



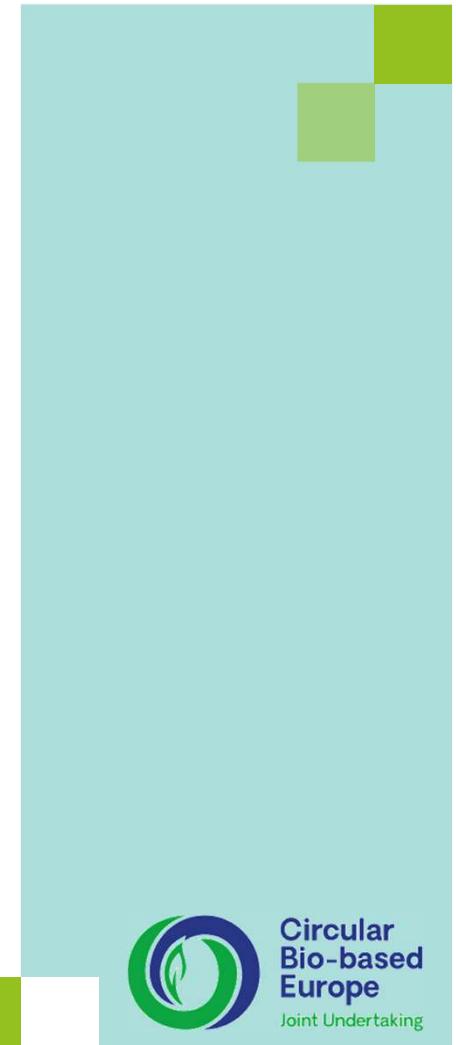
Bio-based in Soil applications with Optimal
biodegradation in their Ultimate Life

IL PROGETTO SOUL:

***BIO-BASED IN SOIL APPLICATIONS WITH
OPTIMAL BIODEGRADATION IN THEIR
ULTIMATE LIFE***

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101214822 – SOUL – HORIZON-JU-CBE-2024



IL CONTESTO

I materiali plastici sono ampiamente utilizzati in Agricoltura per i loro vantaggi:

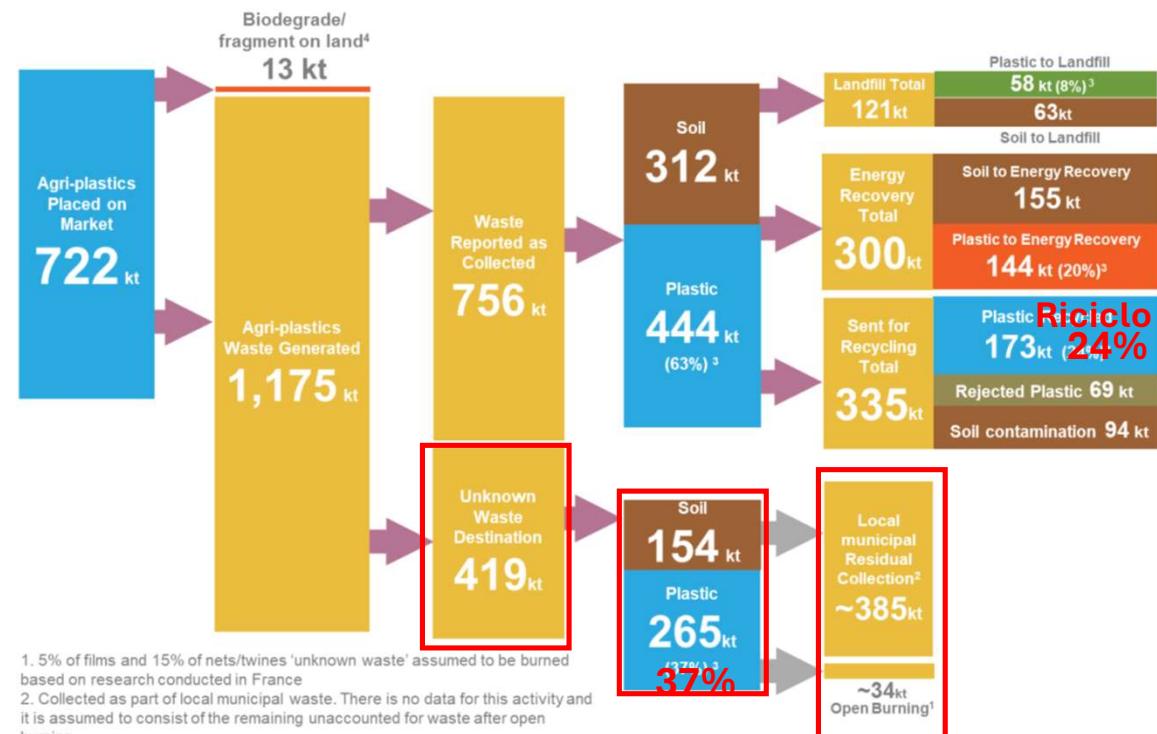
- Ottimizzazione dell'utilizzo di acqua, controllo delle infestanti, miglioramento delle condizioni ambientali di crescita delle piante, incremento delle quantità e qualità delle produzioni

