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Completely degradable plastic mulch foils and other agricultural accessories

WP3 & WP5 webinar

HOW TO PHASE OUT COPPER, PEAT, FOSSIL DERIVED PLASTIC AND
CONVENTIONAL FERTILISERS FROM ORGANIC GROWING IN EUROPE?

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Organic+ PolishCoreTEAM

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Wojciech Pawlikowski, Noweko Comp.
Industrial Partner

Introduction:

- In the beginning there was a BIOCHAR and we started our cooperation 2 years before the Organic+ project
- 1st stage - biochar as a natural filler to fossil polymers PP and PE
- 2nd stage - biochar as a filler to biodegradable polymers, started cooperation with Wojciech Pawlikowski 
- 3rd stage - biochar as a functional additive to biodegradable mulch films – proposal in ORGANIC+

Why Biodegradable polymers??

Because it can be broken down completely into water, carbon dioxide and compost by microorganisms under the right conditions. Agriculture needs biodegradable solutions because waste is generated with which it is not known what to do.



ORGANIC+

Main objective:

Produce a biodegradable mulch films with functional biochar-filled layer

Used technology: EBM – Extrusion Blow Moulding

But due to the small thickness of the foil, it was not possible to add biochar to the inner layer, so we decided to add a natural filler with a finer structure – calcium carbonate CaCO_3 .

We found another use for biochar – but more on that later



oňoweko



Raw material



Melting → blowing → cooling → winding on the spool



Laboratory Extrusion Blow Moulding line

Structure of CUT1 and CUT 2 samples

Polymers used in tested mulch films:

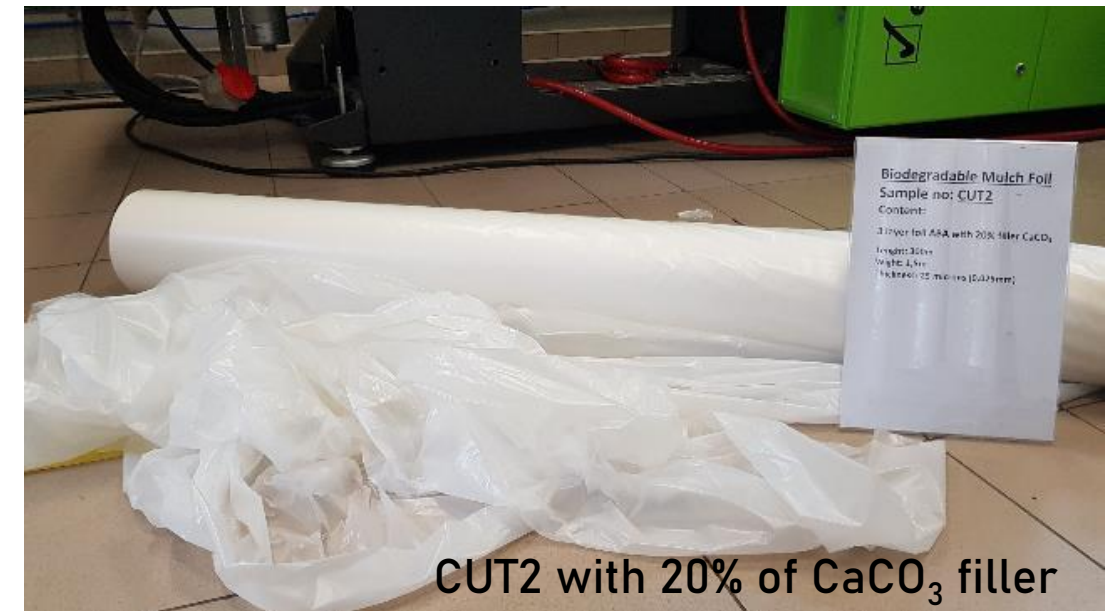
- Bioplast 400 D
- Bioplast 400 ELIT
- 20% Additive with calcium carbonate filler CaCO_3

Both Bioplast are biobased polymers
made from potato starch

Thickness – 25 microns (0,025mm)



CUT1 without filler



CUT2 with 20% of CaCO_3 filler

1st season field tests in UK and TR:

1st season of testing:

Natural conditions (UK Coventry, Turkey)



Photo: Alev Kir



Photo: Alev Kir

Tests in laboratory composting reactor



1st season field tests results:

Why it failed??

- the foils were too transparent,
- it caused weeds to grow and faster destroyed the film structure.

Conclusions and decision were made:

- we needed black film (not transparent),
- we needed film with higher thickness minimum 40 microns,
- 2nd season field tests only CUT 2 and CUT 3.



