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POSSIBILITY OF DENDROMASS PRODUCTION ON WOODY ENERGY PLANTATIONS

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Abstract

Much more renewable energy utilized green economy need to build in Hungary, this way avoid for economic dependence. Biomass as a "green energy" could be to the long-term solution. The majority of the biomass is wood-based (i.e. dendromass). One alternative the producing large quantities of wood in short time are the woody energy plantations. We examined in our research past and present situation of woody energy plantations. Energy plantations examination look back more decade, but their area is not significant yet. The biggest area is produce poplars including AF2 and Monviso clones. The results of examinations have proven that with stump diameters between 8-112 mm or 2 90 mm diameters at breast height the tree mass can be estimated, thus the plantation yield can be determined. So can we value the plantation yield without cutting the trees. We examined the relation between the plantations and markets. We established that the dendromass quantity from the plantations is only minimally sufficient to needs of power stations. Finally we analysed that problems which influence the plantations yield and survival.

Keywords

dendromass, energy plantations, tree mass estimation, yield of the plantations

1. Introduction

The annual energy consumption of Hungary is estimated 1000-1100 PJ [6]. With domestic energy production decreasing continuously our dependence on import has been increasing steadily. It would be wiser to build our future on a green economy basing on local renewable resources instead of depending on import-based and incalculable energies.

Our country renewable energy potential would enables that we could meet almost the half of our energy demand. In view of the country ability our possibility long distance is the „green energy". Not only has biomass a significant role in energetics but is an important factor to rural and agricultural development too.

The majority of this biomass is wood-based [1,5]. One of the possibility the fast and large biomass production is energy plantation.

2. Situation of energy plantation in our country

Energy plantations examination look back more decade equally in abroad and our country. Before 2005 had been energy plantations examinations on 50-60 ha. If we had started the energy plantations deployment in 2005-2006 on 5-10000 ha the energy plantation area should grown 60000 ha by 2010. 1 million t/year biomass were produced on this area. (counting 16 t/ha/year) [9].

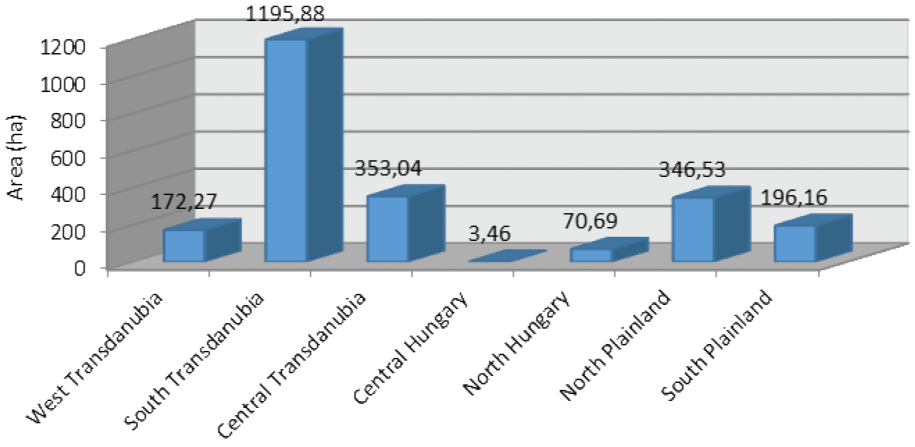

Figure 1. Area of woody energy plantations in Hungarian regions [8]

The first data of energy plantations area we traceable in 2009: 1505 ha [4]. By data of Forest management NÉBIH the announced energy plantations area are in year 2012 2080 ha [7], in 2013: 2338 ha [8].

Analysed the area distrain we can see (Fig. 1.) that the region "South Transdanubia" is prominent, where is found important outlet. (Pannonpower group).

Energy plantations should be installed in a location where the markets are available.

Three species territorial control are significant in our country: poplar, willow, and locust. This species deployment authorized by relevant law. The poplar species have got the most significant area (69%), followed by willows (26%) and standing of the line the locust (5%) (details tab year 2013).

Two Italian varieties territorial control are significant out of poplars: AF2 clone 869 ha and Monviso clone 522 ha. In one respect these varieties adulterant stand by the market and the other hand the yield these clones are greater 10% than the remaining clones. We examined the deployment year of energy plantations (Fig. 2.). Mostly in year 2008 grew the energy plantation area then in year 2012 were a recent deployment wave.