Difficoltà nella gestione del fine vita:

- In EU viene raccolto il 63% del rifiuto plastico, mentre è ignoto il destino del rimanente 37%

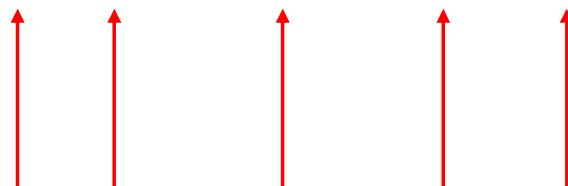
Alcuni manufatti in particolare presentano rischio di dispersione nell'ambiente o sono estremamente sporchi e difficili da riciclare

- **Fertilizzanti a lento rilascio, reti per tappeti erbosi, infill, reti per protezione di alberi, erogatori di feromoni**
 - **Teli di pacciamtura**
 - **Fili e clips**



Rischio di dispersione nell'ambiente ed impatto delle principali applicazioni plastiche (FAO, 2021)
 Basato su criteri di: quantità, uso, potenziale di rilascio nell'ambiente, tipologia di fine vita

| Propagation | Cultivation | | | | | | | | | | | | Feed production | | Animal care | | Fisheries and aquaculture | | | | |
|------------------|----------------------|----------------|--|----------------------------|-------------|------------------------|-----------------------------|--|-----------------------|---|---|-------------|-----------------|---------------------|-------------|---------------|---------------------------|-----|-----|-----|-----|
| Greenhouse films | Pesticide containers | Mulching films | Fertilizer containers – bags and rigid | Plant pots, seedling plugs | Tree guards | Plastic bags (bananas) | Plastic ties, ropes, twines | Polymer coated slow release fertilizer | Crates for harvesting | Irrigation tubes and drips (semi-permanent) | Irrigation drip tape (single-use, on-soil applications) | Pond liners | Silage films | Bale films and nets | Bale twine | Bags for feed | Fishing nets and ropes | | | | |
| 6,7 | 9,5 | 9,8 | 7,8 | 7,8 | 6,4 | 8,7 | 7,5 | 10,5 | 4,0 | 5,8 | 8,8 | 6,4 | 6,8 | 9,3 | 7,4 | 5,1 | 7,5 | 8,7 | 8,5 | 8,7 | 9,0 |



OBIETTIVI

- ✓ Rendere maggiormente sostenibile e circolare il fine vita di alcune applicazioni plastiche per **Agricoltura, paesaggistica, applicazioni nel mondo dello sport, attraverso lo sviluppo di soluzioni biodegradabili in suolo, compostabili, riciclabili o riutilizzabili**
- ✓ **Sviluppare nuovi materiali biodegradabili con alto contenuto di rinnovabilità, a minore impronta di Carbonio, con riduzione del rifiuto e in grado di ridurre la dispersione di materiali non biodegradabili nell'ambiente**
- ✓ **Sviluppare 11 soluzioni rinnovabili** (95%) e biodegradabili in suolo, combinando **3 building blocks** e **8 tecnologie** e raggiungendo **TLR 8** con approccio tipico della bioeconomia circolare e multi attoriale che coinvolga tutti gli attori della filiera
- ✓ Sviluppare un **modello predittivo per la biodegradabilità** in ambiente suolo
- ✓ Verificare l'impatto dei materiali sulla **funzionalità del suolo**





SOUL Improves circularity and resource efficiency via practical application of Circular Bioeconomy

INDUSTRIAL COMPETITIVENESS AND RESOURCE INDEPENDENCE OF BIO-BASED VALUE CHAINS



INNOVATIVE MANUFACTURING PROCESSES TO ENABLE THE...



