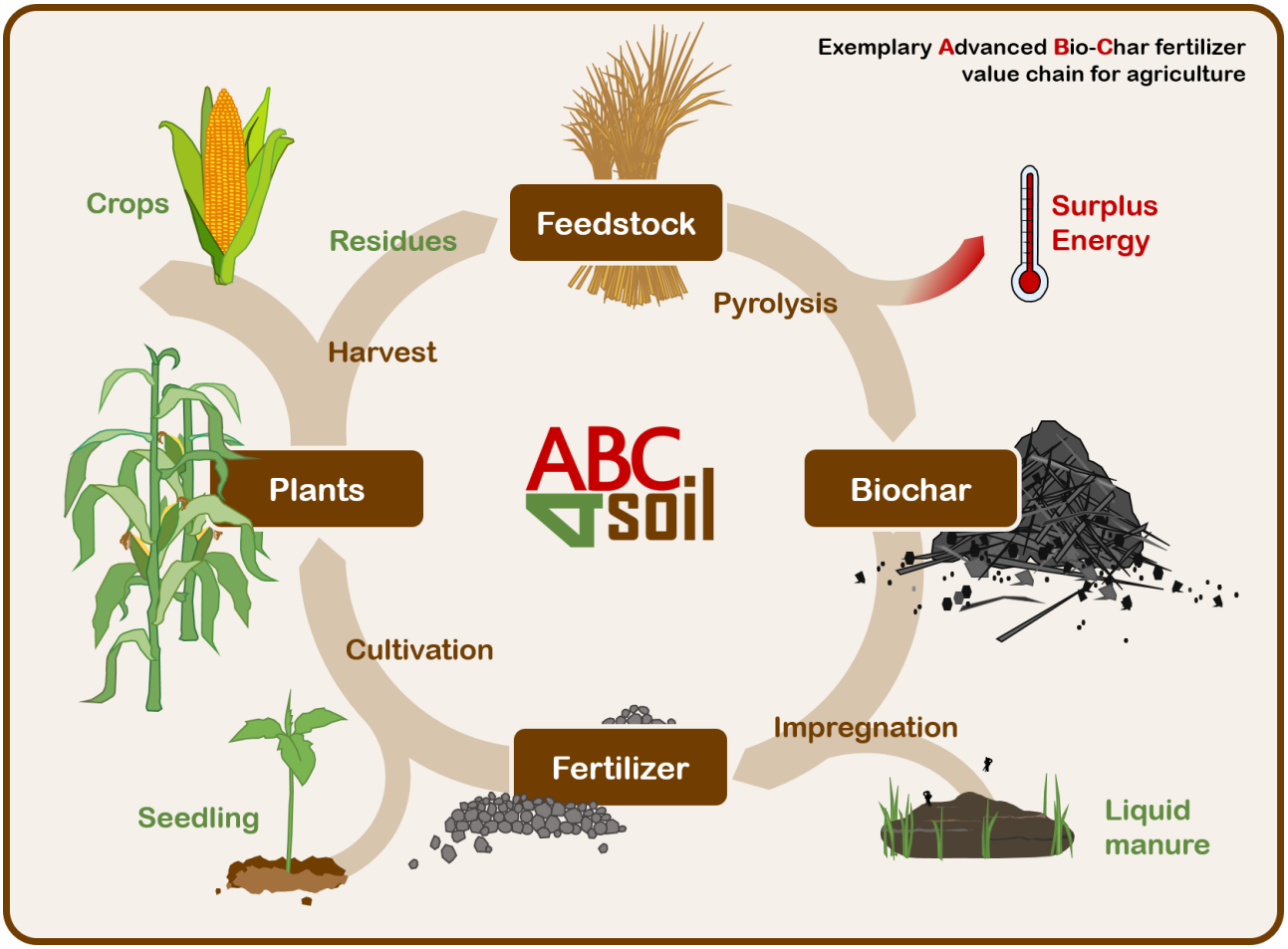
ABC4Soil

ADVANCED BIOCHAR FERTILIZERS FOR MULTIPLE ECOLOGICAL BENEFITS IN SOIL CONDITIONING



1° Call:	2017
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Topic:	Production of biochar-based fertilizers from locally available resources and application of the fertilizers in agriculture, forestry and urban planting.
Keywords:	Biochar, Pyrolysis, Charcoal, Fertilizer
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BACKGROUND

