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*Innovative fully biodegradable mulching films & fruit
protection bags for sustainable agricultural practices
LIFE14 ENV/ES/000486*



Networking Event

Sustainable waste and wastewater management from agricultural and food industries

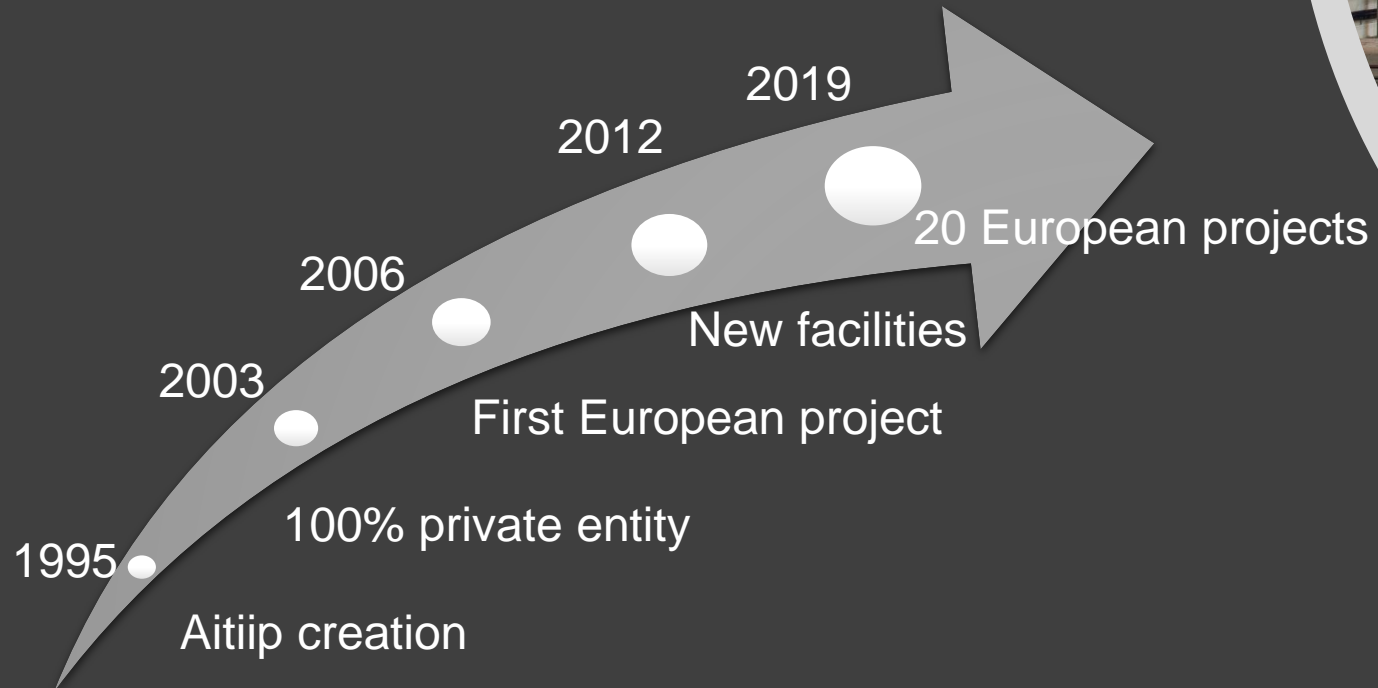
23 January 2019

CETAQUA, Santiago de Compostela

Aitiip Technology Centre

- ➔ Our aim is to help companies overcome their current and future technological challenges in a sustainable way. We do that thanks to our commitment, expertise and human talent through innovation and technology leadership.

THE WHOLE PLASTIC VALUE CHAIN





100



A great team with multidisciplinary training.

12000 m²



Diaphanous space with possibility to enable pilot lines for our customers.

9 M€



Always improving, each year 1,5 M € is invested in new equipment.

175



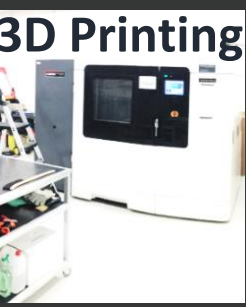
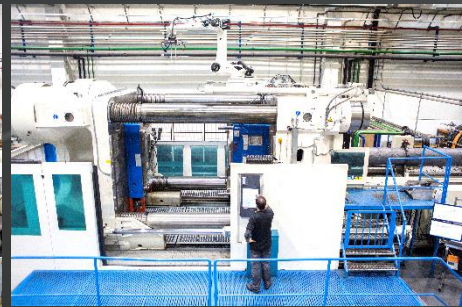
Clients per year, of which 80% are SMEs and 20% are large companies.



