Herbicide-free Establishment of Short Rotation Agroforestry Systems with Different Tree Species - Results from an Organic Field Trial in Bavaria

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Background

One aim of organic agriculture is the minimisation of the use of non-renewable resources. Therefore a more and more important part of the concept of organic farms is to grow renewable energy for their own supply. Due to its high environmental services the cultivation of energy wood according to the principles of agroforestry is particularly suitable. How can short rotation agroforestry systems be established according to the regulations of organic farming and which tree species are suited best?

The study aims to identify methods how to establish and cultivate fast growing trees for woody biomass production without the use of total herbicides in a cost efficient manner.

Objectives and questions

• Growth rate of fast growing tree species
• Weed control

Material and methods

• Site: Experimental farm of the LfL Neuhof (district of Donau-Ries, Bavaria), establishment of the field trial in April 2009
• 2-level factorial strip-plot design, 5 replications
• Tree species (rotation period 7 years, planting distance 1.50 m x 1.25 m): poplar clones 'Max 1', 'Max 3', autochthonous species grey alder, black alder
• Weed control (first year): previous crop grass-clover; soil preparation with plough, rotary harrow; comparison of four different undersown crops to a self-degradable mulch membrane and an untreated control (Fig. 1)
• Investigations: annual determination of average tree height
• Data processing with SAS (PROC GLM)

Results

► Trees showed best growth performance on self-degradable mulch membrane, the undersown crops brought no significant growth advantage compared to the untreated control plot (Fig. 2), but competed weeds efficiently (results not shown).
► Black medic / White clover as legume undersown crops had no positive effect on the growth rate of poplars (non-N-fixing) compared to the alders (N-fixing).
► Final tree height after a rotation period of 7 years: 'Max 3' > 'Max 1' > Grey alder > Black alder (Fig. 3).
► Poplars showed higher increments in the first four years compared to the alders.
► From the fifth vegetation period onwards an increasing growth performance of alders could be observed.

Discussion and conclusions

► Establishing short rotation agroforestry systems under organic farming conditions is possible in southern Bavaria.
► The increasing annual growth rate of alder in 2013 and 2014 indicates that tree growth rate has not yet reached its maximum. Perhaps longer rotation periods -of more than seven years- would lead to a stronger advantage in growth.
► Recommendations for weed suppression are: self-degradable mulch membrane, some undersown crops (False flax, White clover, Rye) or soil preparation only.
► A final suggestion regarding choice of tree species and strategies of establishment can only be given after an economic evaluation of the tree harvest.
► The results could also be applied to conventional agriculture, especially for greening measures in the context of the Common Agricultural Policy (CAP).

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