



# Biodegradable plastics in soil

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**LIFE21-IPE-FI-PlastLIFE**

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# Mulching films – Conventional and biodegradable

## Mulching films

- + Control for weed, moisture and temperature
- + Reduces the use of plant protection products and irrigation

## Conventional mulching films

- Laborious to collect after use
- Need for waste management
- Source of plastic contamination into soil



## Biodegradable mulching films

- + Incorporated into the soil after use  
→ No need for collection or waste management
- **Do they degrade completely and quickly enough in northern climate?**

EU Fertiliser product regulation (EU 2019/1009) for CE labelled products:

- Degradation criteria: At least **90% degradation of the polymer within 24 months** plus the functionality period of the product
- Degradation is demonstrated with standard methods: EN ISO 17556:2019, ISO/CD 23517:2021 or ASTM D5988-96:2018

# MicrAgri 2020 – 2023

Ministry of the Agriculture and Forestry of Finland

Finnish Environment Institute (Syke)  
Natural Resources Institute Finland (Luke)  
Finnish Food Authority

**Report (in Finnish):** <https://helda.helsinki.fi/items/c4d99d0a-e5d9-4a40-986c-d06bc8914681>

# PAPILLONS 2021 – 2025

EU, Horizon 2020

20 Partners from 12 countries  
Coordinated by NIVA (Norway)

## Degradation experiment in field

Agricultural University of Athens (Greece)  
University of Bari (Italy)  
Luke & Syke (Finland)  
IPCB-CNR  
University of Bayreuth



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000210



# MicrAgri: Plastics in agricultural fields after use of mulch films and fabrics

Finnish Environment  
Institute (Syke)

Natural Resources  
Institute Finland (Luke)

Finnish Food Authority

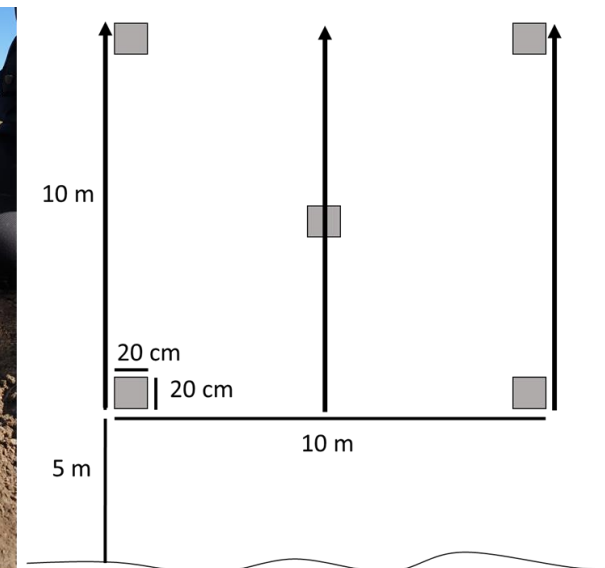


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# MicrAgri: Plastics in soils after use of mulch films and fabrics