In the last decade, large quantities of pure biochar have been tested as soil amendment obtaining encouraging results. But the high costs are prohibitive for farmers. It has recently been shown that small quantities of biochar can be used as a carrier substance for fertilizer. Enhanced with liquid fertilizer, low dosage root application resulted in a significant yield increases. A likely mechanism is nitrate retention in the micropores, preventing leaching. The slow release promotes plant growth. Biochar reduced N-fertilizer induced N2O emissions. In order for ABC-fertilizers to have practical relevance, they need to have economic benefits. This is especially the case for special crop cultures, tree nurseries and city trees. For example, it costs several thousand € to replace a city tree, so avoiding tree death has immediate economic benefits. Furthermore, biochar use is one of the few ready-to-go negative-emission technologies (NETs) available. Without NETs, the 1.5 °C goal of the Paris agreement cannot be met. Two different communities have evolved around biochar: Agricultural sciences, which focus on the application as soil amendment, and energy and process engineering, which develop tailor-made biochars for industrial applications such as metallurgy and water filtration. A strong connection between the communities will benefit an efficient knowledge transfer.

OBJECTIVE

The overall goal of the project is to contribute to the efficient closing of resource cycles in agriculture and forestry by transforming residues into efficient organic fertilizers. Through better recirculation of nutrients and carbon from the feedstock, agriculture-related emissions can be reduced while crop yields can be increased. The fertilizer will be produced from residues and can supplement or replace mineral fertilizers. Its use is intended to promote more sustainable farming. In addition to the environmental benefits, it offers economic chances for farmers as the dependency on commercial fertilizers is decreased and local low value feedstocks and wastes are used for the production. This process will be designed such that it can be carried out directly on-site at farm level, eliminating the need for long-distance transportation. Planting techniques using fertilized biochar have not only a positive effect on food crops, but are also beneficial for plants growing in challenging environments such as urban areas, where compaction, salt stress and drought can lead to slow growth and poor tree health. Furthermore, the fertilizer is fully organic and can thus also be used in organic farming practice.

METHODOLOGY

Biochar will be produced from residues (e.g. straw and wood waste) using several slow pyrolysis reactors. Soaking the char in liquid biomass residues such as manure will increase their nutrient content and produce a fertilizer. The effect of this fertilizer will be tested in field trials both in Germany and Norway. The tests in Germany will focus on growing annual food crops on small-scale farms, whereas the trials in Norway will work with biochar application to enhance tree growth in forests and cities. An economic assessment and life cycle analysis with a focus on the CO2 balance will be used to quantify environmental benefits. Results will be disseminated to the scientific community in relevant journals and on conferences, but most importantly to interested end-users and policy makers in workshops where practical guidance is given.

RESULTS AND KEY FINDINGS

- Description of the entire value chain of the production of advanced biochar-baser fertilizers.
- Understanding of influencing production parameters on biochar and fertilizer properties.
- Insight into the effect mechanisms of ABC-fertilizers on soil quality, plant growth, nutrient use efficiency and crop yield.
- Evaluation of environmental impacts such as nitrate leaching and greenhouse gas emissions, compared to standard agricultural practice.
- Guidelines for the production process for efficient and sustainable ABC-fertilizers.
- Upgrading of locally available residues and transformation into value products.
- Demonstration of the effects of ABC-fertilizers on growth and yield of annual food crops and on the growth and health of trees in forests and urban settings.
- Economic and life cycle analysis.