...SAFE BIODEGRADATION OF BIO-BASED MATERIALS AND PRODUCTS ACCORDING WITH...



...THE ENVIRONMENTAL CONDITIONS AND TIME FRAME FOR SPECIFIC APPLICATIONS...



... LEADING TO HEALTHY SOILS AND INCREASING SOCIAL ACCEPTANCE OF CIRCULAR BIO-BASED SOLUTIONS AND PRODUCTS.



BIOMATERIALS PRODUCTION BY USING 3 BIO-BASED BUILDING BLOCKS (1,4 BIO-BDO, C18-DCA, AZELAIC ACID) FROM EU SUSTAINABLE FEEDSTOCK

LARGE SCALE PROCESSING OF 11 NEW BIOMATERIALS (95% EU RRM) VALIDATED FOR 8 KEY TECHNOLOGIES

11 BPS BIODEGRADABLE IN SOIL FOR 8 APPLICATIONS DEVELOPED FOR 3 SECTORS: AGRICULTURE, GARDENING/LANDSCAPING AND SPORTS/LEISURE

PERFORMANCE, SOIL QUALITY AND BIODEGRADABILITY IN SOIL ANALYSIS IN 5 EUROPEAN REGIONS TESTED. 18 PARTNERS FROM 5 EU COUNTRIES + 1 AC AND 25 STAKEHOLDERS ENGAGED IN THE PROJECT

ZERO WASTE AND ZERO POLLUTION BY:

- 5 DIFFERENT END OF LIFE OPTIONS TESTED
- CIRCULARITY INDEX >0.55
- MPEP < 13 .
- BIODEGRADABILITY PREDICTION MODEL

Safe and Sustainable by Design Tool

AVAILABILITY OF SAFE AND SUSTAINABLE BY DESIGN BIO-BASED SOLUTIONS AIMING AT ZERO WASTE AND ZERO POLLUTION, WITH DECREASED ENVIRONMENTAL ON SOIL, BIODIVERSITY AND CLIMATE

IL PARTNERSHIP

18 partner in 5 Stati Membri
Aziende produttrici di materie
prime, trasformatori, modo della
ricerca, enti di certificazione e
normazione



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I PRODOTTI TARGET E LE SOLUZIONI

| | | | |
|---|---|---|---|
|  <p>BPS1-3 MULCH</p> <ul style="list-style-type: none"> FILM BLOWING (MONO/MULTILAYER, FIRST-OF-A-KIND FLEXO-PRINTING OR STRIP COEXTRUSION FOR TUNED BIODEGRADATION) BIODEGRADABLE IN SOIL ULTRATHIN LOW COST/M2 WITH TUNEABLE DEGRADATION (1) / LONG APPLICATION TIMEFRAME & BIODEG- AFTERWARDS (2-3) UP TO -70% vs LDPE BENCHMARK 45 DAYS (1) / 2 YEARS (2-3) |  <p>BPS4 - CRF</p> <ul style="list-style-type: none"> SPRAY COATING BIODEGRADABLE IN SOIL TUNEABLE RELEASE OF NUTRIENTS COMPLIANT WITH EU REGULATORY RESTRICTIONS -20% VS PU, ALKYD RESINS, WAXES 6-9 MONTHS |  <p>BPS5 - CLIPS</p> <ul style="list-style-type: none"> INJECTION MOULDING, ENZYMATIC MASTERBATCH BIODEGRADABLE IN SOIL, REUSABLE, ORGANIC/MECHANICAL RECYCLABLE DESIGNED FOR REUSE, BIODEGRADATION IN SOIL IN CASE OF ACCIDENTAL DISPERSION -10% vs PP BENCHMARK 6 MONTHS |  <p>BPS6 - TWINES</p> <ul style="list-style-type: none"> EXTRUSION, STRETCHING, TRIMMING, TWISTING; ENZYMATIC MASTERBATCH BIODEGRADABLE IN SOIL, ORGANIC/ MECHANICAL RECYCLABLE HIGH TOUGHNESS, BIODEGRADATION IN SOIL IN CASE OF ACCIDENTAL DISPERSION -20% vs PP BENCHMARK 6 MONTHS |
|  <p>BPS7-8 - PHEROMONE DISPENSERS</p> <ul style="list-style-type: none"> INJECTION MOULDING, EXTRUSION, PHEROMONE EMBEDDING, ENZYMATIC MASTERBATCH BIODEGRADABLE IN SOIL, ORGANIC/ MECHANICAL RECYCLABLE PHEROMONE TUNEABLE RELEASE, BIODEGRADATION IN SOIL IN CASE OF ACCIDENTAL DISPERSION Up to 40% vs LDPE BENCHMARK 3-5 MONTHS |  <p>BPS9 - TURF NETS</p> <ul style="list-style-type: none"> NET EXTRUSION & STRETCHING BIORIENTED BIODEGRADABLE IN SOIL MEDIUM-LONG APPLICATION TIMEFRAME & AFTERWARDS BIODEGRADATION IN SOIL -50% vs PP BENCHMARK 12-14 MONTHS |  <p>BPS10 - TREE SHELTER</p> <ul style="list-style-type: none"> NET EXTRUSION BIODEGRADABLE IN SOIL, REUSABLE, ORGANIC/MECHANICAL RECYCLABLE DESIGNED FOR REUSE, LONG APPLICATION TIMEFRAME, BIODEG. IN SOIL IN CASE OF ACCIDENTAL DISPERSION -40% vs PP BENCHMARK 2+ YEARS |  <p>BPS11 - INFILL</p> <ul style="list-style-type: none"> COMPOUNDING WITH EXPANSION BIODEGRADABLE IN SOIL LONG APPLICATION TIMEFRAME, COMPLIANCE WITH REGULATORY RESTRICTIONS, OK FIFA -20% vs FOSSIL-BASED BENCHMARK 5+ YEARS |



