Interreg
2 Seas Mers Zeeën
Horti-BlueC
European Regional Development Fund

2020

NEWSLETTER 2

provincie Oost-Vlaanderen
Provincie Antwerpen
PROEFCENTRUM HOOGSTRATEN
Université de Lille
ADAS
CATO ENGINEERING
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HORTI-BLUEC

NEWSLETTER TWO 2020

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INTRODUCTION

The Horti-BlueC project has come a long way since take-off in February 2018 and aims to continue realizing outputs and deliverables while everyone deals with the unprecedented implications of the Covid 19 virus. This 2020 edition of the Newsletter will convince you that the project is still at full speed, however. Please find below a summary of work done within the first 2 work packages of the project.

WP1:

Processing feedstocks into building blocks for growing media

WP2:

Testing innovative growing media blends in the greenhouses. The same amended blends provided by AGARIS have been and continue to be tested at NIAB EMR, ADAS, Proefcentrum Hoogstraten and the University of Portsmouth

UPDATES

We planned to have visits to the greenhouse trials later this year, but there is a change of plan: maybe there will be no real-life visits, instead the Horti-BlueC **YouTube Channel** presents a virtual visit to a gasification plant for producing bio-char, in combination with CO_2 capture for reuse as fertilizer in greenhouses, and for taking a look at the ongoing trials in the greenhouses.
The intended EU policy to cope with the recession induced by Covid19 starts from 'never waste a good crisis': this economic recovery plan will not focus on going back to "Business as usual", but takes the opportunity to couple the recovery plan with the green deal policy. What will be the specific consequences of this EU strategy for soilless cultivation of tomatoes and strawberries, and for heating and CO_2 recycling in greenhouses? Will the decision tool be helpful for applying the new solutions? We don't know the answer yet, although the knowledge gathered in Horti-BlueC is ready for adoption!

YOUTUBE WEBSITE

TWITTER INSTAGRAM

Interreg 2 Seas Mers Zeeën Horti-BlueC

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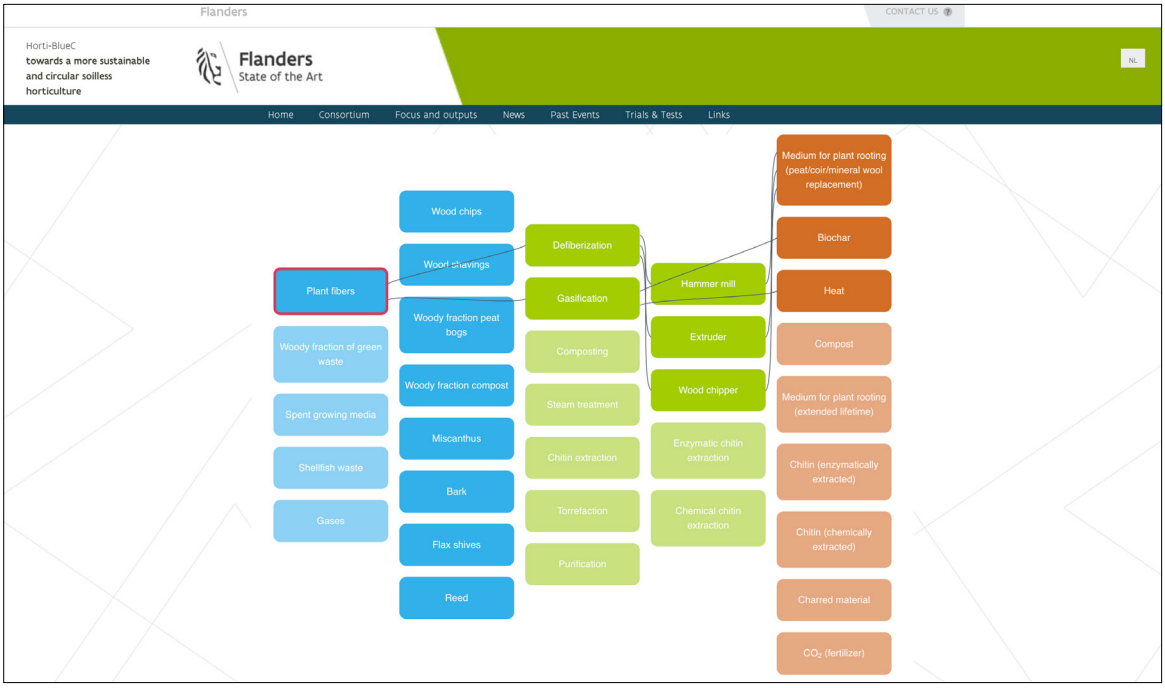
HORTI-BLUEC
DECISION TOOL

In the first Horti-BlueC work package, feedstocks were processed into building blocks for growing media, i.e. biochar, chitin, fibres, or other materials or CO_2 fertilizer. We worked on 1 gaseous waste stream (off-gasses from the chimney of a bio-energy installation) to be used as CO_2 fertilizer and 4 solid waste streams to be used as replacer for peat and mineral wool in growing media.