Injection area

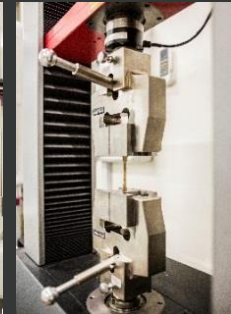
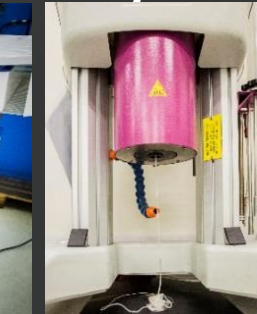
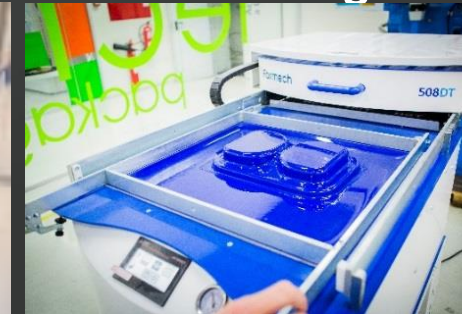


Machining and finishing area of high quality



3D Printing

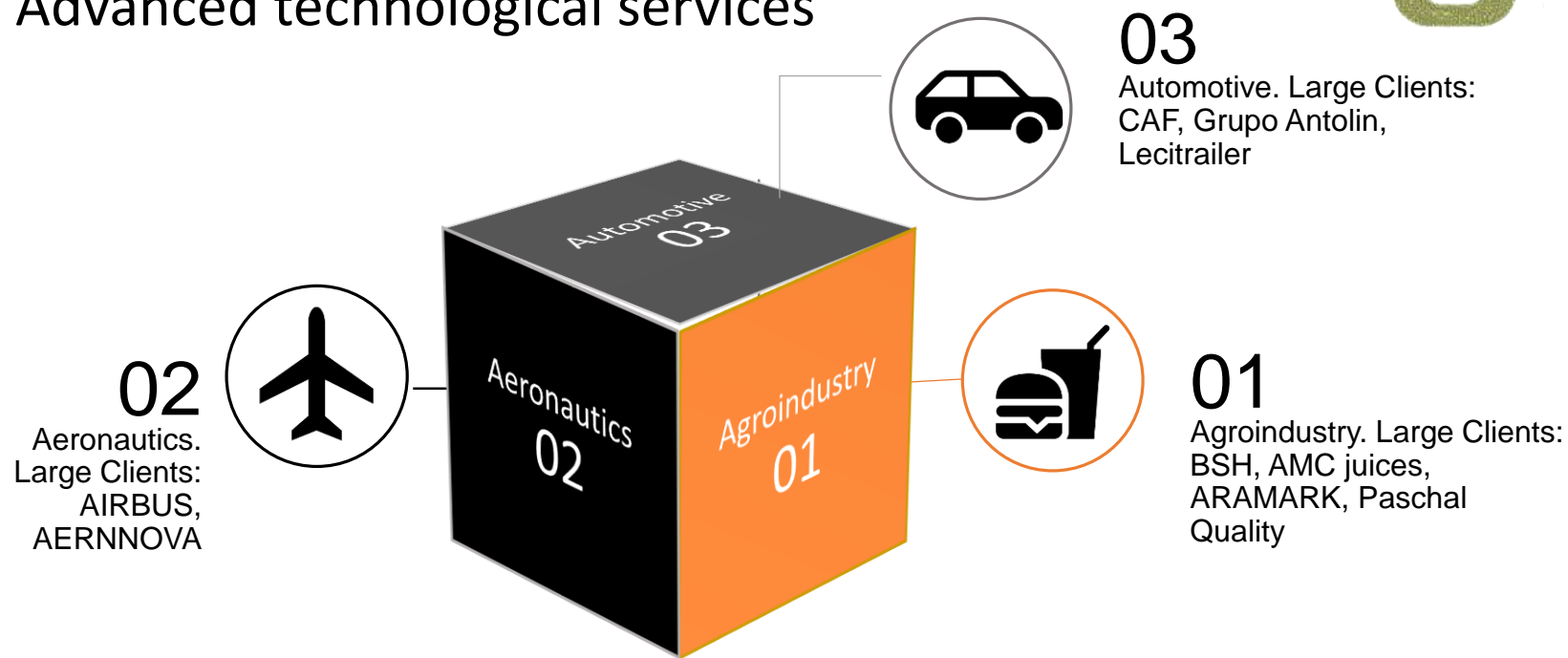
Semi-industrial machinery for processing materials and mechanical testing laboratory



