

Willow cultivation technology and biomass utilisation in Poland controllare titolo

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Abstract

Energy production in Poland is based mainly on fossil fuels, with hard coal and brown coal predominating. The share of renewable sources of energy on the national level is estimated to be about 7.6%, with solid biomass distinctly dominating at 87.7%. According to national regulations, biomass obtained outside forests, i.e. in agriculture, will in future be an important source of energy. Pursuant to the Regulation of the Minister of Economy of 14 August 2008 (J. of Laws no. 156, item 969) the share of biomass from outside forests, i.e. from field cultivation of energetic plants, in energy production in plants with electrical power higher than 5 MW, in which biomass is co-fired with other fuels, should be at least 40% in 2011 and increase in subsequent years to reach 100% in 2015. The share of biomass produced outside forests and used in CHP systems and in those that burn only biomass, in plants with electrical power exceeding 20 MW, is to increase to 60% by 2017.

Arable land, orchards, meadows and pastures in Poland, occupied about 16.18 million hectares. Forecasted land area for energy production from agricultural sources in 2020 should occupy about 2 million hectares, therein cultivation of rapeseed for biodiesel production shall cover about 500 thousands ha, cereal crops for bioethanol production 600 thousands ha, crops for biogas production 500-560 thousands ha and 500 thousands ha for perennial energy crops. Four plant species in Poland – short rotation willow coppice (*Salix* spp.), poplar (*Populus*), virginia mallow (*Sida hermaphrodita* R.), and giant miscanthus (*Miscanthus x giganteus*) – seem most likely to enter the biomass production market. Among all the perennial plants cultivated in Poland, naturally growing willow enjoys the greatest interest. The area of its cultivation totalled about 6.2 thousand hectares, whereas willow and other energetic plants altogether were cultivated on an area of ca. 10 thousand hectares.

The yield of willow wood dry biomass, obtained in experimental conditions in Poland, is highly variable and ranges from a few to as much as 30 tonnes of dry wood per 1 hectare per year. One of the major factors which determine the future yield is the choice of the appropriate cultivar for planting and another is the choice of soil. Successful cultivation of shrub willows as a source of energy is also determined by proper agronomic practices, from the preparation of the site through subsequent years of plant vegetation. Another very important factor is the duration of the assumed cycle of biomass production – one, two, three or four years – and the density of planting the cuttings.

Extending the harvesting cycle of *Salix viminalis* from annual to triennial results in a significant yield increase compared to annual harvesting. In the conditions predominating in Poland, annual willow harvesting may also be an interesting option due to high fragmentation of agricultural farms and the possibility of deriving an annual income from the sale of biomass. The yield of *Salix* spp. from commercial cultivation on good soils in Poland ranges from 9 to 12 tonnes of dry matter per hectare per year, whereas on poorer soils, which at times may be too dry, the yield is lower and ranges from 5 to 7 tonnes of dry matter per hectare per year.

Willow are harvested in one or two stages. Fresh stems biomass has a moisture of about 50%, whereas the moisture of biomass which is harvested in two stages and seasoned ranges from 20 to 30%.

Willow cultivated in short rotation coppices on agricultural land is used as a chips in individual boilers for heating detached houses as well as for local and municipal heating plants. Moreover, it is co-fired with coal in a power industry for electricity generation. Harvested willow biomass is also processed into a pellet or briquette. However recently it becomes possible to utilize willow biomass for second generation biofuels and various chemicals production in integrated biorefineries.