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PLANTATION OF "ENERGY WILLOW" IN SZABOLCS-SZATMÁR-BEREG COUNTY

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ABSTRACT
One of the basic requirements for energy willow plantations in Hungary is to determine the most suitable areas for such activity. Furthermore, it is necessary to identify the most suitable varieties for the given circumstances and to develop the adequate crop-production technology.
3,9 % of Szabolcs-Szatmár-Bereg County arable land (282.200,00 ha) is a regularly flooded area (27 181,59 ha), of which 1,4 % is left for a fallow (3.171 ha). There are several coherent, wide expanding areas in the county appropriate for growing "energy willow"; e.g.: the floodplains of the Upper-Tisza and the reservoir of the Szamos – Kraszna close (see *Figure 1*, marked in red).
Benefits of decentralized energy production by growing this plant species may play an outstanding role in the life of some settlements or even a whole region, thus reshuffling the attitude of inhabitants towards its environment. However, this is in spite of the fact that most potential biomass and renewable energy resources in general will represent only a minor role in the future of Hungary's energy balance.
The insect damage of the "energy willow" was surveyed. What we have come to establish is that the extent of damage caused by the green willow aphid (*Aphis farinosa* /syn.: A. *saliceti*) is variable, while the following species shall be considered as virus vectors(!): giant willow aphis beetle (*Tuberolachnus salignus* GMELIN), the willow-feeding leaf beetles (*Galerucella lineola* FABRICIUS), imported willow leaf beetle (*Plagiodera versicolor* LAICHARTING). We may expect further pestiferous species too.
We observed that already during the second year such insect communities invaded the "energy willow" plantations which are, on the one hand, typical to willows, and which are, on the other hand, polyphagous insects. We also saw to appear in the plantation the natural enemies of the insect species which damage the willow.

Keywords: „energy willow", Szabolcs-Szatmár Bereg county, potential area, settler insects

INTRODUCTION

Because of the decrease of the fossil energy resources and the threats and unresolved problems of atom energy, efficiency of renewable energy resources are becoming more and more prominent. Despite of the fact that renewable energy resources consumption has a relatively long history, its contribution to the global energy utilization is still fairly moderate. According to the conditions in Hungary in 2003, renewable energy consumption represents a 3.6% partial produce within the total energy use (TAR ET AL., 2005).
In Hungary, out of the "renewable energy sources", the biomass is considered to be one with almost the highest potential. We have excellent natural conditions that make the production and the energetic usage of these resources possible.
Out of the renewable energy sources, biomass is our greatest potential, as Hungary has very good endowments to produce biomass (BAI ET AL., 2005). The size of agricultural land per capita in Hungary is 0.48 hectare. Besides the area necessary for food production (0.3 ha/capita), it is 0.18 ha/capita that could be potentially suitable for energy plant production.
A plant species bearing outstanding energy-providing qualities amongst biomass energy resources is "energy willow" (*Salix viminalis* L.).

The big regions of Szabolcs-Szatmár-Bereg County, such as the riverside and watered areas of the Nyírseg, the Szatmár and the mangled Bereg are really appropriate for willow growing (SIMON, 2000). Since the willow is not particular about soil, though its nutrient demand is not very well known as yet, it is likely to be successively grown in these areas.
The *Salix viminalis* L. is not a new plant in this region. A less extended production of it was already general previously, as it was widely used for wickerwork and for the spinning of other home devices.
As botanically seen, the ”energy willow” is a grain-flowered, dicotyledonous, dioecious, insect pollinated, wooded plant. It is deciduous and has cylindrical sprouts. The leaves are lanciform and are in a diffused position (BORHIDI, 2003). This species is among the most quickly growing ones. Its sprout may grow 3-5 cm per day. In the first year, it can reach a height of 3 – 3.5m, whereas its yield might reach an average 8-10 t/ha. After the 3rd year the productivity can reach 20-40 t/ha.
The willow's cropping technology is being established in our country. One of our tasks is to work out the adequate pest control.
Croplands covered in spring melt waters reached 200,000 ha in Hungary. This regular problem results in great losses for agriculture in every year. It is a major problem to find the right crop and land use system for these lands.
„Energy willow” prefers wet, moist conditions and can tolerate flooding waterlogged conditions. Due to its preferences it can be an alternative crop besides the commonly cultivated plants in areas such as riversides, floodplains, waterlogged areas where traditional agriculture is less productive but agriculture is still needed either for environmental purposes or to provide rural population with an alternative income source besides the traditional crops.

