Economy of short-rotation production of downy birch in former peat production areas

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Introduction

Peat constitutes 6–7% of the total energy consumption in Finland. By 2020 ca. 40 000 ha of cutaway peatlands will be released for re-use. One after-use option could be to continue energy production, since the demand for biofuels is increasing due to the need for reducing greenhouse gas emissions. Native birch (*Betula pubescens*) is a potential tree species for energy production in Finland. Due to low concentrations of K and P in the residual peat, however, improvement of soil nutrient status is usually required. We studied stand establishment methods and the profitability of biomass production with downy birch on former peat production areas.

Material and methods

Our study consists of four parts. We studied:

1) *Establishment methods* based on field experiments (e.g. natural seeding, broadcast seeding, soil preparation or wood ash fertilization).
2) *The development of coppice stands* after clear-cut.
3) *Biomass production* in naturally established downy birch stands.
4) *Profitability of biomass production* based on bare land value (BLV) calculated for six naturally established stands. Stand establishment costs included the cost of natural or broadcast seeding, wood ash fertilization or mounding, harvesting, chipping and chip transportation. Sales incomes were derived from current price of fuel chips.

Results

Dense downy birch stands can be established naturally or by broadcast seeding, if the soil is fertilized or mineral soil is available to the seedlings due to soil preparation or thin layer of residual peat (Fig 1). Untreated soil remains un-vegetated for a long time. The birches coppiced well after the clear-cuts, and second-rotation stands can be established with coppice shoots (Fig 2).

The total leafless above-ground biomass of naturally regenerated 15–26 years old stands was 47–78 t DM ha^{-1} (Fig 3). Sales revenues from fuel chips covered the cost of harvesting, chipping and chip transportation without subvention in five cases out of six (Fig 4). Biomass production was profitable in terms of bare land value in these cases with an interest rate of 3%, for example (Fig 5). With equal biomass production, shortened rotation achieved with broadcast seeding did not offset the increase in stand establishment costs.

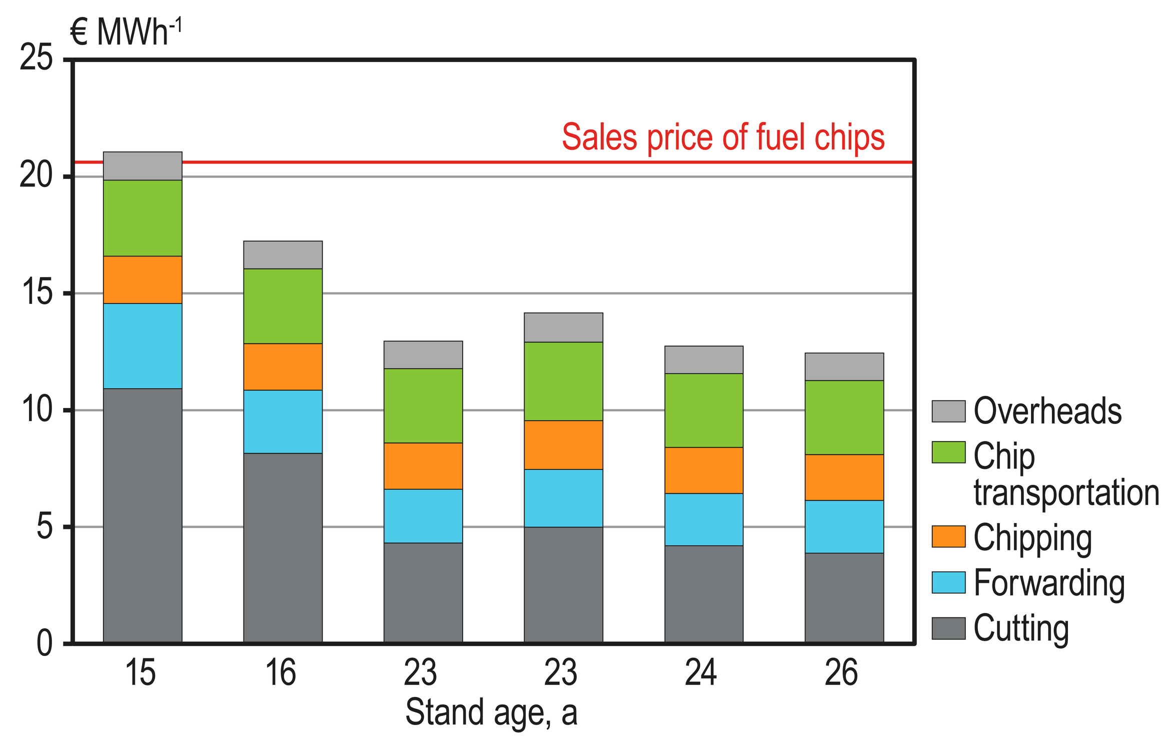

Figure 4. Production costs of fuel chips in the example stands.

Figure 2. A 15-year-old birch stand before clear-cut, when leafless above-ground biomass was 56 t DM ha^{-1} and stand density 30 200 trees ha^{-1} (A). After three growing season the coppice stand biomass was 5.4 t DM ha^{-1} and stand density 107 000 trees ha^{-1} (B).