AGRO SECTOR



GARDEN/LANDSCAPING



LEISURE/SPORT

SOUL

IL FINE VITA

Tutte le soluzioni sviluppate saranno biodegradabili in suolo, ma anche altri fine vita saranno valutati, per rendere maggiormente versatile la loro gestione circolare

| SOUL | REUSE | MECHANICAL RECYCLING | INDUSTRIAL COMPOSTABILITY | ANAEROBIC DIGESTION | BIODEGRADABLE IN SOIL |
|--|---|---|---|---|---|
| BPS1-3 Mulch films  | | | | |  |
| BPS4 Controlled release fertilizers  | | | | |  |
| BPS5 Clips  |  |  |  |  |  |
| BPS6 Twines  | |  |  |  |  |
| BPS7 Pheromone dispensers  | |  |  |  |  |
| BPS8 Pheromone dispensers  | |  |  |  |  |
| BPS9 Tree shelters  |  |  |  |  |  |
| BPS10 Turf nets  | | | | |  |
| BPS 11 Infills  | | | | |  |

LE ATTIVITA'

Pillar 1: Production of SOUL materials

- Upscaling of new biobased and biodegradable polyesters
- Enzyme optimization and production
- Extrusion compounding of blends



Pillar 2: Production and evaluation of SOUL solutions performance and sustainability

- Industrial production towards bio-based and biodegradable in soil products.
- Validation in real sites in Poland, Italy, Spain and Ireland.
- Soil quality and Biodegradability in soil analysis.



Pillar 3: Application of the SSbD methodology and EoL

- Implementation of digital tools to predict biodegradation.
- EoL demonstration (Industrial composting, anaerobic digestion, mechanical recycling and reuse).
- Integration of LCA, sLCA in the SSbD tool.



Pillar 4: Assessment of the Market and replication potential

- Generate Business Case and Circular Business Models
- Assessment of the replication potential for materials and transformation processes in other sectors.
- Standardization work will be carried out helping market introduction of the new developed materials and products.