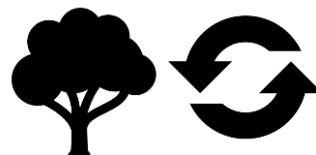
Main sectors and lines of work

- 250 Technological services to companies.
- 25 own projects in R&D.
- 75 collaborative projects with companies.

Advanced technological services



R&D



Circular Economy

- Valorization of agricultural waste
- Biopolymers
- Green composites



Digitalization - Industry 4.0

- Multi-material additive manufacturing and 3D printing
- Robotization of processes



European projects



Para mayor información : www.aitiip.com



Coordinator

 2014

LIFE MULTIBIOSOL
LIFE14 ENV/ES/000486
www.multibiosol.eu

 2016

LIFE CITRUSPACK
LIFE16 ENV/ES/000171
www.citruspack.eu

Associated beneficiary

 2013

LIFE FRESHBOX
LIFE13 ENV/ES/001362
www.fresh-box.info

 2015

LIFE RECYSITE
LIFE15 ENV/BE/000204
www.recysite.eu

 2017

LIFE CEPLAFIB
LIFE17 ENV/SI/000119
www.ceplafib.eu

Examples of results from ongoing European projects



→ Click on the logos to go to the project website

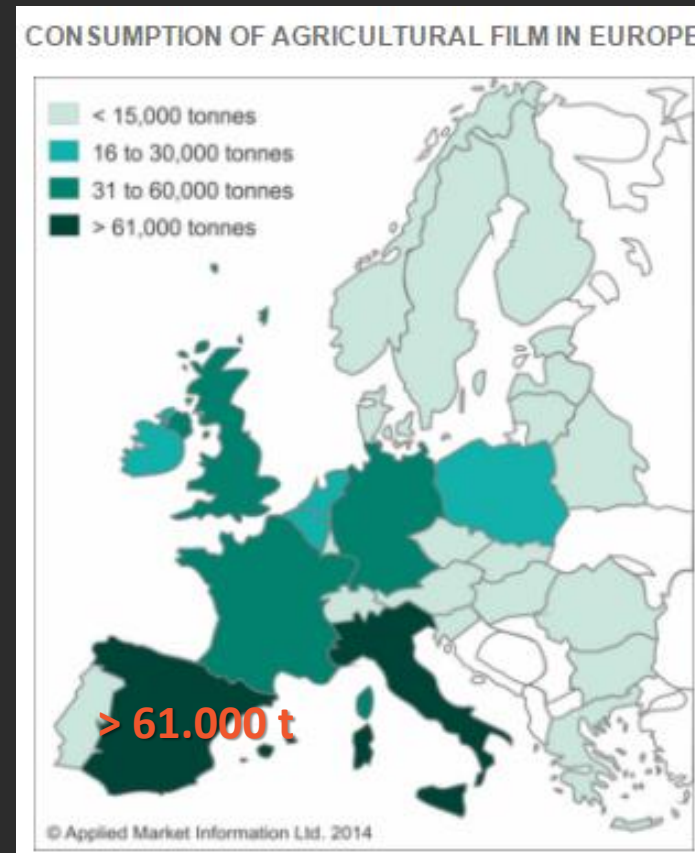


General overview of the project

Production



Consumption



End of life



They are used mainly in Italy, France, Germany, Benelux and Spain.

General overview of the project

Current semi-intensive and intensive farming practices require the use of large quantities of plastic film and paraffin wax paper.