The pretreatment from waste to feedstock is documented in a fact sheet to select the best processing techniques. Some materials may only need defiberization, cutting, milling, ...whilst other waste streams or applications require more advanced treatment. We developed a tool to indicate how to process residual biomass into CO_2 fertilizer and building blocks for growing media. All fact sheets on the processing of these materials are available and linked to the decision tool. You can find the decision tool below. The building blocks developed here will be combined into sustainable growing media blends, which will be tested in the greenhouses.

Click below to explore the decision tool:



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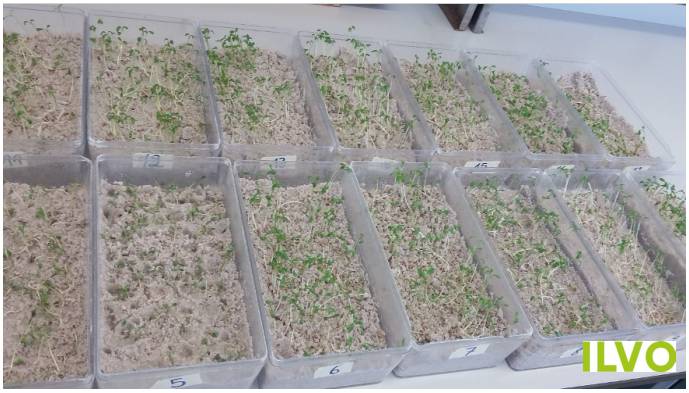
ILVO
LEAD PARTNER

ILVO's involvement in this project is investigating the added value of plant fibres, compost, biochar and chitin in sustainable growing media. These constituents are based on renewable resources, with a special focus on their interaction with nutrient use efficiency and disease suppression. The project offers ILVO the possibility to jointly perform research on recycling marine and agronomic waste and developing sustainable growing media, a key topic in circular horticulture. Chitin-rich materials were made from shellfish waste by a combination of different techniques and compared with a commercially available chitin.

PACKAGE 1

In work package 1, ILVO, ECN>TNO and the University of Lille produced 23 chitin rich materials from shrimps or Chinese mitten crab, and they were tested for their chemical composition and their capacity for N release. Thermally produced chitins (by roasting at 200, 255 or 300°C) had a clearly lower N release than chemically produced ones. For the latter ones, more than half of the N was mineralized after 100 days at 15°C.

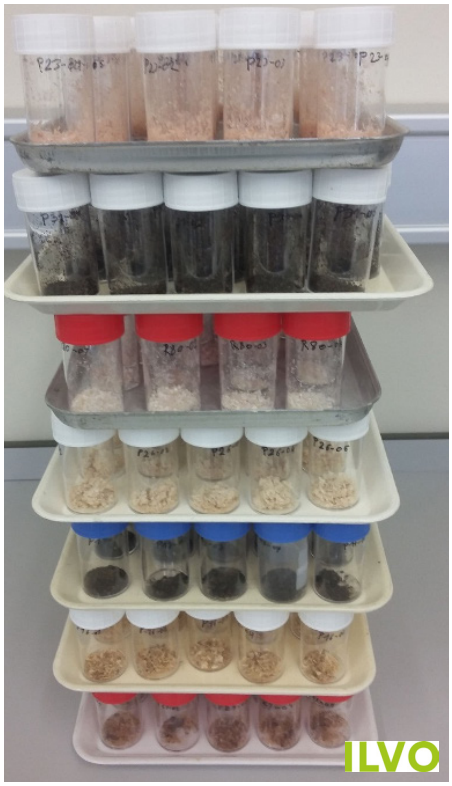


Testing different chitin sources produced by Horti-BlueC for phytotoxicity.

The effect on the growing medium, both chemically and microbiologically, was analysed, including the characterisation of the microbial diversity in the growing media. The greenhouse trials confirmed that effects on plant growth were a result of a combination of the increase of mineral N, other micronutrients, salts and fungi in the rhizosphere.

PACKAGE 2

In work package 2, different batches of chitin-rich materials produced within Horti-BlueC were tested in two greenhouse trials with strawberry and in a nutrient leaching experiment. This leaching experiment was executed to assess the interaction between chitin and fertigation in order to be able to adapt the fertigation regime later in the project, if needed. Thermally treated shrimp shells released more salts and phosphorus than the other chitin rich materials, while we found that the commercial chitin source immobilized potassium.



27 portions for each of the 7 Horti-BlueC chitin sources ready for testing nitrogen release during three months in an incubator.