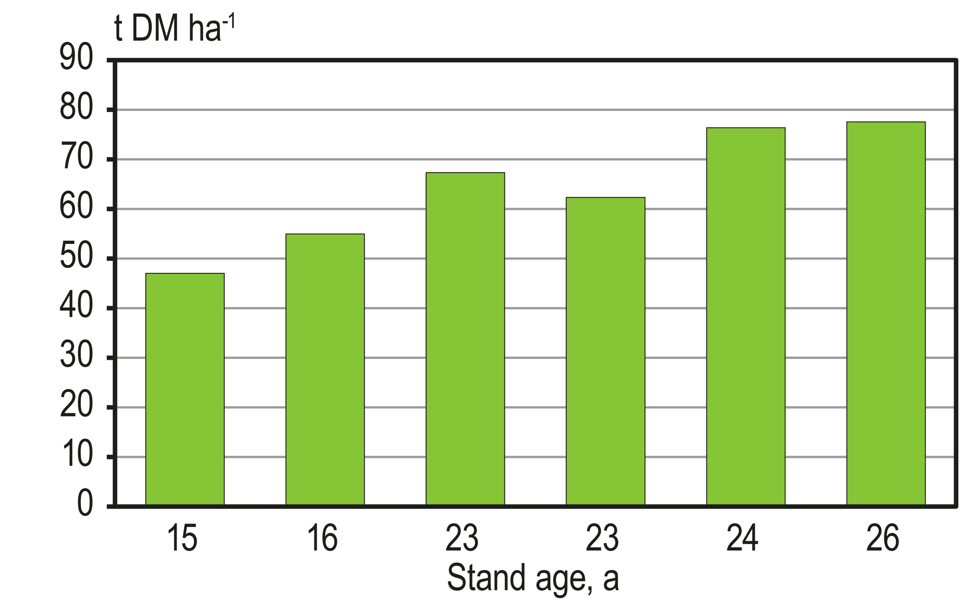

Figure 3. The total leafless above-ground biomass in the case stands.

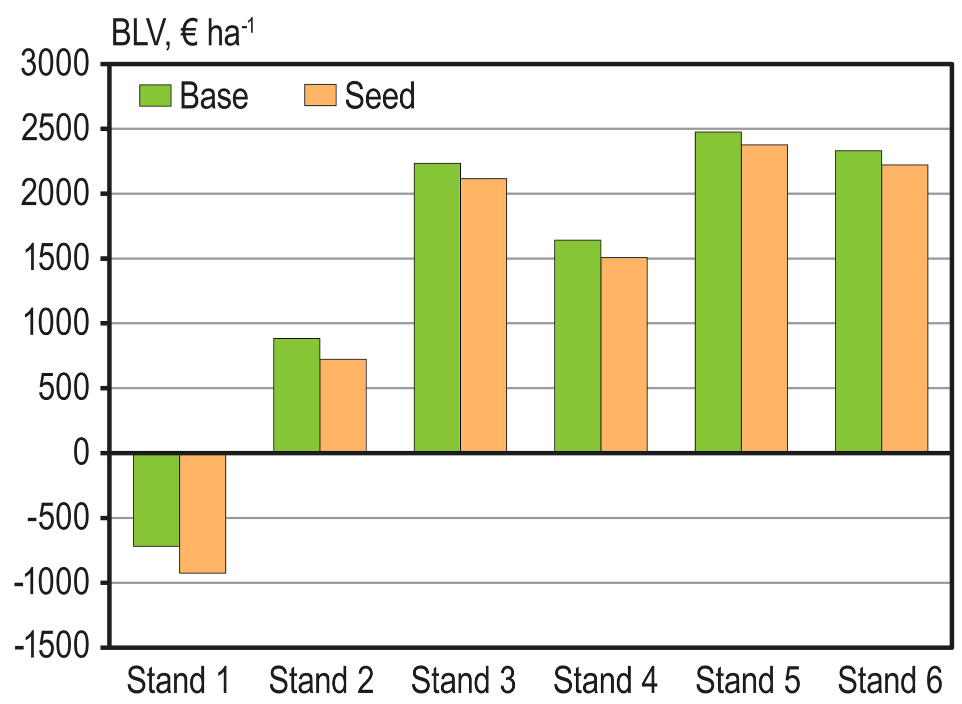

Figure 5. Bare land value (BLV) per hectare with an interest rate of 3% in the case stands.

Figure 1. There is usually scarcity of P and K in the residual peat. Therefore soil remains free from vegetation for a long time (1A). In the right an ash-fertilised plot three years from broadcast seeding. Number of birch seedlings exceeds 100 000 ha^{-1}.

Conclusions

Cut-away peatlands show potential for profitable energy biomass production with downy birch. An annual biomass production of more than 3 t DM ha^{-1} can be achieved with minor investments. However, profitability is sensitive to harvesting cost, which greatly depends on tree volume. Therefore minimum rotation should exceed 20 years.

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