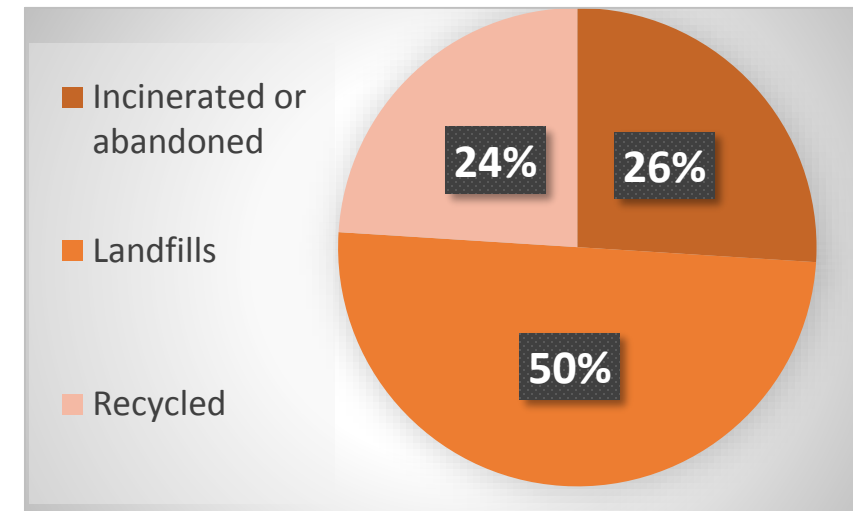
These practices have a significant environmental impact:

- Single use only
- Elimination involves high costs in terms of time and money



Environmental consequences if not removed correctly

1. High economic and environmental impact in the use of conventional plastics and fossil energy (50% is disposed of in landfill).
2. HDPE – LDPE material abandoned in landfills or open fields may take about 100 to 500 year to degrade or/and break completely.
3. Loss of harvested products due to improper use, soil loses fertility (less nitrogen fixation and nutrients) and lead to erosion as a result of concentrated runoff. Some plastics contains traces of heavy metals,...



General overview of the project

Agroplastics are needed:



Innovations



Sustainability

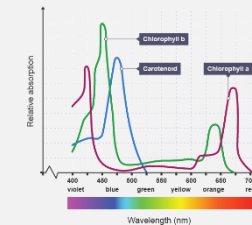
- Conserve water and nutrients
- Prevent weed growth
- Permit adequate temperature in the rhizosphere



Trace elements



- Protection against pests and infestations
- Isolate fruit from plant protection products
- Fruits with uniform skin colour



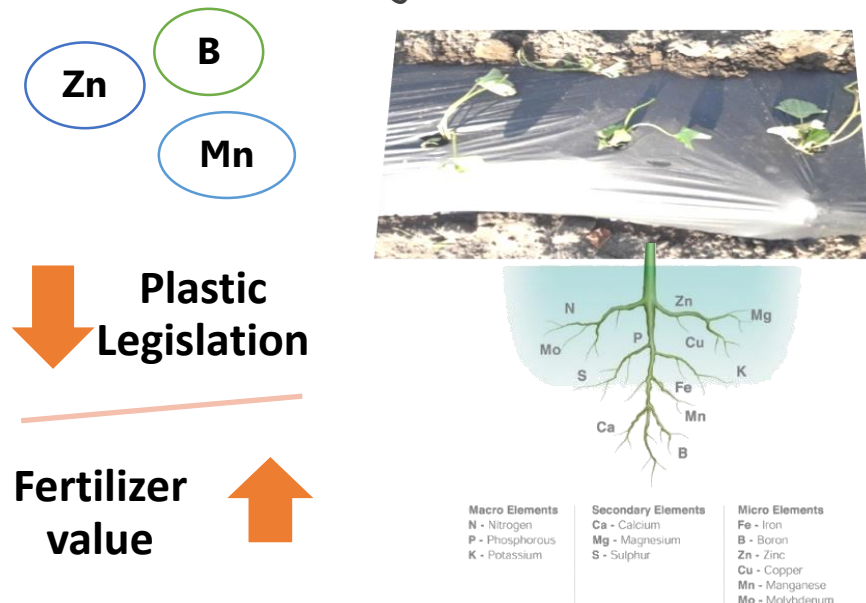
Macro-perforations
Coloring bags



The overall objective of the project is to demonstrate that the **sustainability and efficiency of agricultural practices** can be achieved by introducing an **innovative**, economically viable and soil biodegradable plastic that **eliminates waste** completely.