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ECN > TNO

The Netherlands Organization for Applied Scientific Research (TNO) connects people and knowledge to create innovations that boost the competitive strength of industry and the wellbeing of society in a sustainable way. ECN>TNO is the energy research arm of TNO and one of the road maps in energy research is towards CO_2 neutral fuels and feedstocks. The goal is to enable a smooth, safe and efficient transition from traditional energy sources towards renewable CO_2 neutral energy carriers.

In the past months, ECN>TNO produced a large batch of biochar based on spent coir and a large batch of woody (coarse) biochar. The roadmap for the Life cycle assessment (LCA) was finalized, and calculations for this LCA were conducted.

ECN > TNO has extensive experience in biomass conversion for energy and products. One of the developed processes is the co-production of bioenergy and biochar from biomass. For Horti-BlueC, biochar from spent substrates was produced by TNO at the end of 2019 and early 2020. The biochar was produced from peat-based and coir-based substrates used in tomato and strawberry cultivation by partners in WP2. The biochar made from these spent materials was upcycled into new substrate media for ongoing trials in WP2. With this circular use, a major sustainability criterion and major target of the project is met.

Upscaling of biochar production was tested based on woody biomass. A batch of 175 litres of biochar from mixed park wood residues was produced for future plant trials in WP 2. The plant trials will start during the second half of 2020 and/or first half of 2021 and will have some higher percentages of biochar in the growing medium blend. The material was sent to the project coordinator in March 2020 for distribution among partners.

175 litres Biochar from upcycled substrate media for ongoing trials in 2020 and 2021

Upcycling spent peat (left) into biochar (right)

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UNIVERSITY OF LILLE

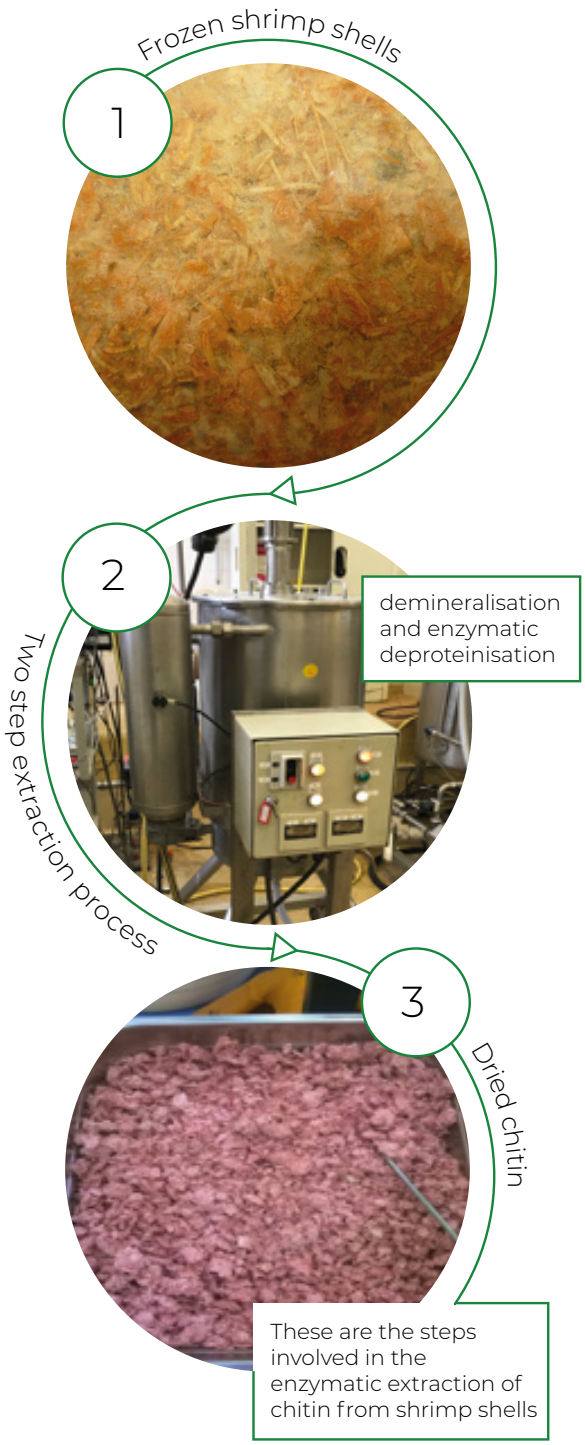
The Research Institute for Food and Biotechnologies (Institute Charles Viollette, University of Lille) develops academic research in food and biotechnology. It brings the following expertise to Horti-BlueC :

- Characterization of agro-food coproducts streams
- Identification and valorization of biomolecules of high benefit from coproducts and wastes
- Enzymatic hydrolysis, eco-extraction and separation processes.
- Bioprocesses scale-up

University of Lille is involved in the Horti-BlueC project for enzyme assisted extraction of purified chitin from shrimp shells. Extraction was carried out in an enzymatic process involving two steps: for demineralization, shells were ground and suspended in a medium acidified with H_3PO_4 and then a deproteinization step using a commercial enzyme: alcalase. It is the most effective and employed enzyme among various commercial proteases to remove protein from crustacean shell.

