NEW MACHINES FOR HARVESTING OF SRC IN HUNGARY

(Ergebnissen in die Emtwicklung der Ernte-Technik von Holz-Energieplantagen)

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Recently remarkable changes are took place in the energy demand of Hungary. Either of these important factor is that much more than 70 % of the hungarian energy supply is depended on only imports, which is problemtical from the aspects of economic and strategy.

The other important factor is that in Hungary (first of all correspondence of the EU-connection) the function of the renewable energy is increasing, and the RES of the whole energy consumption of the country increases from the present 3,2% to 7% (by 2010), and we have to increase the RES rate of the eletric power production from the present 0,28% to 3,6%.

Among the renewable energy sources the wood has an important traditional function. This kind of role increase over, even if the funtcion of other renewable energy sources show spectacular increase.

In the traditional, semi-naturel kept forests, the logging will prospectively be 8-9 Mm^3 by 2010. Based on the previous trends about 34-38 PJ/year energybase is available from the lumbered wood.

It can be stated that the traditional forestry can still assure the basic material of the present and the developed wood-chip based heat-centres and power plants, but in addition to the present characteristic of development, we have to count on other sources to assure the basic material of developed capacities (by 2010 60 PJ, respectively by 2020 80 PJ).

In the future the forest cover of Hungary will increase, it can reach the 24% by 2030 (at the present 19%). The increasing of the forest land areas results traditional forests, so in the long run from the 600.000 ha new forest land areas, the present rates of utilization, would have thought (3,3 gross m^3), 10-12 PJ/year surplus energy sources can be developed. This basic material can be produced in 20-25 years, so it is too slow for the energetical development.

Our researches have been extended to the possibilities of the energywood production in the traditional silviculture, and to the dendromass-yield increase with the newest technologies.

It can be stated that the traditional forestry will be a source for the wood basic material for energy purposes in the future too, but the results from the foregoing, it can not satisfy the fast

growing energywood-pretention. Consequently the short rotation intensive coppice (SRIC) and the energyforest can be important source of the energywood in the future.

Experiments and results of research on the short rotation coppice

The production of wood material (dendromass) for energy purposes, has examined by the West-Hungary University, Department of Energetics (Sopron) with the Parképítő joint-stock company, in Tata.

The aims of the experiments:

- in experimental plot, with different tree species network and yield measurements,
- the determination of optimatical frequency of harvesting cycle (rotation),
- and doing some technological researches on mechanization of harvesting and utilization of produced chip for energy purposes.

The experimented tree species: hybrid poplar clones (Populus clones), black locust (Robinia pseudoacacia), willow (Salix sp.), tree of heaven (Ailathus sp.).

In the selection of the species and clones, it was an important consideration, that the stocks, after the tree cutting, sprout very intensively and sprout with great safety. It renders possibly to cut the plantations in every 3-5 years after planting, and thus its longivity (in 25 years) altogether 450-550 m^3 dendromass can be harvested. This quantity is 5-6 times of the available yield of the traditional forest management.

The age of the maturity of so-called minirotation energetical plantations, in the case of hybrid poplar, is 3-4 years, in the case of balck locust, is 5-6 years.

The reached yields of different tree species in the trial plantation:

Tree species	Age (year)	Stumps/ha	kg/m^3	Yield t/ (ha*év)
Hybrid poplar (Poplar ssp.)	5	7800-11000	14,6-27,8	19,5-37,1
Black locust (Robinia pseudoacacia)	4	12 600	13,1	17,5
Willow (Salix ssp.)	1	12 700	3,3	22,1
Tree of heaven (Ailanthus altissima)	4	9 600	12,8	22,0

Energetical wood plantation (2 years old hybrid poplar)

The mechanization of harvesting of energetical wood plantations

For the harvesting of the stand form of the short rotation coppice (energetical wood plantations) and the energy forest several directions technology can be applied:

1. motormaunal felling, chipping with transfer chipper,
2. motormaunal felling, chipping with mobil chipper,
3. walking-chipping as a whole machine,
4. walking-chipping with an adapter, which can be connected to the tractor rear ram,
5. cutting-felling, chipping with mobil chipper,
6. cutting.felling, bundling, chipping in the user.

In the motormanual harvesting light chain saw or petiolate clearing circular saw are predominantly applied. This technology can be recommended for the smaller dimension plantations.

In Hungary harvester machine is being developed for the harvesting of minirotation plantations. With the Optigép Ltd. experiments are started for the development of mechanization of harvesting of short rotation coppice.

The harvesting machine, so-called walking-chipper is suitable for the minirotation wood plantations, which is the economist solution, if it is connected to the tractor TLT.