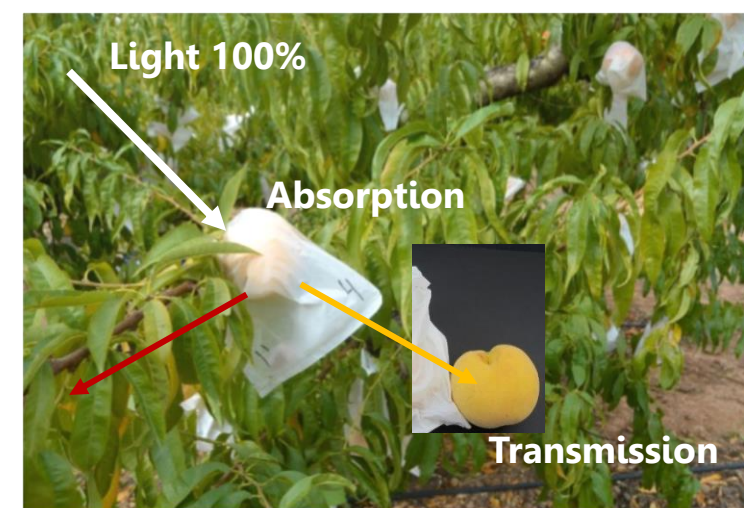
General overview of the project

Mulching Innovations

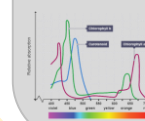


- **Boron** deficiency appears in dry climates (important for plant metabolism)
 - **Zinc** is required by many enzymes (hormone auxin, little leaf)
 - **Manganese** is necessary for photosynthesis (coloration)

Fruit protection bags innovations



- **Macro perforations** to prevent rotting due to the concentration of water vapour.
- **Pigment Skin Active Radiation** capable of producing colour surface fruit.



Partners



Coordination and bioplastics production

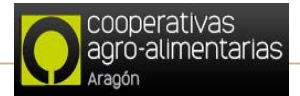
- Development of plastic products: bags, clips and mulching
- Technical evaluation

- Technical assistance in film production
- Validation in **France and Belgium**

Green Creatie

ARCHA

- **Technical assistance**
- Technical **validation** of the solutions
- Biodegradability test



- **Technical assistance**
- **Validation partners (horticulture and fruit trees)**
- Dissemination



- **Post-harvest**
- Validation of product quality
- Production control



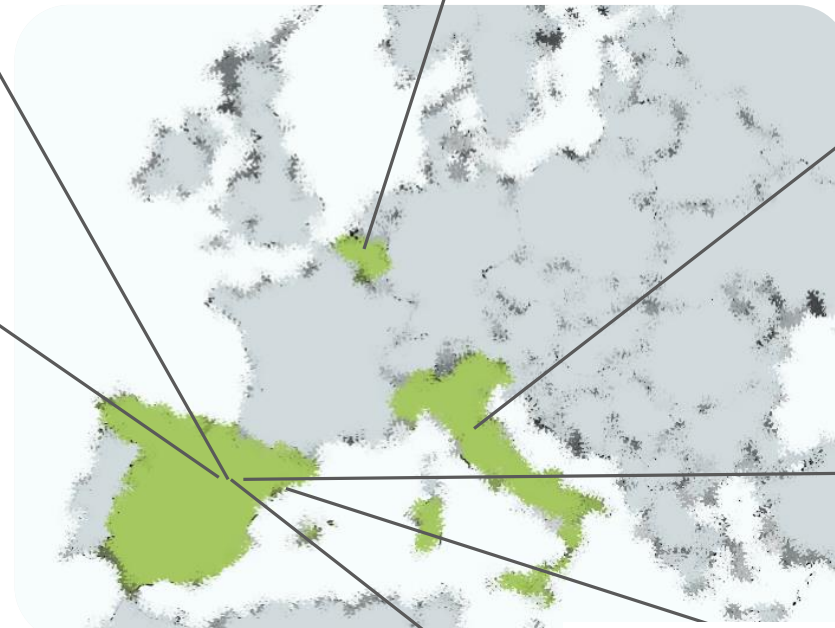
TRANSFER
CONSULTANCY

- **Dissemination and communication**
- Web, information



Pre-harvest

- Crop tests (soil, plant)
- Fertilization tests with new films
- Environmental impact

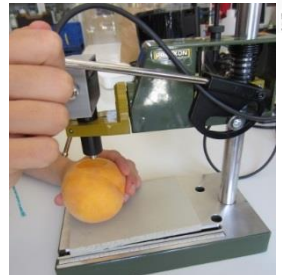


Replicability and transferability



✓ Replicability and Transferability: The environmental problem that we solve exists in many European areas.