Enzymatic extraction was first designed at a lab scale before scaling-up to pilot plant scale. Hydrolysis conditions were the same at both lab and plant scale. The main differences were the treated quantities (26 kg of ground shrimp shells at pilot scale instead 300 g at lab scale) and the use of an acid to stop the hydrolysis reaction instead of heating (lab scale). The equipment used included a 1 L jacketed glass reactor (lab scale) and a stainless-steel hydrolysis reactor with a volume of 80 L (pilot scale).

Calculated on the initial dry shell basis, the extraction yield of chitin was in the range of 14.37 ±1.54%. Under the conditions used below, percentage of ashes and proteins were dramatically reduced. The pH and electrical conductivity (1:5 extract in water) were low, i.e., 4.0, and 39 µS/cm, respectively, and were low compared to other types of chitin from shellfish waste. The chitin wasn't phytotoxic for cress seedlings, in contrast to other types of chitin.



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ADAS

Our work with biochar and chitin as growing media amendments continues as we seek to develop a commercially meaningful evidence base for their use in tomato and strawberry production. We are seeking to further examine the impacts of substrate amendment on yield, nutrient use and disease resistance through a combination of targeted laboratory and commercial-scale trials. By demonstrating that these materials can provide added value for production we can help promote step change in the industry to help promote a circular economy in food production.

TRIALS

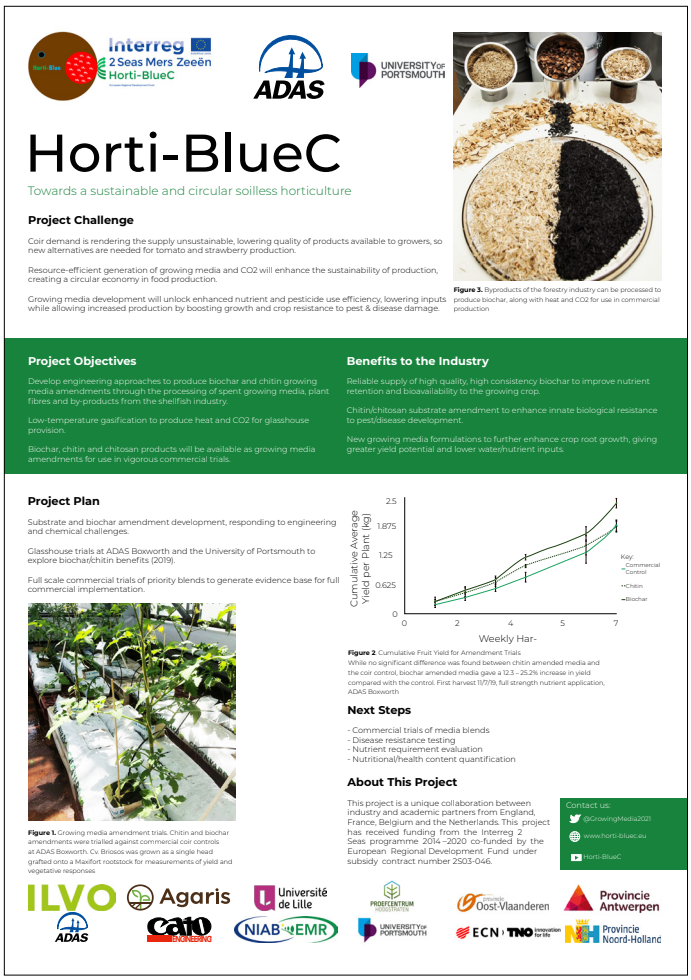
For tomato we are running three trials on site looking at the chitin and biochar amendments. We are replicating the same treatments as last year, but with the inclusion of rockwool as a second control media. We are trialling two nutrient rates to test whether there is any potential for the amendments to reduce nutrient inputs while maintaining yields. The prototype tomato substrates also have enhanced sustainability through reduced coir content and are entirely peat free.

Ongoing trials at ADAS

We are also testing whether the biochar and chitin amendments can reduce the severity of root disease development in a crop inoculated with root mat disease *(Rhizobium radiobacter)*. We are also running two commercial scale trials of the biochar amendment, comparing it against a coir and rockwool control crop. This will allow us to test for the benefits of substrate amendment in commercial production directly.

Our activities this season continue and expand upon our results from last year. In strawberry we are repeating our comparison of biochar and chitin amended substrates against a range of coir and peat-based substrates, including commercial controls to replicate last year's work in a second season. The prototype substrates have a significantly reduced peat content, benefitting from the bulking capacity of wood fibres and composts, aided by the nutrient retention ability of the biochar amendments. We have also expanded our trial of reduced strength nutrient applications in the same media blends to test whether the amendments improve nutrient retention, allowing growers to reduce nutrient inputs.

