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Successful implementation of biochar carbon sequestration in European soils requires additional benefits and close collaboration with the bioenergy sector

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Biochar soil application has been proposed as a measure to mitigate climate change and on the same time improve soil fertility by increased soil carbon sequestration. However, while on tropical soils the beneficial effects of biochar application on crop growth often become immediately apparent, it has been shown to be more difficult to demonstrate these effects on the more fertile soils in temperate regions. Therefore and because of the lack of carbon credits for farmers, it is necessary to link biochar application to additional benefits, both related to agricultural as well as to bioenergy production.

Thermal gasification of biomass is an efficient (95% energy efficiency) and flexible way (able to cope with many different and otherwise difficult-to-handle biomass fuels) to generate bioenergy, while producing a valuable by-product – gasification biochar, containing recalcitrant carbon and essential crop nutrients. The use of the residual char product in agricultural soils will add value to the technology as well as result in additional soil benefits such as providing plant nutrients and improving soil water-holding capacity while reducing leaching risks.

From a soil column (30 x 130 cm) experiment with gasification straw biochar amendment to coarse sandy subsoil increased root density of barley at critical depths in the soil profile reducing the mechanical resistance was shown, increasing yields, and the soil's capacity to store plant available water. Incorporation of residuals from a bioenergy technology like gasification show great potentials to reduce subsoil constraints increasing yield potentials on poor soils.

Another advantage currently not appropriately utilized is recovery of phosphorus (P). In a recent pot experiments char products originating from low-temperature gasification of various biofuels were evaluated for their suitability as P fertilizers. Wheat straw gasification biochar generally had a low P content but a high P plant availability. To improve the fertilizer value while keeping a high carbon content in the char, the gasification of a combination of sewage sludge and wheat straw was implemented, resulting in a char product with a promising performance as a fertilizer and soil amendment.

To implement gasification-biochar as a promising soil improver on the marked, independently of potential carbon market developments and CO_2 certificates, stakeholder involvement is strongly required. In a newly established project consortium Bregentved Estate (one of Europe′s largest agriculture companies) and the DONG Energy company (one of the leading energy groups in Northern Europe) are in a joint effort trying to integrate the economic matrix of i) biomass needed for bioenergy, ii) profit from energy generation and iii) soil advantages gained from biochar application. Experiments are conducted with a 6MW biomass gasification demonstration plant producing straw biochar used in field plots (12 m x 250 m).