Demonstration character of the project



aitiip centro tecnológico **Raw materials**
 - 100% biodegradable
 - Polymers based on natural sources

Production processes
 - Materials extrusion
 - Film blowing



ARCHA

Validation of plastics in laboratory
 - Mechanical tests of materials
 - Tests for certification OK BIODEGRADABLE SOIL

Validation of plastics products in fields
 - Tomato (Spain and France), pepper and cucumber in Spain and sweet potato in Belgium
 - Bags for apple and peach (Spain)

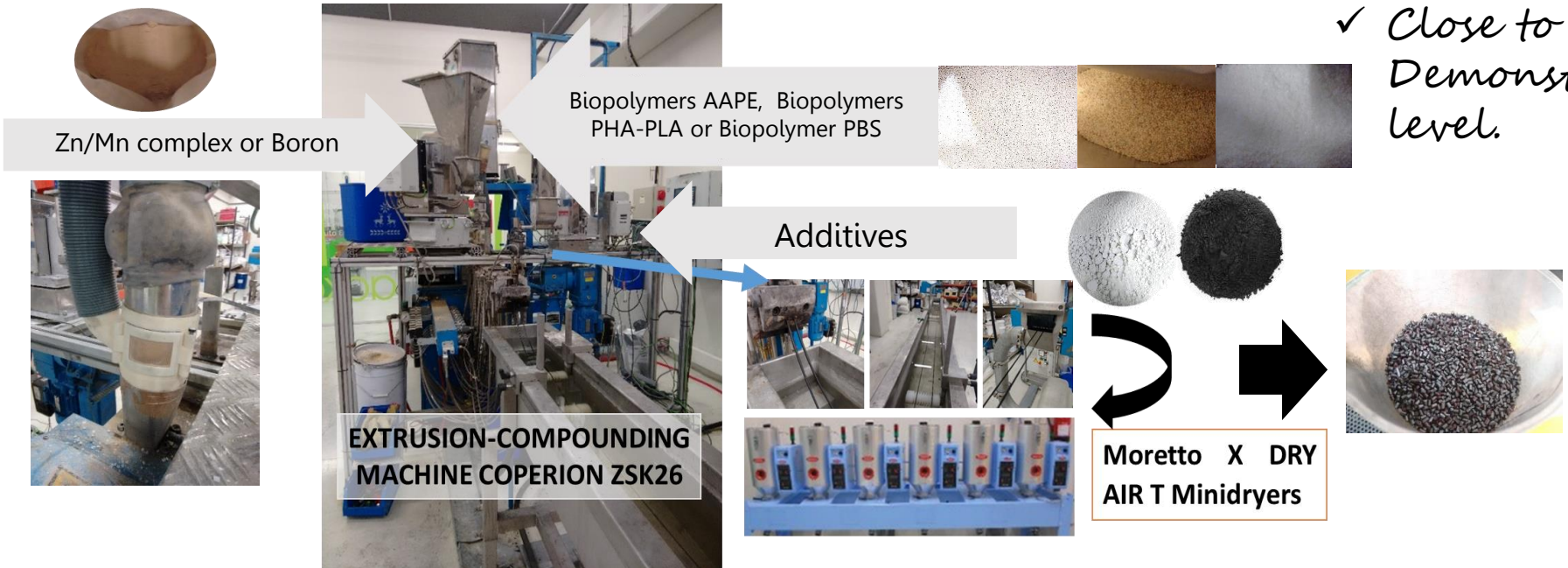


Validation of quality:
 - Soil
 - Crop (Pre-harvest)
 - Product (Post-harvest)

Expected results
 - Reduction of plastic waste
 - Less CO2 emitted during the production of plastics/Non-emissions from disposal
 - Improvement of soil quality
 - Improvement in crop quality
 - Certification OK BIODEGRADABLE SOIL



Production of bioplastics



✓ Close to the market.
Demonstrators at semi-industrial level.

Control samples:
Conventional LDPE mulching (Comercial Arnedo, Spain)
Conventional waxed paper bags (Cooperative Calanda DO).