MATERIAL AND METHOD

As a first step of exploring the possibilities of making “energy willow” growing part of plant breeding in Szabolcs-Szatmár-Bereg County, we conducted an assessment on the role this plant fulfils among woody energy-growing plants both at a county- and country-wide level.
In order to achieve improvement in the situation of “energy willow” production, we decided to explore those areas which could be suitable for the production of this plant in Szabolcs-Szatmár-Bereg County. Practically all the experts seem to agree that for poor quality lands that are unable to be utilized with food crops in an economic way and can be cultivated – due to the seasonal water coverage – only with a high production risk, growing energy-producing plants on them can be an alternative solution for their use. Therefore, we focused our assessments on two areas: on the poor quality set-aside areas, and on the emergency flood storages between the Szamos and the Kraszna.
Since the history of “energy willow” (*Salix viminalis* L.) production in Hungary began only a few years ago, not every element is clear yet in the production process. Our aim is to carry out studies which could provide us data for the draw-up of a more complex future production technology adapted to the local conditions. Within the framework of this, we initiated different experiments and made observations in “energy willow” plantation of Szalka-Pig Ltd. in Mátészalka.
We paid special attention to the introduction of the insect pests in these large, homogenous plantations with short cutting intervals.
Szalka-Pig Ltd. planted „energy willow” on 17 ha in 2005, and a further 43 ha in 2006. In the last ten days of April, 20 cm long cuttings were planted with 75 x 45-50 cm stem and

bed space in twin rows. They provided a cultivation path between every fourth rows for the production vehicles. During the herbicide treatment in the breeding period they faced up with problems that can hardly be neglected any longer

Our entomological samples were taken in the 50 acres willow (*Salix viminalis* L.) land in Mátészalka, Szalka Pig Ltd. During three occasions of supervisory outings (24. April, 03, June and 25. July) we examined feral pests of the "energy willow". We repeated our examinations four times on 25 one year-old, and 25 two year-old plants per occasions. On each outing we measured the rate of damaging and specified the species of pests.

We also ventured to observe and record imported species, in a perspective of a better professional overview to estimate forthcoming damages. We took photos and notes of the import species, and the damaged area on host plants.

RESULTS

In 2012 the total size of woody energy-producing plantations in Hungary was 6,208.42 hectares, "energy willow" covering 1201,53 hectares out of this, meaning 19.3% of share. The distribution per species varies from county to county. The number of "energy willow" plantations grew in a rapid pace between 2005 and 2008. In 2008 the total size of production areas was 1,476.4 hectares, however, despite the fact that the total area of all woody energy-producing plantations is growing, this was followed by a gradual decrease.

In Szabolcs-Szatmár-Bereg County "energy willow" was grown on 160.2 hectares in 2012. The decreasing tendency in the number of areas included in production is clearly visible in this county, too.

The size of permanently set aside areas in Szabolcs-Szatmár-Bereg County (between 2010 and 2012) was 3,171.17 ha. These arable lands may be – on certain conditions – suitable for growing "energy willow". This gives a twenty times bigger area of the current growing area.

On the basis of our model, on the area of the emergency flood storage between the Szamos and the Kraszna, a land use that would significantly increase the level of production safety, also adapting to the unusual conditions of the storage, could be reached on 1,800–1,900 hectares by including "energy willow" in production. The storage in itself already provides possibility for "energy willow" production on an area of a size almost as big as 2/3 of the arable lands not used for 3 years.

The assessment showed that the average land size of the permanently set aside emergency storage areas between the Szamos and the Kraszna exposed to seasonal floods is fairly small (2.1 ha). Taking size efficiency into account, as well as the fact that unemployment in this region is significantly higher in the national average, we concluded that carrying out certain elements of production technology manually is justified.

During our supervisory outings, we experienced that various types of pests plant themselves in our "energy willow" (*Salix viminalis* L.) plants, and damage it in the course of their feeding. Primarily polyphagous pests and willow-specific insects got planted, of which living is tightly related to it. We establish that this year the dominant pests on 1 and 2 year-old offshoots and branches are the following:

- Imported willow leaf beetle (*Plagiodera versicolor* LAICHARTING). Its young larvae are peeling the leaves in groups between July and September. When grown, they chew irregular holes and pits on the leaf, contaminating it with their black droppings. Their imagos are lacing budding plants' leaves mainly in springtime (*Figure 1*), sometimes to the extent of complete loss of foliage.

- Small willow aphid (*Aphis farinosa* GMELIN /=*A. saliceti* KALTENBACH/) (*Figure 2*). Damages in early spring season after harvesting, at the start of the sprouting time. The loss it makes is not outstanding in terms of economy, however, it is a virus-vector.
- The willow-feeding leaf beetles (*Galerucella lineola* FABRICIUS) (*Figure 3*). Its larva damages all through the breeding season. According to our assumptions it is the most important pest in Szabolcs-Szatmár-Bereg county. The blackish-brown, young larvae start damaging on the end leaves, going downwards. It can even have four generations a year.
- Giant willow aphid beetle (*Tuberolachnus salignus* GMELIN) (*Figure 4*). They appear in the second half of the breeding season at the woody stem of the shoot. Due to their damage in the willow bark, growth of the shoots and twigs is retarded, peelability of the energy willow declines.

CONCLUSIONS

Considering the ecological needs of the "energy willow" and all the natural facilities of the county, proportion of crop lands could be increased about 3.000 – 3.500 ha.
During the plantation process of the "energy willow" (*Salix viminalis* L.) we can establish that the first two production years already came with several willow-specific and polyphagous feral pests planting in the plantation. The nutrition of these pests causes economically significant damage, so it is practical to monitor their living habits, the pace and characteristics of their breeding and the rate of damaging. We can put forward an effective, on-the-purpose pest control on the technological level. Professional pest control is going to be one important chain link in the growing technology of the arable land willow.

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