The walking-chipper with the cutter- and puller structure

There were harvesting test made with the machine. Some important parameters measured during the gathering:

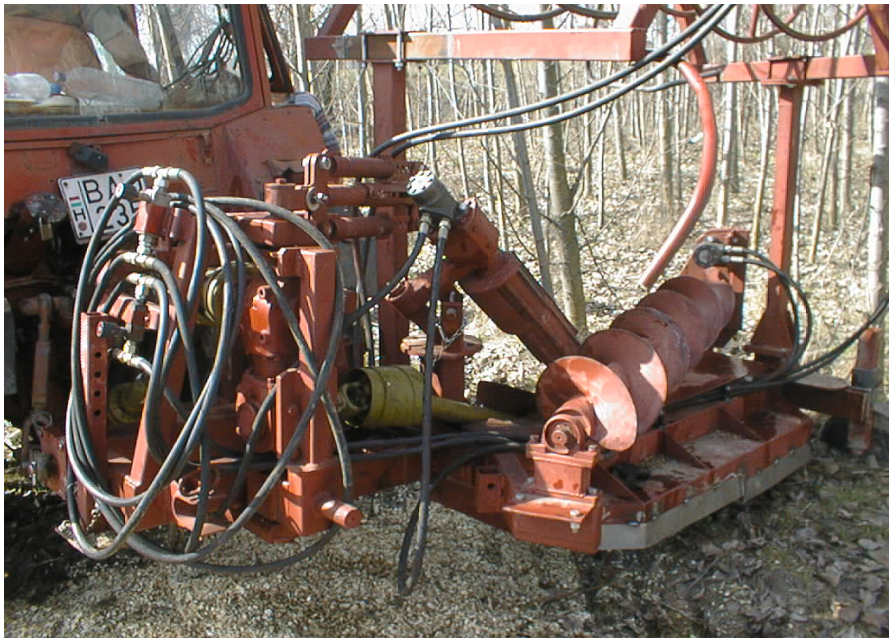
- Pace: 1,5-3 km/h,
- Performance: 1-3 ha per hours, depending on the age of the plantation,
- Flow of material: 9-22 t/,
- Specific energy demand: 30-80 MJ/t.

The harvesting machine, so-called cutter-feller is suitable for the midirotation wood plantations, which is also tested with the Optigép Ltd. The results are promising, since it cut and fell the midirotation plantations, energy forests for the next row, in one motion. The cutter-feller, like the walking-chipper, get the power from the universal tractor rear ram. The cut is made by two circular saw blades, which diameter is 90 cm. The felling of the cut branchy stems are done by two manipulators and one snail.

Some important parameters are experimented during the cutting-felling:

The determined results:

- Pace: 3-5 km/h,
- Performance: 1,5-3,5 ha per hours, depending on the age of the plantation,
- Flow of material: 15-28 t/,
- Specific energy demand: 30-70 MJ/t.



The cutter-feller

Further aims of technology development:

The felled energywood, after the cutting-felling, can be moved in two ways to the power plant or to the heat-centre.

In the either technology the felled branchy stems are chipped by mobil chipper, and after the chip are transported.

In the case of the second and the more advanced technology, the stems are bundled by so-called bundler. In this technology the chipping is made by the user.

The particular of the bundler with the made woodbundle (Timerjack, Finnland development)

On the basis of our experimented results, it can be stated that, on the foregoing performenced walking-chipper respectively cutter-feller technology are reguired further experiments, tests and researches.

Besides further researches are already developed in the case of the energyforest for the bundling technology trying, since in Finnland a few years ago active

energywood bundle – tranport – chipping in the power plant – electrical and heat power technology are economical.

Some important publications connected to the researches:

Ivelics R.: The latest technological result of harvesting of energetical wood plantations. Hungarian Biomass Conf., Performance, Sopron, 2004.

Jung. L.: Woodenergetics and forestry. MTESZ publication, Hungarian Science Day, Eger, 2003.

Marosvölgyi B.-Kovács J.-Jung L.: Analysation of wood basic material-supply possibilities with forestry informatic database applying, MTA-AMB Conf., Proced, Gödöllő, 2004.

Marosvölgyi B.-IvelicsR.: Efficiency analization of energetical utilization of wood fuels. MTA-AMB Conf., Proced, Gödöllő, 2004.

Marosvölgyi B.-Vityi A.: The European standardization process on the biomass utilization for energy purposes, within the frame of Bionorm Project, MTA-AMB Conf., Proced, Gödöllő, 2004.

Marosvölgyi B.-Vityi A.: Use of biomass for energy purposes in Hungary. (Stet of Prospective) Int.Biom.Conf, Budapest, 2003.