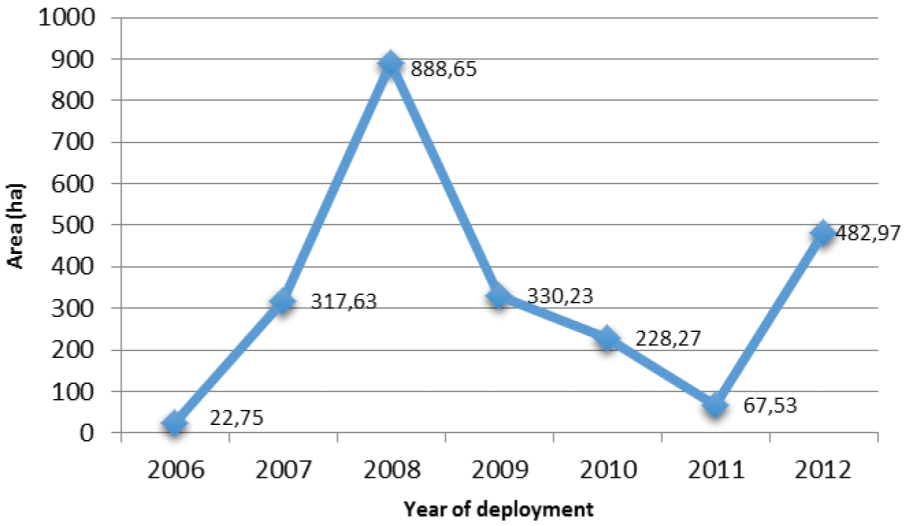

Figure 2. Woody energy plantations deployment yearly 2006-2012 [ha] [8]

3. Yield estimation on woody energy plantation

Because of the lack of yield estimation functions in Hungary, and in order to develop a tool to predict yield we made a suite of own measurements in 36 separate plantations by 19 settlements. Our aim was to collect data for various site conditions. Yield measurements were carried out in each case outside the vegetation period, in AF2, AF6, Monviso, Kopecky, Pannonia, I214 poplar plantations 1-7 years of age. Predominantly AF2, Kopecky and Monviso plantations were surveyed. Measured were 10 m long sections with three replicates for each plot respectively. Taking in account shoot and row space, we measured the diameter at soil surface and breast height (1.3 m) level with mm accuracy, afterwards felling trees on 3x10 m sections and weighing them with an accuracy of 10 g for each.

After ordering data along age and clone type we produced yield graphs. Our measurements were carried out for a range of 8-112 mm diameter at soil surface and 2-90 mm breast height diameter, and they resulted in high correlation yield estimation functions (Fig. 3., 4.). [2, 3].

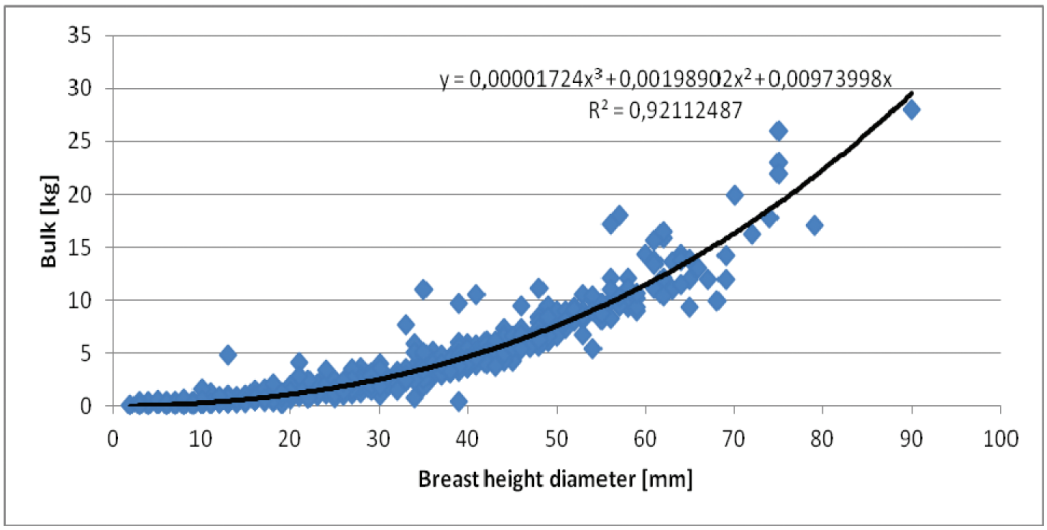

Figure 3. Estimated bulk weight as a function of shoot diameter 1,3 m above ground [3]