CUT1 Sample residuals after 1st season



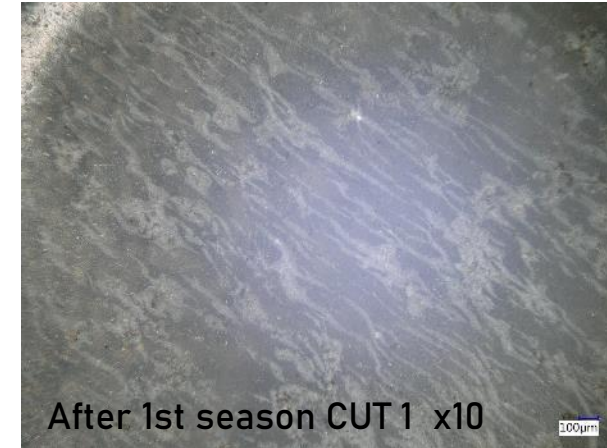
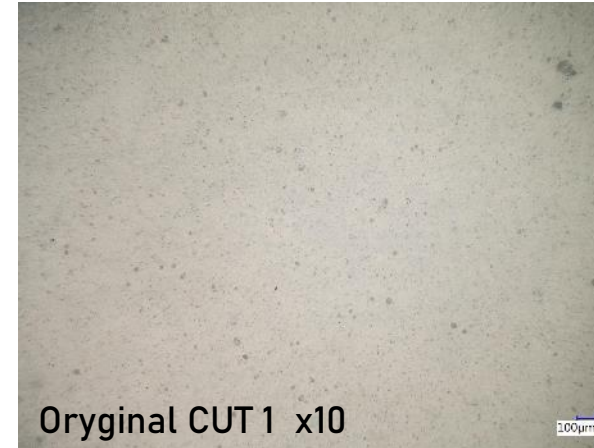
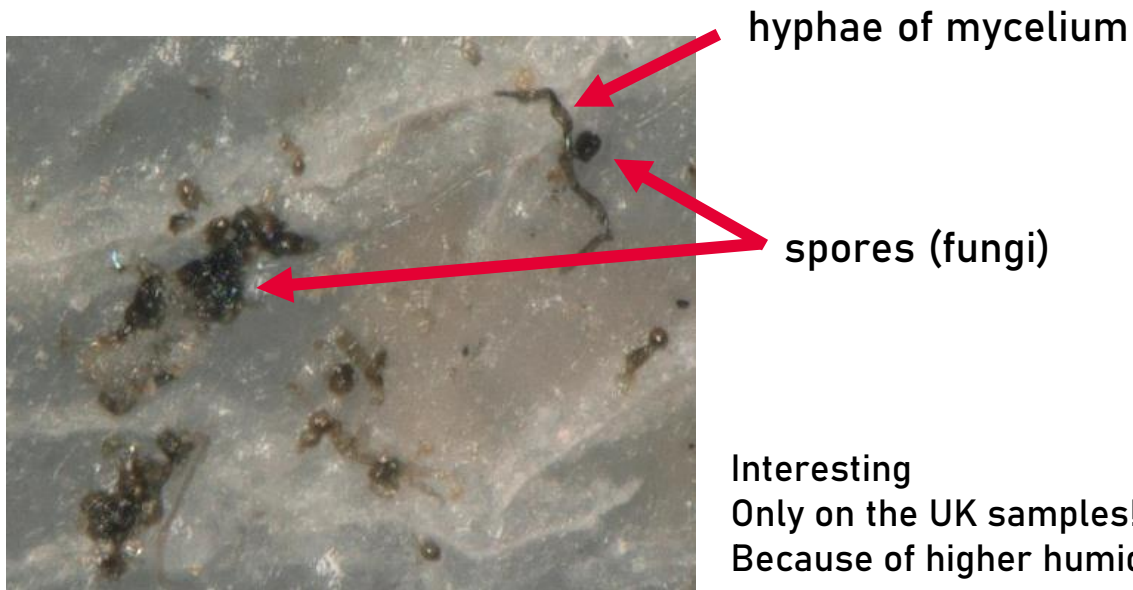
1st season tests in TK

Due to the high transparency of the test samples produced, weeds under the cover also developed well during plant growth. This caused that after exceeding the critical stresses, the tested films began to crack.

1st season field tests results:

But it wasn't so bad with these samples at all:

- We could see the degradation processes,
- Tested films completely destroyed so the films could be mixed with soil – good news 😊
- The surface was colonized by fungi.



Field tests of CUT3 sample

Polymers used in CUT3 mulch films:

- Bioplast 400 D
- Bioplast 400 ELIT
- 5% BLACK colorbatch PolyONE
certificated biobased and
biodegradable black pigment

Thickness – 40 microns (0,040mm)



Photo: Alev Kir



Photo: Alev Kir

CUT3 sample field test in pepper cultivation in Turkey 2nd season

Field tests of CUT3 sample in Poland



Mulch films after harvest
ready for mixing with soil

Mulch films field test in sunflowers
cultivation in Poland 2nd season

Application of biochar as a filler to produce various accessories for agriculture:

- Production of agricultural accessories (supports, and plants clips)
- Technology: injection molding
- Material: BioPLAST GE 2189 field with 2,5 and 5% vol. content of biochar.



Clips



Supports



24 cavity Injection mould
Cycle time: 28s
Productivity: 3085 parts/h

Injection moulding machine
ENGEL Victor 50



Tests and application in Poland:

- We tested it in the greenhouse on the tomato plants and in accelerated tests in laboratory composter,
- Currently, CUT2 and CUT3 are being tested for chemical composition, biodegradability (in soil) and compostability (in industrial conditions and home compost), phytotoxicity. All those tests will last till August next year and will give grounds for certification of biodegradability and compostability.



Clip

Support

Photo: Agnieszka Pudetko

The latest ideas and future plans:

- We are going to test transparent samples foil CUT1 and CUT2 for soil solarization in the early spring – Assumpció Anton idea thank You ☺
- We also during tests of extruded fibres (sended from Ralf Pacenka) as an natural filler for agriculture accesories made by injection moulding, (biodegradable composite for flower pots, plates and other accessories).



Strenght and flow test samples



**Thank You for Your
attention**

**ORGANIC+ is like a box a chocolate
you never know what you're going to get**

~Forest Gump~