

UHASSELT

UHASSELT MAGAZINE



**BIOCHAR HELPS
STRAWBERRIES TO GROW**

BIOCHAR AS SOIL IMPROVER FOR STRAWBERRY CULTIVATION

Biochar, sustainable alternative



for potting soil



Residues such as manure, wood and green waste from agriculture and industry can perfectly be used as new raw materials. This is demonstrated by UHasselt researchers from the Centre for Environmental Sciences. In collaboration with ILVO, they processed organic residual streams into biochar, which can be used as a soil improver for strawberry cultivation. A sustainable, high-quality and economically profitable alternative to traditional potting soil.

ONE BIOCHAR IS NOT THE SAME AS THE OTHER

This research project revolves around biochar, but what is it exactly?

ANN CUYPERS: “Biochar is a bit like charcoal. It is a black, solid matter made from organic residual material, such as grass clippings, crop residues or wood chippings. This is done using the pyrolysis technique, in which we heat these residual streams at high temperatures of 400 to 800 degrees in an oxygen-poor environment.”



Dries Vandamme

DRIES VANDAMME: “Because there is no oxygen involved, pyrolysis is not a combustion process. You will chemically crack the connections of your material by heating the residual stream. The decomposition of your material causes a cascade of chemical reactions that ensures that a carbon-rich matrix remains at the end of the pyrolysis process: biochar.”

ANN CUYPERS: “But one biochar is not the other. Each biochar is unique. Depending on the material you start from – because it already has certain chemical characteristics – and how you will fine-tune and manipulate the pyrolysis process, you will get a biochar with different properties. So it comes down to finding the right match for every application.”

we worked together with ILVO on three applications for biochar in sustainable agriculture. What type of biochar can we use in processes such as composting, fermentation or manure storage to make the process more efficient and reduce greenhouse gas emissions? Which type is most suitable as a peat substitute in strawberry cultivation? And which biochar can be used as a soil improver in open field cultivation on marginal soils? After all, in Belgium there are many metal-contaminated and drought-sensitive agricultural lands. Can biochar also be a sustainable way to improve soil quality and increase crop yield there? We investigated this together with our project partners.”

DRIES VANDAMME: “In this project, we investigate very specifically which type of biochar can be used best for each application. We tried to predict which type of residual material would provide the best outcome for these concrete applications.”

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Traditional potting soil for substrate cultivation is often not sustainable. Our biochar is an ecological alternative

A SUSTAINABLE SOIL IMPROVER

What exactly did you investigate in this study?

MARIJKE JOZEFCAK: “In this project,

ANN CUYPERS: “When we presented our research idea to ILVO, they were immediately enthusiastic. They had also experimented with biochar themselves, but so far without successful results. Although they had already made a small breakthrough in strawberry cultivation, on which they wanted to build further. Within the project, screening tests were developed with which the different biochars could be tested before we used them. And with Proefcentrum Fruitteelt we brought a fantastic project partner on board. They have a lot of experience in research with strawberries and in this project they carry out the large trials with attention to crop yield and storage time of the strawberries that have been processed with biochar. Together with ILVO, we then analyse the fruits in more detail down to the cellular and molecular level.”

What are the challenges in substrate cultivation with strawberries today?

DRIES VANDAMME: Strawberry cultivation is extremely important in Flanders, but these crops are often not sustainable. The traditional potting soil used in substrate cultivation consists largely of (white) peat. The continuous exploitation of that raw material is unsustainable in any case. In addition, to start mining peat, you have to dry out areas. And this releases a lot of CO₂ and we naturally want to avoid that. Especially when you know that peat actually works as a kind of sponge for CO₂. If you take that away, you also take away that extra advantage. If biochar could replace part of the peat, then you really create a much more sustainable alternative.”

MARIJKE JOZEF CZAK: “Another challenge in strawberry cultivation

is the disease resistance of the fruits. Strawberries are extremely susceptible to diseases, which is why many chemical crop protection products are still used today to prevent diseases. We are investigating whether certain types of biochar can increase the disease resistance of crops.”

BETTER AT ECONOMIC AND ECOLOGICAL LEVEL

How many types of biochar have you tested?