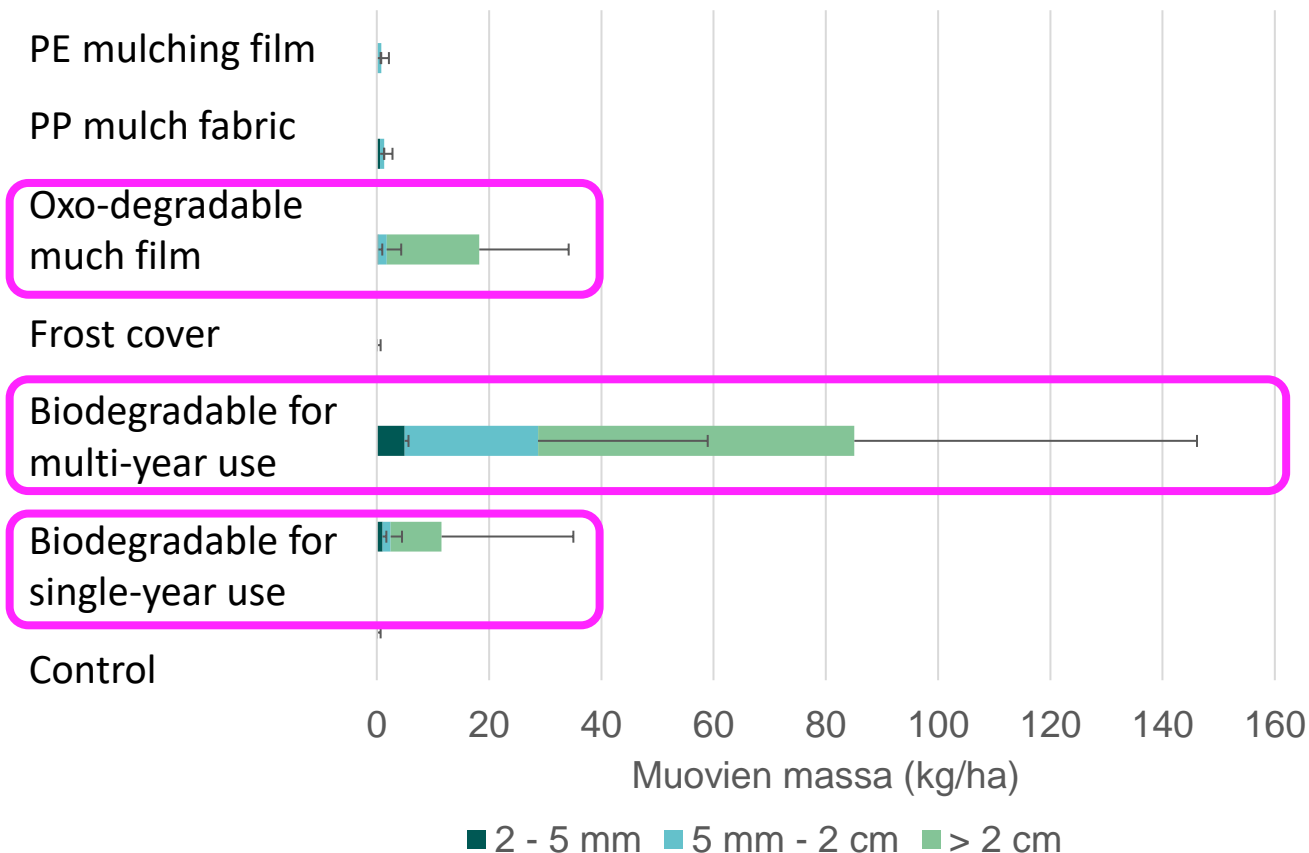
Syke, Finnish Food Authority, Luke

- **Polyethylene (PE) mulching film (4 sites)**
  - Strawberry
- **Biodegradable PBAT mulching film (9 sites)**
  - Single-year use: vegetables
  - Multi-year use: strawberry
- **Oxo-degradable PE film (6 sites)**
  - Corn
  - Bringing to the EU market now prohibited (SUP)
- **Polypropylene (PP) mulch fabric (4 sites)**
  - Berries
- **PP frost covers (4 sites)**
  - Potatoes, strawberry
- **Control sites (4 sites)**
  - One composite soil sample per site
  - Plastics > 2 mm from all samples
  - Microplastics < 5 mm were not analysed from biodegradable mulch film sites due to low resistance of partly degraded plastics to the extraction methods



# MicrAgri: Plastics in soils after use of mulch films and fabrics

Syke, Finnish Food Authority, Luke



- Highest number of plastic fragments (> 2 mm) were found at sites after use of biodegradable plastics for multi-year use
- The next highest numbers for oxo-degradable and biodegradable plastics after single-year use
- Plastics were present several years after use of biodegradable plastics
- Also many farmers had noticed the challenges in degradation
- In a survey, more than 50% of the farmers answered that they collect the fragments of biodegradable mulch films from the field after use either actively or occasionally

# PAPILLONS: Field experiment on degradation of biodegradable mulch film

Agricultural University of Athens,  
**Greece**

University of Bari, **Italy**

Finnish Environment Institute  
(Syke) & Natural Resources  
Institute Finland (Luke), **Finland**

IPCB-CNR, Italy (polymer &  
chemical composition)

University of Bayreuth, Germany  
(microplastic analyses)



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# PAPILLONS field experiment on degradation

University of Athens, Syke, Luke, University of Bari,  
IPCB-CNR, University of Bayreuth

- Pieces of biodegradable mulch films, treated with UV radiation were buried in 10 cm depth in soil
- Greece and Finland: PBAT + starch
- Italy: PBAT + starch + PLA
- Both materials certified as biodegradable in soil
- Samplings over 2.5 years
- Photo → Area of the remaining plastic
- Background data: Soil properties, climatic conditions



# PAPILLONS field experiment on degradation

University of Athens, Syke, Luke, University of Bari, IPCB-CNR, University of Bayreuth

- In Greece, the plastics were degraded in 6 months
- In Italy the degradation was slower, but over 80% was degraded in 2.5 years
  - Different material
- Degradation in Finland was slow: on average 40% degraded in 2.5 years
  - Low temperature
  - Soil properties

→ Northern climatic conditions and soil properties should be taken into account when assessing the biodegradability

# Challenges and a way forward

**Challenge:** Biodegradation of biodegradable mulch films is slower in Northern Europe than in other parts of Europe. Current standard methods do not guarantee that the biodegradability criteria are met in northern conditions

**Concern:** Accumulation of plastic debris in soil over time due to repeated use of biodegradable mulch films

→ Possible negative implications to soil health, and the spread of plastics into the surrounding environment

→ Specific methods and degradation criteria are needed for plastics marketed as biodegradable in Northern countries

→ Mandatory Europe-wide certification is needed for biodegradable mulch films (and other biodegradable plastics that can end up in soil)

→ The test methods and degradation criteria should apply to entire plastic material, not only to polymer

→ All chemicals in the material should also degrade, transparency on the chemical composition is needed



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# Thank You



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MicrAgri report (In Finnish):  
<http://hdl.handle.net/10138/359639>



Maa- ja metsätalousministeriö  
Jord- och skogsbruksministeriet  
Ministry of Agriculture and Forestry



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