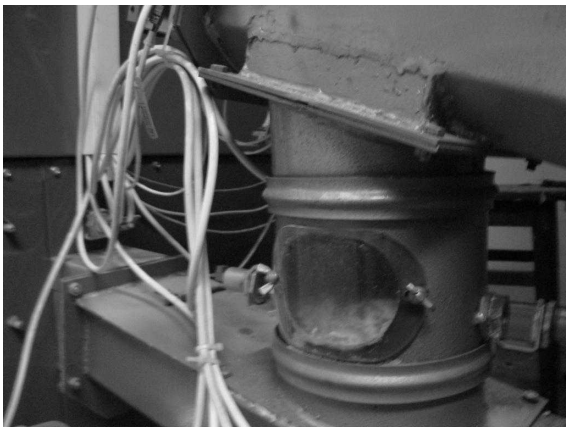

Fig. 8. *The serial screw feeding system*

Fig. 9. *The image of the combustion in furnace*

CONCLUSIONS

The first harvesting of energetic willow was a real success.

The chopped willow LHW was very high and from this point of view is an efficient renewable fuel.

The burning experiments indicate a wetness of the chopped willow under 30%, but the maximum efficiency imposes a wetness of 20-22%.

REFERENCES

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