We are also running commercial trials of the prototype peat-free, biochar and chitin blends at a strawberry grower in Cambridgeshire using both a standard and reduced-strength feed regimen to produce commercial data to test the potential of these substrates to benefit productivity in a commercial setting.



Horti-BlueC

Towards a sustainable and circular soilless horticulture

Project Challenge

Coir demand is rendering the supply unsustainable, lowering quality of products available to growers, so new alternatives are needed for tomato and strawberry production.

Resource-efficient generation of growing media and CO2 will enhance the sustainability of production, creating a circular economy in food production.

Growing media development will unlock enhanced nutrient and pesticide use efficiency, lowering inputs while allowing increased production by boosting growth and crop resistance to pest & disease damage.

Figure 3. Byproducts of the forestry industry can be processed to produce biochar, along with heat and CO2 for use in commercial production

Project Objectives

Develop engineering approaches to produce biochar and chitin growing media amendments through the processing of spent growing media, plant fibres and by-products from the shellfish industry.

Low-temperature gasification to produce heat and CO2 for glasshouse provision.

Biochar, chitin and chitosan products will be available as growing media amendments for use in vigorous commercial trials.

Benefits to the Industry

Reliable supply of high quality, high consistency biochar to improve nutrient retention and bioavailability to the growing crop.

Chitin/chitosan substrate amendment to enhance innate biological resistance to pest/disease development.

New growing media formulations to further enhance crop root growth, giving greater yield potential and lower water/nutrient inputs.

Project Plan

Substrate and biochar amendment development, responding to engineering and chemical challenges.

Glasshouse trials at ADAS Boxworth and the University of Portsmouth to explore biochar/chitin benefits (2019).

Full scale commercial trials of priority blends to generate evidence base for full commercial implementation.

Figure 1. Growing media amendment trials. Chitin and biochar amendments were trialled against commercial coir controls at ADAS Boxworth. Cv. Briosos was grown as a single head grafted onto a Maxifort rootstock for measurements of yield and vegetative responses

Figure 2 Cumulative Fruit Yield for Amendment Trials
While no significant difference was found between chitin amended media and the coir control, biochar amended media gave a 12.3 – 25.2% increase in yield compared with the control. First harvest 11/7/19, full strength nutrient application, ADAS Boxworth

Next Steps

- Commercial trials of media blends
- Disease resistance testing
- Nutrient requirement evaluation
- Nutritional/health content quantification

About This Project

This project is a unique collaboration between industry and academic partners from England, France, Belgium and the Netherlands. This project has received funding from the Interreg 2 Seas programme 2014 –2020 co-funded by the European Regional Development Fund under subsidy contract number 2S03-046.

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Poster exhibited at the Tomato Growers Association Conference September 2019; and the Hoogstraten meeting in November 2019)

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AGARIS

Agaris has been testing raw materials and blends for their chemical, physical and biological parameters for the Horti-BlueC Interreg project. In addition, large-scale blend productions were set-up in order to provide the materials and blends for the greenhouse trials. To facilitate this, we developed an in-house semi-manual growbag packing line. In this way several blends could be bagged in an efficient way.

Agaris grow bags in situ at the ADAS trials.

These blends are then used for the strawberry and tomato trials at ADAS, Proefcentrum Hoogstraten (PCH), NIAB and the University of Portsmouth. Furthermore, we investigated the methodology and set up the guidelines to calculate the economic feasibility and life cycle analysis of growing media blends and raw materials.

Strawberry trial at Proefcentrum Hoogstraten

Rolling up sleeves: Loading the experimental media blend grow bags, made at AGARIS for the greenhouse experiments, during the Horti-BlueC meeting at ADAS in Boxworth in June 2019.

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NIAB EMR

Currently UK strawberry growers replace the standard coir (coconut fibre) media every year, which is expensive and environmentally unsustainable. There is also evidence that treating plants with amendments can have positive effects on plant health. At NIAB EMR, we are running several experiments with strawberries. These include: 1. The re-use of standard coir media; 2. The amendment of woody biochar (oak, beech) at planting time to standard coir media; 3. Testing five novel media blends and 4. The addition of amendments e.g. shellfish chitin and coir biochar upcycled from shellfish waste and used coir media. In 2019, preliminary results of experiments 1 and 2 showed no significant differences in yield and quality with reused coir, or with the addition of woody biochar. This indicated that standard coir can be reused on a June bearer without negative effects on yield and quality. In 2020, we are testing an everbearer variety with experiments 1 and 2 to determine any differences over a longer harvest period, as well as completing experiments 3 and 4.

Currently UK strawberry growers replace the standard coir (coconut fibre) media they use every year, which is expensive and environmentally unsustainable. Growers report using the coir more than once has deleterious effects on yield and quality. There is evidence that treating plants with amendments such as biochar and chitin can have positive effects on plant health.