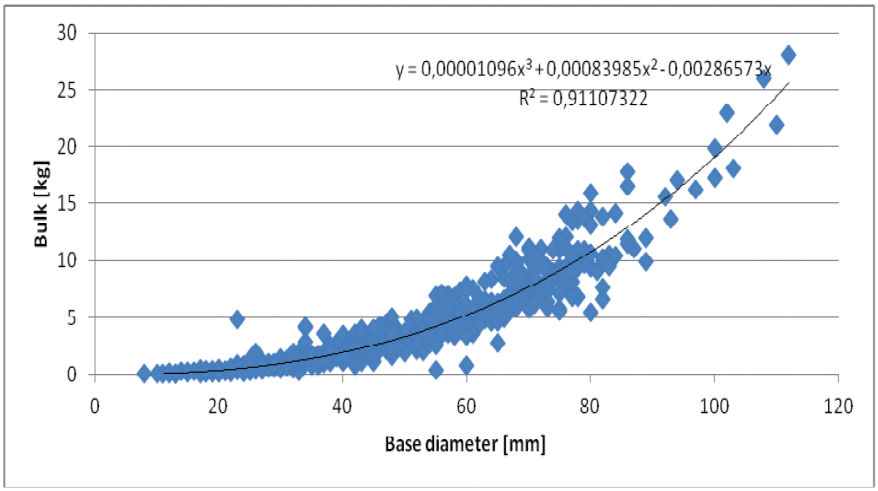

Figure 4. Estimated bulk weight as a function of soil surface level (base) shoot diameter [3]

Chart 1. Comparison of yield estimation results with measured biomass from harvesting in a Kopecky poplar clone plantation by Kiskunlacháza [3]

	1 [t/ha/2year]	2 [t/ha/2year]	3 [t/ha/2year]	4 [t/ha/2year]	5 [t/ha/2year]	6 [t/ha/2year]	7 [t/ha/2year]
	19,03	20,52	18,7	20,02	22,08	19,7	19,6
difference to measurement	-3%	+4%	-5%	+2%	+12%	-0,5%	-

Key to signs: 1 – Yield with base diameter by „Kiskunlacháza" diagram, 2 – Yield with breast height diameter by „Kiskunlacháza" diagram, 3 – Yield with base diameter by „Kopecky" diagram, 4 – Yield with breast height diameter by „Kopecky" diagram, 5 –Yield with base diameter by „global" diagram 6 – Yield with breast height diameter by „global" diagram, 7 – Measure yield after harvesting

Results of the yield estimation method were compared with the total biomass measured after harvesting a 2 years old Kopecky poplar plantation (Chart 1.).

Chart 1 clearly indicates, that there is no significant difference between the estimates and the measured data (maximum deviation 12%), so it was stated that all our yield estimation functions can be used to predict the amount of dendromass.

In case of the plantations of this measurement, with an age ranging from 1-7 years (later already after 3 harvesting), yield estimation functions predict 2 t/ha to 50 lutro-t/ha yearly biomass production (6.600 shoots/ha, 90% planting success).

4. Location matrix of energy power plant and woody energy plantation

Conventional power generation in our country is still largely under central control, the innovative (electrical) power generation is characterized by decentralization, which is running in a smaller scale, at multiple sites, closer to the end-users. As nowadays the decentralized energy production has only a small proportion in Hungary, biomass has often to be transported to big (30 MW) power plants, the profitability of the plantations is limited.

We examined the location of power plants and plantations creating a matrix, from which the different input-output of them can be determined.

We can ascertainable that biomass demand of active power plants in Hungary are (Fig. 5.) 1.500.000t/year, on the woody energy plantation produced biomass satisfy of this 1,3%.

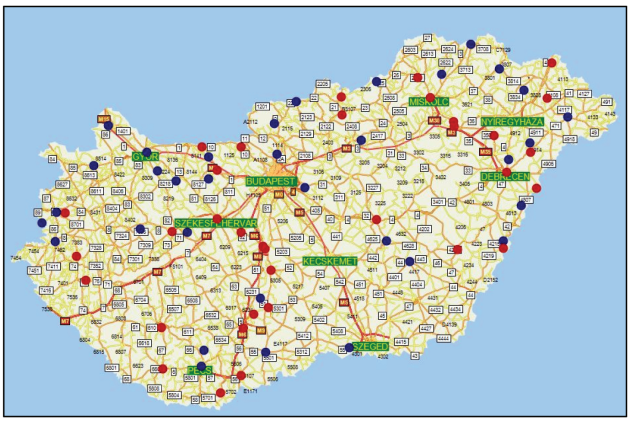

Figure 5. Biomass power plants in Hungary (blue dots=running; red dots=planned) [3]

5. Technologies, difficulties, reasons and consequences in woody energy plantations

The laws gives a large control above the woody energy plantations. It is important to simplify or discontinue the laws.