Samples				Additives
MULCHING	2016	M11		A%-B%
		M21		
		M31		
	2017	M12		A%-B%
		M42		
FRUIT BAGS	2016	B11		A%-B%
		B21		
		B31		
	2017	B12		A%-B%
		B22		
		B42		

Film blowing unit LABTECH LF 400



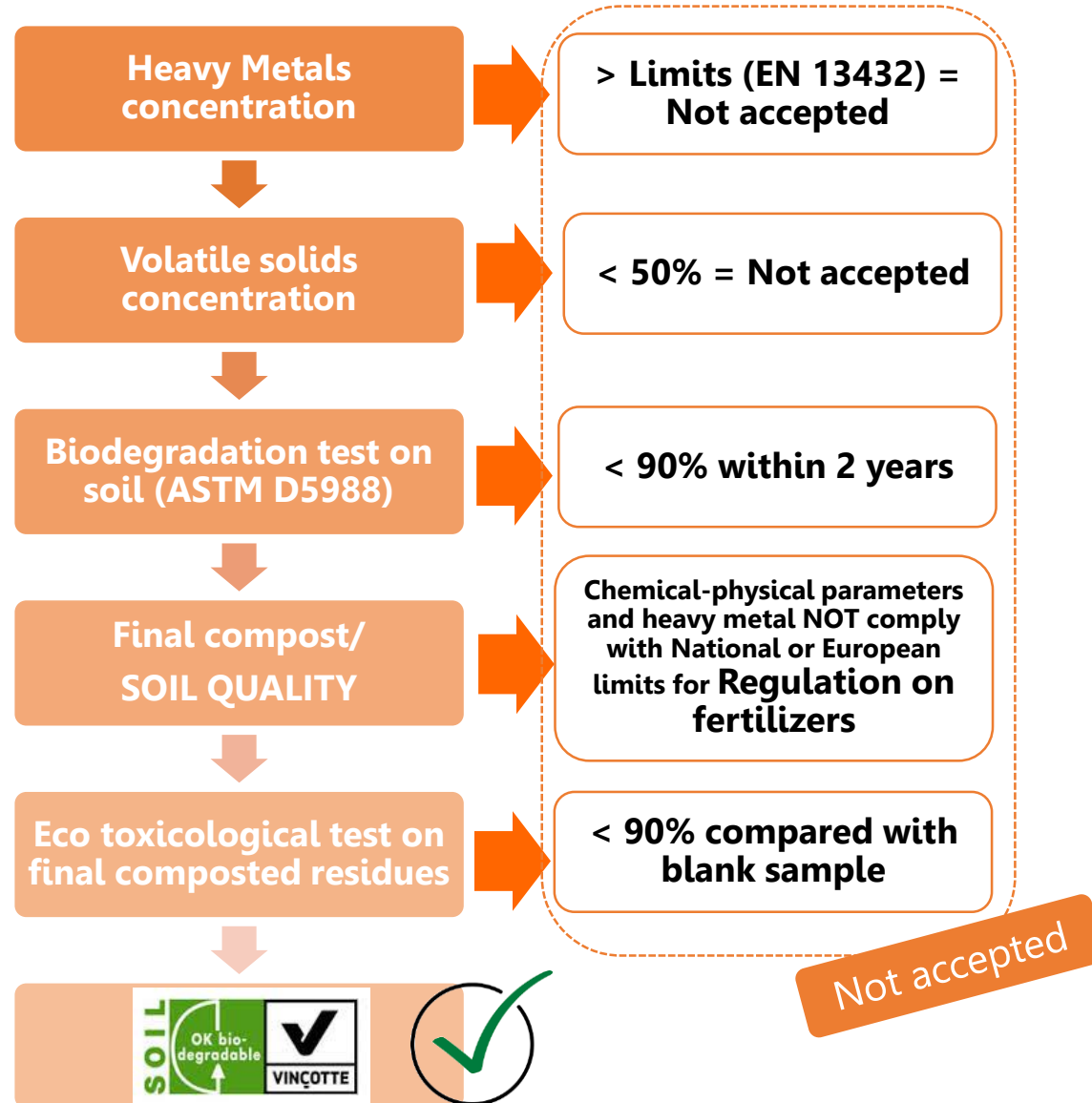
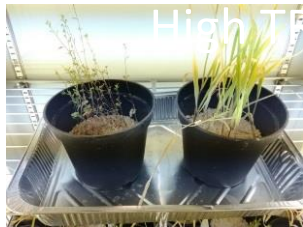
Mulching