At NIAB EMR, we aim to answer several questions regarding strawberry yield and quality including 1. Does the re-use of coir have a negative effect? 2. Is there a benefit by amending the substrate with wood biochar (oak, beech) to planting holes at planting time? 3. Are there benefits when using five novel media blends over the standard coir media? And 4. Are there benefits with the addition of amendments to the standard coir e.g. chitin made from shellfish waste, and coir biochar made from the used coir media?

The re-use of media in strawberry production will save in production costs as fewer new coir bags will need to be purchased. It will also reduce the environmental impact of sending the used coir and its plastic packaging to landfill. The use of novel media blends and amendments incorporating shellfish chitin and coir biochar products will be an important part of the circular economy and more sustainable strawberry production.

Adding woody biochar to planting holes, May 2019

Coir age woody biochar experiment, July 2019

Preliminary findings for experiments 1 and 2 in 2019: we found no significant reduction of yield or quality when reusing the standard coir, and there was no effect of adding woody biochars. In 2019 we used a June bearing strawberry variety. In 2020, we will use an everbearer variety that crops for a longer period, to test any differences. We are currently setting up experiments 3 and 4.

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EVENTS AT WHICH WE HAVE PRESENTED

We have presented our Horti-BlueC work at several events, including: Fruit Focus held at NIAB EMR on 17th July 2019, the NIAB Centenary seminars at NIAB Cambridge on 26-27 June 2019 and the Soft Fruit Day at NIAB EMR on 20th November 2019. On 4th-5th June 2020 we showed our 2020 experiment set up in a virtual meeting.

NIAB Centenary seminars at NIAB Cambridge on 26-27 June 2019

Fruit focus at NIAB EMR July 2019

NIAB EMR Soft Fruit Day 20 Nov. 2019

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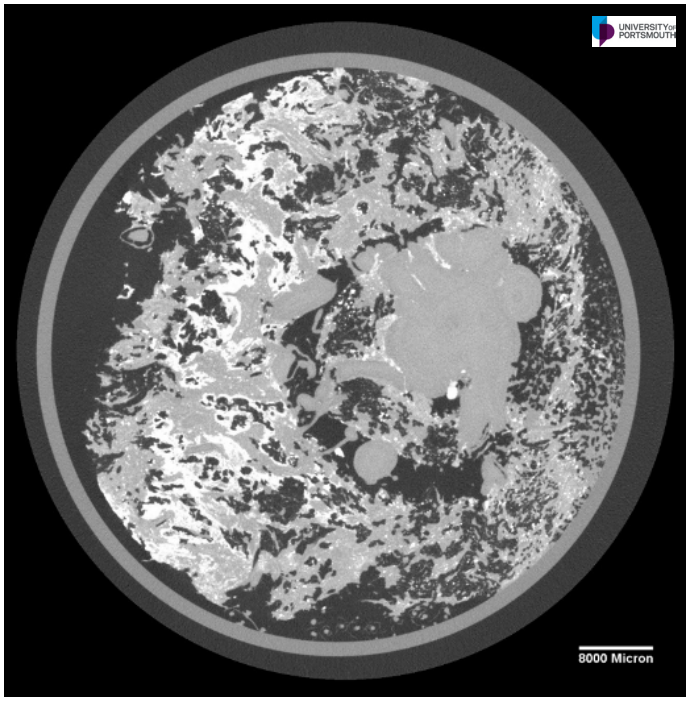
UNIVERSITY OF PORTSMOUTH

At the University of Portsmouth, a Horti-BlueC funded PhD researcher, Edward Collins, is investigating the use of chitin as a growing media amendment to improve the growth and health of lettuce and tomato plants. Results from the lettuce trial indicated that chitin amendments in growing media increased the rate of growth and yield of this crop. The tomato trial, however, used a lower percentage of chitin in the growing media and found no significant differences in growth rate or fruit yield. Lettuce grown with a higher percentage of chitin showed improved antioxidant activity, however, tomato grown with a lower percentage showed no significant difference in antioxidant activity. Further testing of tomato plants with chitin-amended growing media is underway to investigate this.

Horti-BlueC is investigating the use of chitin as a growing media amendment to improve crop health and crop yield sustainably. Edward Collins has conducted greenhouse trials using both lettuce and tomato plants to investigate the effects of amending growing media with chitin.

X-ray tomography of a tomato root structure in chitin-amended growing media.



To test the blends on lettuce, a chitin amendment derived from crab and shrimp shells was added independently to growing media as follows: 0% (control), 1%, 2%, and 3% (dry weight). Results from this trial indicated an increased fresh mass of lettuce leaves in the 1% and 2% chitin treated plants when harvested after 7 weeks growth. Fresh mass in samples grown with 3% chitin was found to be lower compared to the 1%, and 2% chitin leaves. This suggests that there is an optimum range of chitin to be added to growing media, as adding too much could potentially be detrimental to growth. The antioxidant content of harvested leaves increased proportionally with an increase of chitin in the soil (for example ~1500 ug/ml polyphenol concentration in 0% chitin leaves, and ~3100 polyphenol concentration in 3% chitin leaves).