Based on the experiences in Hungary, the economic efficiency of woody energy plantations largely depends on the attitude of the farmers.

The law doesn't make obligatory the preliminary site. Therefore many case was not the right species/clones for the specific site so we can find several plantations with low productivity or even total failure and the area was ploughed.

Weed control has a crucial role in plantations in Hungary. On sites with limited water supply of the plants, strong weed concurrence can effect tree growth dramatically in a negative sense, even leading to total failure of planting.

In Hungarian energy plantations there is no irrigation, and fertilization activity is low. Rust is the most important disease caused by various fungi of the Melampsora spp., and energy plantation is in some cases effected by the red poplar leaf beetle (Chrysomela populi L.), while pest control is virtually unknown to private farmers. Significant damage occurs only in the first year, from the second growing season stocks are not appreciably effected unless yield is partly decreasing.

In Hungary the significant number of wild game is important for woody energy plantations, red deer and roe deer can cause the highest damage to them. In some registered cases game damage made up to 100%. Fencing can extremely increase the cost of establishment. [2]

Further problems can arise in terms of harvesting, as indeed only few proper machines are available. In the future expected additional investigation and machinery technology adaptation which we can take care of the harvesting optimal and economically. Difficulties, reasons and consequences in energy plantation are summarized in Fig. 6.

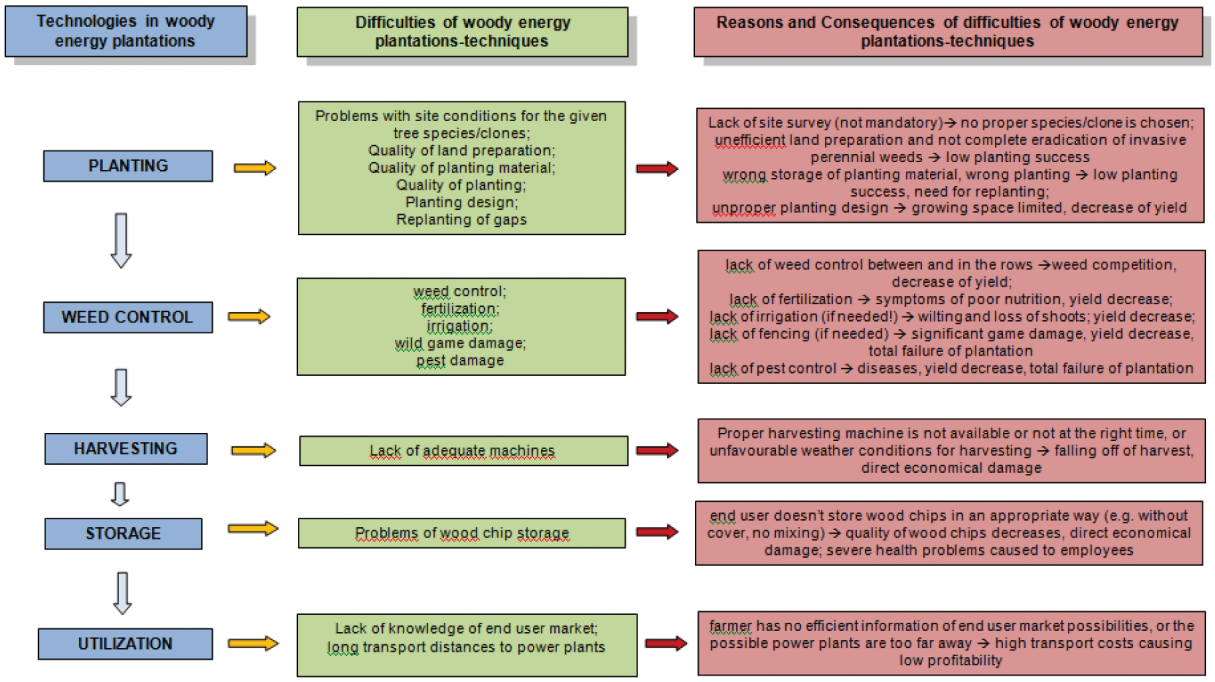

Figure 6. Technologies, difficulties, reasons and consequences in energy plantation [3]

6. Conclusion

We can establish the result of research that increase of woody energy plantations area would be needed in coming years in our country. So can the wood energy plantations signify dendromass base for energy plants.

Area increase promote a deliberate economic and legal regulation besides would be needed the supporting incentive and the continuation of the results home machinery development.

Knowledge with woody energy plantation of farmers would be needed increase so they can eliminate the problems and deficiency and extend the yield and age of energy plantations, improve the sanitary status.

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