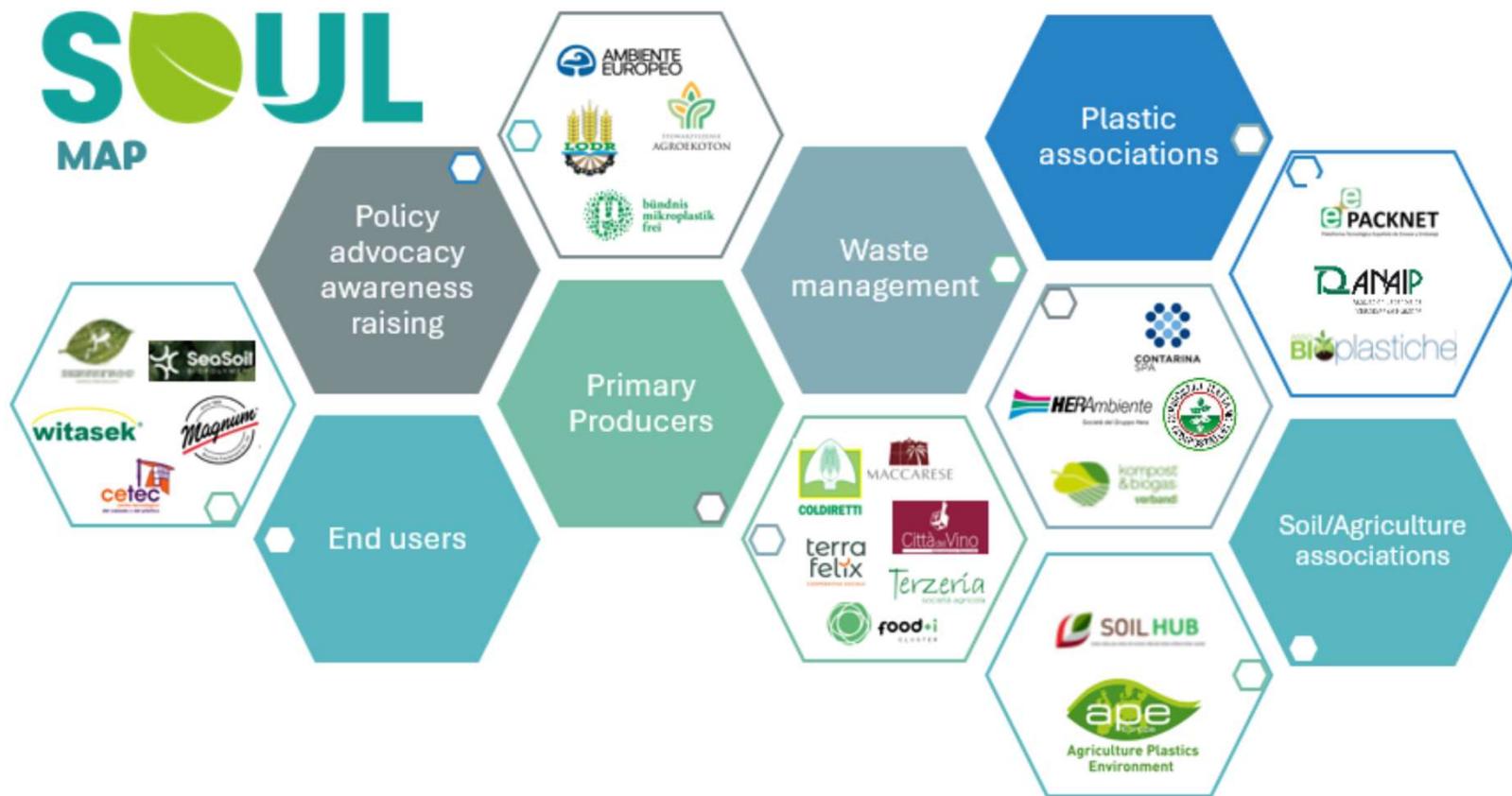


Pillar 5: Multiactor Approach

- Creation of a Multiactor advisory panel (MAP). To cocreate in dedicated workshops and specific training sessions.
- Validation of products with end users, to get feedback from them and develop recommendations for labelling.
- Policy advocacy.



STAKEHOLDERS ENGAGEMENT



REPLICABILITA' E FUNZIONALITA'

Le soluzioni sviluppate saranno validate, in prove in campo in diversi contesti climatici, in funzione delle loro caratteristiche d'uso

5 siti dimostrativi in Spagna, Portogallo, Polonia e Irlanda
2 cicli di prova





EFFETTI SU SUOLO E PIANTE

Analisi di laboratorio e in pieno campo per evidenziare variazioni nelle proprietà chimiche, fisiche e biochimiche del suolo

In particolare analisi degli effetti del telo di pacciamatura su suolo e piante in condizione di campo per un periodo di più anni

Su suolo:

- Verrà determinato il Soil Quality Index (SQI) partendo da un set di proprietà chimiche e biochimiche applicando il metodo Soil Management Assessment Framework (SMAF)
- Analisi delle principali attività enzimatiche

Su piante: Biomassa vegetale, Contenuto di clorofilla, Attività fotosintetica, Stress ossidativo

Grazie mille!



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