MARIJKE JOZEF CZAK: “We started with about thirty biochars to ultimately select five for this strawberry trial, of which we suspect to have the exact properties we needed to improve the quality of the strawberries and increase disease resistance.”

DRIES VANDAMME: “In order to make that selection, we didn't just look at the carbon stability and other chemical properties of the biochars. The CMK environmental economists also immediately took the techno-economic aspects into account. After all, it makes no sense to produce an ideal custom biochar with residual flows that are only present in small volumes or that are too expensive to process. With this project we want to create a real impact on the field and come up with solutions that are also economically profitable for the farmers. If our alternative soil improver – however sustainable it is – is not economically interesting, it will never be successful in practice.”

And is biochar a sustainable alternative for peat?

MARIJKE JOZEF CZAK: “Absolutely. Biochar has many unique benefits. Due to its special composition, our soil improver can absorb water and nutrients better than the traditional alternatives. When you fertilise the plants and it rains, biochar ensures that the nutrients do not just wash away and end up in the groundwater. In addition, because biochar has such strong absorbing properties, it can also bind metals. In metal-contaminated soils, the plants will therefore absorb less metals, because the biochar already does that. Tests in the ILVO lab also showed that some of our biochars can strengthen the defence system of the strawberry plant. Those biochars actually act as vaccines for the plant. As a result, less chemical crop protection agents are needed in comparison to traditional potting soil.”

DRIES VANDAMME: “And you use organic residual flows – which are still considered waste today – to produce that biochar in a circular and sustainable way. In this phase of the research we still focus on mono-streams (based on one residual stream), but we will soon



Ann Cuypers

be investigating whether we can also combine these successful input materials with other residual streams, which are currently abundantly available and no longer fulfil any function. If we succeed in this, we will create major added value.”

LEGAL OBSTACLES

Does this success story mean that biochar can immediately be used as a soil improver in fruit cultivation tomorrow?

ANN CUYPERS: “Unfortunately not. A lot of additional research will have to be done first. The more answers you find, the more new questions arise. We are really still at the beginning of this type of research, but with this project we are laying a very solid foundation. Moreover,

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Our soil improver
can absorb water
and nutrients
better than the
traditional
alternatives

we notice that the interest in biochar is growing steadily. We are often contacted by companies that have tons of the same residual stream every year and – based on the idea of the circular economy – would like to do something with it. Today, for those companies, that's just waste that they have to pay for to have it removed. They show great interest in pyrolysis-based processes to make new raw materials with added value.”

MARIJKE JOZEFCAK: “It will come down to really design our biochars as detailed as possible so that they can be used in a very targeted manner for a specific application with a proven added value. That is tailor-made biochar, but if we can demonstrate in black-and-white in further research that certain types



Marijke Jozefczak

In this research project, UHasselt researchers from the Center for Environmental Sciences (CMK) are working together with the Institute for Agriculture, Fisheries and Food Research (ILVO) and the Proefcentrum Fruitteelt in Sint-Truiden on a soil improver from organic waste streams for sustainable agricultural applications. This research is part of the SBO project BASTA, which receives financial support from the Flanders Research Foundation (FWO).



of biochar can, for example, prevent a high percentage of infections in strawberries, or increase crop yields in dry or marginal soils, then the economic added value of the product will increase, which will convince the growers even faster. In these times where sustainability is an increasingly important issue, the added value of ecosystem services that biochar provides – because this is also calculated by our environmental economists – will also help to convince governments.”

DRIES VAN DAMME: “But in the meantime, a lot of legislative restrictions still need to be tackled. That is why environmental lawyers are also involved in this project. Unfortunately, there is currently no legal framework in Belgium or Europe so you cannot immediately implement the pyrolysis technique

to produce biochar. There is still a long way to go to convince all authorities of the safety and the economic and ecological added value of biochar. However, good initiatives are happening at European level that give us hope. I strongly believe that the global climate challenges and water issues in Flanders can be a trigger to accelerate research initiatives and, based on this, create a legal framework to accelerate the introduction of biochar to the market. We can only applaud that. If we can innovatively convert residual streams from the industry and agriculture into sustainable raw materials, we will all win in the end.”