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Remarkable Economic and Energy-Based Income from a Harvested Poplar Plantation in the South of Sweden

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ABSTRACT

Search for alternative energy sources has been going on in Sweden since the middle of the 70 ties. Energy plantations of different Salix clones are well established and now even poplar plantations start to become of interest. A poplar plantation in the south of Sweden has been harvested with the following results: a woody production above ground of 29 m^3/ha, year. This production gives an economic outcome of 510 US$/ha, year. Efficient Light Absorption Factor (ELAF) for woody biomass production above ground and under bark was 0.6% in this plantation.

Keywords: Poplar, Biomass, Woody production, Economy, Rotation time

SHORT COMMUNICATION

The oil crisis in 1973 and 1979 forced scientists in Sweden to search for alternative sources of energy. The new idea of using fast-growing tree species as effective solar energy collectors began with dense plantations of various willow species on the abundant agricultural land at the end of the 1970s [1]. This initiative was followed by a few plantations of hybrid poplar and hybrid aspen at the beginning of the 1990s in the southernmost part of Sweden [2,3]. One of these 24-year-old poplar plantations, on the Näsbyholm Estate, has been harvested so that the actual economic and energy-based results can be calculated and reported.

The plantation, of the old, hybrid poplar clone OP 42 (*Populus trichocarpa* × P maximowiczii) [4], is located on an organic soil with a good water-holding capacity. It is neither fertilised nor irrigated and is not fenced. The area is 0.8 ha with 720 stems per ha. The mean annual precipitation is 628 mm and mean annual global solar radiation is 973 kWh/m^2.

The trees were lumbered to 8-10 cm at the top and the total stem volume under bark was 467 m^3. The volume of the tops and the branches was estimated as 92 m^3 (this wood was dried in the open air during the summer, chipped in the autumn and used for domestic heating). This means that the total volume of woody biomass produced in 24 years on 0.8 ha was 559 m^3, equivalent to an annual production of 29 m^3 per hectare. The edge effect is compensated for by regulating the area.

We know that 1 m^3 of aspen wood will give about 2000 kWh of heat; or 700 kWh electricity; or 120 L of ethanol (fermentation, efficiency 35%) plus an equivalent amount of energy residual products; or 280 L of methanol (gasification, efficiency 60%) plus small amounts of residual products [5]. With annual global solar radiation of 975 kWh/m^2 and annual above-ground and under-bark woody biomass production of 29 m^3/ha the Efficient Light Absorption Factor (ELAF) for woody biomass production above ground and under bark was 0.6% in this plantation.

The trunks were sold for pulp for 18100$ (1$=8.30 SEK) and the chips will be sold for an estimated 4300$ (Nilsson, per.com.), a total of 22400$ from 0.8 ha. Harvesting, chipping and transport costs totalled 6500$.

This plantation, 0.8 ha and 24 years old, thus provide an income of 15900$. The income calculated per ha and year is 830$.

THE ESTABLISHMENT COSTS WERE

Soil preparation, planting (1100 plant/ha), maintenance 1450 $/ha weed control in the first two years 350 $/ha, total 1800 $/ha.

A 3% interest rate of 1800 for 24 years is 1800 × 1.0324, equal to 3700 €/ha, this gives 150$ per ha and year. The fencing cost for a field [6] calculated in the same way, would be 170 $/ha and year.

Thus the total annual cost per hectare is 150$+170$=320$. The annual income would be 830-320=510 $/ha. For a 5% interest rate, the equivalent income would be 400 $/ha, year

We can ask whether any other forest in our country in the past has yielded such a good return. Similar results have also been achieved for other poplar and hybrid aspen plantations, yet to be harvested, on fertile land in southern and central Sweden [3].

But the most surprising economy yields are to be expected in the second generation, when new shoots emerge from the stump and the roots, so no new planting is needed, and there are no new costs for weed control or fencing [6]. In addition, some results so far suggest that growth will be slightly higher (R. Övergaard and H. Böhlenius, per.com.). Examples of second generation poplar plantations, 9 and 5 years old, 32 and 8 ha, respectively, can be found at Sångletorp and Kadesjö [3] in the most southern part of Sweden.

ADDITIONAL INFORMATION

The article has been language corrected by Dr Margret Jarvis, Edinburgh.

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