Injection moulding for obtaining biodegradable clips



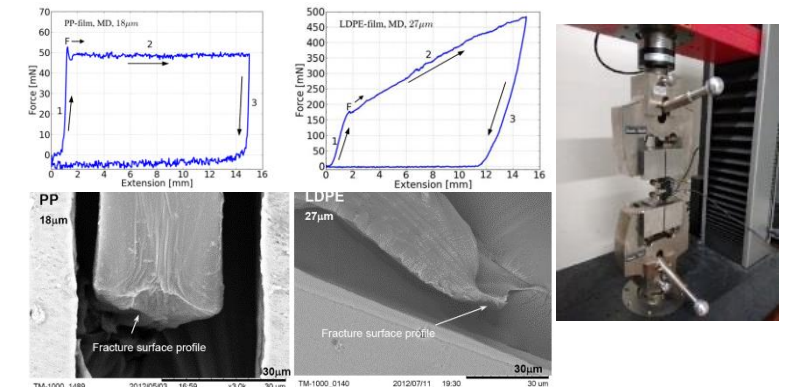
Film for fruit bags

Bioplastics validation for certification



Laboratory plastics validation

BIOPLASTICS CHARACTERIZATION	Method
Tensile Properties of Thin Plastic Sheet	ASTM D 882 – 12
Elasticity	ISO 604
Biodegradation test	ASTM D 5988-12
Plastics – Methods of exposure to laboratory light sources	EN:ISO 4892-3
Heavy metals concentration of the biofilms	EPA 3052 1996 EPA 6010C 2007
"OK Biodegradable Soil"	EN13432:2000



Vegetables and fruit samples



Treatments were randomly distributed in three blocks, with six repetitions each block

Area Mid-Ebro Valley (Zaragoza, Spain):

Year 2016: 0,2 Ha Year 2017: 0,5 Ha

Tomato *Solanum lycopersicum* "Manitu"

- Planting dates:
 - 24/May/2016
 - 02/June/2017
- Collection dates:
 - 25/August/2016
 - 31/August/2017



300 bags/batch were tested (2016) and 500 (2017) and randomly distributed in six blocks, with one tree each block

Area Ebro Valley (Calanda, Spain):

1 ha, 5×4 m

Peach *Prunus persica* "58GC"

- Bagging dates (middle of season):
 - 14/July/2016
 - 17/July/2017
- Collection dates:
 - 13/September/2016
 - 06/September/2017



Fruit and vegetables quality parameters measurement

150 fruits per experimental unit were analysed



- CIELab colour space with the aid of a spectrophotometer (Konica Minolta mod. CMS 700; Tokyo, Japan).



- Firmness was measured with non-destructive Acoustic Firmness Sensor (AWETA; Netherlands) for peaches and Durofel (Agrosta; Forges Les Eaux, France) for tomatoes.



- Destructive Magness-Taylor using a digital penetrometer (Agrosta) with a tip diameter of 8 mm for peaches and of 4 mm for tomatoes.



- Soluble solid content (SSC) as Brix degrees was determined by crushing the flesh and transferring the intact juice of the 10 samples to a digital refractometer (Atago mod. PR-101; Tokyo, Japan).



- Titratable acidity (TA) by an automatic titrator (Mettler Toledo mod. G20 Compact Titrator; New York, NY, USA).

Soil collection and analysis

- Samples were collected randomly in each repetition of each block of plastics. Each sample was composed of 8 sub-samples taken throughout the entire line.
- Soil electrical conductivity, pH, total carbon, total N and total macro- and micronutrient was determined.
- Soil samples, only for mulching, were collected from the upper layer (20 cm).



**Incorporation
plastics (Y1):
28/03/17**

**2 months
before first soil
sampling**

**At the beginning (Y2): 24/05/2017
At the end (Y2): 03/10/2017**

**Incorporation
plastics into
the soil:
07/11/17**

Some of the conclusions obtained during the project...

- Additives (oligoelements and/or colourants) difficult plastic processing. In general, all selected bioplastics showed appropriate mechanical properties.
- Adequate biodegradation in the field and in the laboratory was observed with selected bioplastics.
- The addition of Zn is not proper to obtain the “OK biodegradable SOIL” certification, but fertilization effect was reached: higher concentration of Mn and Zn than in control samples was founded in the soil.
- Biomulching in tomatoes decreased the incidence of blossom end rot, improving the production, and not affecting to the rest of quality parameters.
- For peaches, the colour obtained with biobags was more uniform and yellowish than with conventional bags without modifying other quality parameters, improving their sell value for the producers.



<http://multibiosol.eu/>





Final Conference will be held in Zaragoza
Provisional Date: 29th May 2019



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