

Effect of Biochar substrates on tree growth and soil on Windthrow areas and Christmas tree cultures

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Introduction

This study is a part of the joint research project “LaTerra” that is aimed to investigate effects of Biochar substrates on contaminated and poor soils.

In this part of the project the biochar substrates are tested for reforestation of windthrow areas in North Rhine-Westphalia that are result of storm “Kyrill” in the year 2007 and also as an alternative for mineral fertilizers that are used for Christmas tree cultures which are an important economic sector in this region.

Materials and Methods

In this study we are using field trials for tree growth measurements and soil sampling and lysimeter trial for soil- and leachate sampling.

In the lysimeter trial we use the forest soil from the nearby windthrow site and mix it with biochar substrates, which mainly consist of compost with 15 or 30% wood char in it respectively (here referred as BKS15 and BKS30). These substrates were mixed in a top soil with an application rate of 30 t/ha, which is a legally permissible limit, and 60 t/ha respectively. These applications are compared to a control forest soil and pure compost applications of 30 and 60 t/ha. All applications are planted with spruce.

Soil samples are collected twice a year (spring and autumn) and analyzed for plant available nutrients and general parameters.

Leachate is analyzed for dissolved nutrients, especially for nitrate, which is potentially a pollution source for groundwater.

Field trials are established in a windthrow area and on the Christmas tree culture area in the region. On the windthrow area trees were planted in plant holes, which were filled with BKS15 and BKS30 and also with native soil as a control. Test fields were planted with spruce and beeches. On the Christmas tree culture area BKS15 and 30 were mixed into a top soil. Apart from control and pure biochar substrate application there are applications with combined biochar substrate and conventional fertilizers here. Test fields were planted with Nordmann fir.

On the windthrow area Christmas tree culture test fields the tree growth is measured twice a year (spring and autumn). On the Christmas tree culture field soil samples are also taken and analyzed for same parameters as in lysimeter trial.

Results and outlook

Results of the lysimeter trial suggest, that biochar is on one side playing an important role in nitrogen mobilization and on the other side is preventing leaching of great amounts of nitrogen. The regulation of nitrogen cycle is arguably the most important feature of biochar amendment to soil.

The measurements also show, that biochar is stable in soil as its mixing is not causing an increase in leachable carbon fraction.

Tree growth measurements to this time only show significant differences on the windthrow site, where we see a greater length growth on control site, and greater growth on BKS30 against BKS15 test field respectively. It is definitely too early to make conclusion at this point as trees are only now coming in the stage of sufficient growth after the root adaptation phase. In the next steps we expect the possibility of detecting the vitality of trees through chlorophyll- and needle weight measurements and also sampling of needles and leaves for nutrients measurements as it can give a direct indication of nutrition state.