The tomato plant trial took place under commercial growing conditions, using wood fibre media bags provided by project partner Agaris containing 2 g/L chitin, with an automatic fertigation system providing additional nutrients. No significant differences were found in the growth of the tomato plants or the fruit yield in this trial. Antioxidant assays did not show any significant differences between fruit samples from the different growing media treatments. When further investigated through x-ray imaging of the roots, no differences were observed in the root structures.

Tomato plants in growing media bags produced by project partner Agaris.

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The next experiment to be carried out the University of Portsmouth will be to grow tomato plants under the same conditions as the lettuce trial. The aim is to identify if any effects of chitin can be observed on tomatoes using a similar percentage range of chitin additions as used in the growing media for the lettuce crops.

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UNIVERSITY OF PORTSMOUTH

COMPARING THE ANTIOXIDANT ACTIVITY OF DIFFERENT TOMATO VARIETIES GROWN IN THE UK AND EUROPE

Edward Collins, Matthew Tallis, Cressida Bowyer and Mridula Chopra, University of Portsmouth, UK

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Benefits to the Industry

Tomatoes and tomato products are known to be a great source of dietary antioxidants including carotenoids, phenolics and vitamin C (1). Our previous research has shown that tomato consumption can increase the antioxidant activity of plasma (2) and can pose cardio-protective effect through inhibition of oxidation of low density lipoprotein (LDL, a risk factor for cardiovascular disease) (3). We have also previously shown several anticancer properties of lycopene (a antioxidant carotenoid in tomatoes) in the laboratory experiments (4-6).

Aim: The present study was set out to examine the phenolic and antioxidant activity of different tomato varieties.

Materials and methods

- The FRAP assay is one of the most widely used antioxidant assays in research measuring the reducing ability of a sample [7].

- The Folin's assay measures the total phenolic content of a sample[8].

- Varieties tested include 8 varieties (all vine) from the Tomato Stall (Isle of Wight, UK) and 4 shop bought varieties produced in Continental Europe (Netherlands, Spain, Morocco)

- Samples were homogenised and filtered to produce a clear solution for the analysis.

Figure 1. Cocktail vine tomatoes supplied by the Tomato Stall, Isle of Wight, UK

Figure 2. Yellow large vine tomatoes supplied by the Tomato Stall, Isle of Wight, UK

Results

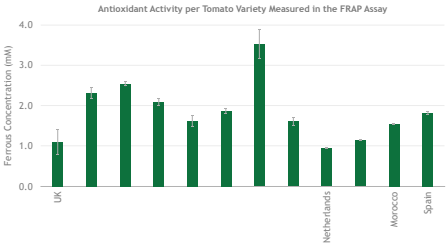

Figure 3. Results of the FRAP assay carried out on the tomato varieties. Error bars indicate standard deviation.

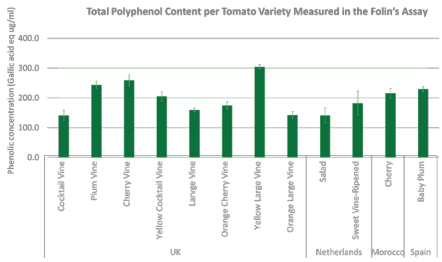

Figure 4. Results of the Folin's assay carried out on the tomato varieties. Error bars indicate standard deviation.

Summary

A significant positive correlation was found between the phenolic content and antioxidant activity of tomato varieties that were tested ($r=0.778$, $p< 0.001$, Pearson correlation).

Plum tomatoes from UK and Spain showed a similar phenolic content and antioxidant activity, however the red cherry tomatoes from UK showed significantly higher phenolic content ($P=0.02$) and antioxidant activity ($p=0.003$) than the variety from Morocco (Figures 1 and 2).

Large yellow tomatoes grown in the Isle of Wight, UK showed the highest phenolic content and antioxidant activity.

Conclusions

- The same tomato varieties, grown in different places exhibit different antioxidant activity and content.
- How a tomato is grown influences the health benefits and nutrition obtained by the fruit.
- Up-cycling of waste products into crop production can be optimised for producing a crop with improved the health benefits to consumers.

With acknowledgements to Paul Thomas from the Tomato Stall, Isle of Wight for the generous donation of tomato samples, and Bamidele Peter for helping to analyse tomato samples.

Horti-BlueC project is a unique collaboration between industry and academic partners from England, France, Belgium and the Netherlands. This project has received funding from the Interreg 2 Seas programme 2014 –2020 co-funded by the European Regional Development Fund under subsidy contract number 2S03-046.

