BRILIAN - Pilot Key Results

ITALIAN PILOT →

Aims to improve the adoption of regenerative agricultural practices through the cultivation of low-inputs oil crops (cardoon, safflower and sunflower) on marginal lands, to be valorised to produce added-value bio-based products.

SPANISH PILOT →

Aims to recover starch from the process water and potato rejections, which would otherwise be lost while contributing to decrease the levels of organic matter by physical methods without the need to add chemicals therefore minimizing water consumption required in the potato processing and the environmental footprint of the potato processing industry.

DANISH PILOT →

Aims to develop a process for protein extraction from hot and cold rapeseed cake, aiming at a protein product suitable for food applications and for bio-based adhesive applications.

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Circular Future for Rural Areas

ITALIAN PILOT

Farmers engagement procedure

Cooperation agreement established between Novamont, Coldiretti (Italian farmers'union), Filiera Agricola Italiana (Italian Agricultural Supply Chain) and Consorzi Agrari d'Italia (Italy's Agricultural Consortium) to disseminate the cultivation of drycrops among farmers.
Farmers engagement procedure:
1) Meetings and site visits of each agricultural land.
3) Sharing cultivation protocols with the interested farmers, adapted based on pedo-climatic conditions of the growing areas.
4) Assessment of technical issues (eg quipment and logistical aspects) for each site.
5) Signing cultivation agreements.

Phases accomplished

1) Selection and involvement of primary producers.
2) Soil preparation, sowing and plant protection treatment.
3) Monitoring of agricultural data and monthly field inspections.
4) Seed harvesting and crushing performed.
5) Monitoring of agro-feedstock and biomass quality.
6) Cardoon biomass (stems and leaves) was harvested at farms.
7) Valorisation phase started for the: benchmark pelargonic acid as bioherbicide and animal feed.

Outcomes

-Cultivation of 46 hectares of safflower and 10 hectares of cardoon.
- Seeds yield season 2024: 45.4 tonnes of safflower seeds; 1.6 tonnes of cardoon seeds.
- Animal feed application: Ongoing first trial at buffalo farm to valorize cardoon oil cake as animal feed.
- Plant protection application: trial with a benchmark bioherbicide evaluated the efficacy of pelargonic acid on ryegrass as desiccant with promising results.
- Substrate for mushroom cultivation: the cardoon lignocelluosic biomass is stored at the local farm that will carry out further treatments to produce mushrooms bales

SPANISH PILOT

Value chain steps

- Starch Extraction: Installation of starch extraction facilityto recover starch from potato rejections and process water. This facility significantly contributed to
reduce water consumption and COD of the water used in the potato processing industry.
- Starch Valorisation: The extracted starch is then processed into thermoplastic starch (TPS) through extrusion processes.
- Bioproduct Development: The TPS will be used to develop bio-based blends for shrink films, and in a second step mulching films

Phases accomplished

1) Defining piping and instrumentation diagrams
2) Installation and commisionning
4) Plant operation and fine tuning
5) TPS production at AITIIP facilities: pretreatment, TPS production and testing.

Outcomes

After two batches of testing, the following key findings were reached:
- Starch Recovery: The extraction plant is fully operative. The starch extraction process enabled to achieve a significant reduction in water consumption and COD (decreased 62%), BOD (decreased 78%) and suspensed solid (decreased 93%), demonstrating its potential for improving the environmental sustainability of the potato processing industry.
- TPS Production: TPS with good processability was successfully produced from potato starch. The TPS exhibited good thermal stability but further assessment on processability must be performed to optimize the process.
TPS will be used to develop bio-based blends for: shrink films and mulching films

DANISH PILOT

Value chain steps

Pilot tests have been performed to validate and optimize protein extraction from rapesseed cake. Although the two tests were very promising, the final products did not meet the objectives of protein content and protein yield (neither for CPR nor HPR). Therefore, a set of experiments in lab scale, in which different conditions during enzymatic hydrolysis are tested, were designed to optimize the parameters that can increase the efficiency of protein extraction from the raw material.
The protein powder obtained is also tested to manufacture protein-based resins aiming to reach the highest phenol replacement ratio possible while fulfilling the standard comparing to a reference formulation.

Phases accomplished

1) Rapeseed harvesting and dried for long-term storage.
2) Oil pressing performed: hot pressing and cold pressing. Agroindustry provided these 2 types of rapeseed cake for the biotransformation activities.
3) Aqueous extraction with or without enzymatic hydrolysis aiming at a scalable process.
4) Several process optimization activities have been done: pilot scale validation and lab-scale optimization of enzymatic hydrolysis with both types of cake.
5) Manufacture of pilot scale plywood panels to evaluate the performance of protein-based phenolic resins. 5 rounds of laboratory experiments have been accomplished testing various levels of phenol replacement (20%, 40% and 50%).
6) Physicochemical properties measured to determine if the plywood panels fulfill the standars requirements

Outcomes

-Two pilot trials have been conducted in the BRILIAN project to validate and optimize the process with HPR and CPR.
-There are slight differences in the protein and fat content between HPR and CPR, both at the starting material and the final product.
>CPR: Protein yield was lower, 18.6%, compared to 28% when using HPR. The protein content (48.6g protein/100gDM) still needs further optimization (targeted at 90g protein/100gDM).
>HPR: tprotein content on the first pilot trial (45.9 g protein/100gDM) very close to the target (50 g protein/100gDM), and the protein yield was only 12% lower than the target.
- The centrifugation step was tested to remove any remaining oil in the liquid and small particles that could hinder the filtration process.
- An enzyme-assisted aqueous extraction was tested in pilot scale.

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