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Poster exhibited at the Tomato Growers Association Conference September 2019; and the Hoogstraten meeting in November 2019

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PROEFCENTRUM HOOGSTRATEN

In 2019, strawberry substrates were amended with 2g/L biochar and 2g/L chitin at Proefcentrum Hoogstraten. In a first trial, we checked the cultivation for increased resilience towards diseases and pests. We could not identify effects of the supplements in the plant health. The low percentages did not seem to stimulate the immune system of the plants. In a second trial, a fourth substrate with 10% biochar (in volume) was added. The incorporation of biochar and chitin could lead to the binding or release of certain nutrients. So far, use of chitin or biochar does not need a modified fertigation scheme.

Strawberry trials at Proefcentrum Hoogstraten 2019

In July 2019 Elsanta strawberry plants were planted in three different substrates, a control substrate next to the addition of 2g/L biochar and chitin. In this first trial, we tried to record increased resilience towards two spotted spider mite, thrips, powdery mildew, *Botrytis* and root diseases. To elevate pest/disease pressure we reduced the chemical crop protection so that the main pests, *Phytophthora* and powdery mildew, will infest the autumn crop. *Botrytis* was artificially inoculated to get homogenous disease pressure.

After intense plant, leaf, flower and fruit evaluations we could not find an increased tolerance of the crops in the biochar or chitin enriched substrates. In the second trial we focused on the effects of the additives in terms of nutrient use. By mixing biochar or chitin in the substrate, certain nutrients could be fixed or released and would indicate the need for a changed fertigation scheme to fulfil the plant need. A fourth substrate containing 10% biochar was added to the substrates of the previous trial. Effects were investigated for an Elsanta double cropping system with the first harvest period in autumn 2019. Drain, substrate and leaf analyses were performed to reveal differences in nutrient use.

The yield results showed that substrates did not specifically release or fix certain nutrients. All substrates could maintain a healthy-looking autumn crop and deliver production rates without any differences. In the spring harvest of 2020, the effects of biochar and chitin on nutrient use will be analysed.

For the tomato trials at Proefcentrum Hoogstraten we are testing the same objects in 2020 as in 2019, i.e., Rockwool, Peat, a wood fibre blend, wood fibre blend + biochar (2g/L), wood fibre blend + biochar (4g/L), or wood fibre blend + chitin (2g/L). Moreover, there are two added objects where we investigate the interaction with micro-organisms (wood fibre blend with *Trichoderma spp.*) and a wood fibre blend with both biochar (2g/L) + chitin (2g/L).

On 9 September 2020 we will present results of the Horti-BlueC tomato trials to tomato growers and on 30 September we will present the results of the Horti-BlueC strawberry production trial at workshops hosted by Proefcentrum Hoogstraten.

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EVENTS 2020

4th - 5th JUNE

We held a Horti-BlueC virtual Steering Committee and Technical Meeting **conference call** presenting progress on work packages 2 and 3.

6th - 9th JULY

TNO is exhibiting at the 28th European Biomass Conference & Exhibition, Transition to a Bioeconomy, the world's first virtual exhibition, specifically for the biomass and bioeconomy sector, e-EUBCE2020.

9th SEP

Proefcentrum Hoogstraten will host a **Workshop**:
Results of tomato trial production.

30th SEP

Proefcentrum Hoogstraten will host a **Workshop:**
Results of strawberry trial production.

3rd - 4th DEC

The University of Portsmouth will host a Horti-BlueC Consortium meeting and observer partners event.

EVENTS 2021

1st - 5th MAY

Horti-BlueC results will be presented at the IX International Strawberry Symposium in Rimini, Italy.

GROWING MEDIA 2021

We warmly invite you to **GrowingMedia2021**, the 2nd International Symposium on Growing Media, Soilless Cultivation, and Compost Utilization in Horticulture (ISHS) to be held in the historic University of Ghent, Belgium from 22 until 27 August 2021. GrowingMedia2021 will be organised by ILVO, Ghent University and Hasselt University.
The conference will focus on sharing expertise on growing media, soilless cultivation and compost utilization in horticulture, with sessions on:

- Growing media and sustainable use of resources
- Integrated disease and pest control via interaction with the growing medium
- Soilless cultivation added value of innovations for water and nutrient use efficiency
- Compost utilization in horticulture and its potential for carbon storage

Oral and poster presentations will be invited to cover the full spectrum of research, from theory to implementation and adoption by stakeholders. This is an important opportunity for Horti-BlueC to present results and findings of the project. Finally, our social program will allow you to meet colleagues from all over the world, whilst enjoying Belgian chocolates, beers, fries and music. We are looking forward to welcoming you to Ghent in 2021!
Attendance registration will open on 1 January 2021, abstract **submissions** will be open from 1 December 2020 until 15 January 2021.