

Sustainable innovations for the development of cloth sacks for application in ornamental horticulture and gardening. Selection of substrates and species

Summary

The project focuses on finding innovative solutions for the materials, the structure of the cloth, the design of the products and the manufacturing processes in order to obtain new, differentiated solutions in relation to the cloth sacks currently used for the cultivation and planting of ornamental plants. The proposal is the adoption of the circular economy philosophy, using as the base material by-products from the agricultural activities of other Catalan cooperatives, such as by-products from the harvesting of corn or other cereals. It will be necessary to characterise the new fibres, study how the sacks can be produced in these fibres and assess their behaviour in nursery and field conditions with respect to species of commercial ornamental plants.

Objectives

- Characterise the mechanical properties and morphology of the fibres made with the by-products.
- Prepare structures such as nonwoven fabrics with the fibres.
- Determine the most suitable fibres for making cloth sacks for the growing plants based on mechanical behaviour, permeability, degradability and/or compostability.
- Design the patterns and assembly systems for the sacks, optimising the characteristics of functionality, mechanical behaviour, permeability, degradability and/or compostability necessary for their manufacture.
- Design and make prototypes based on the application of the cloth, patterns and assembly systems developed.
- Research the production of the sacks, including the substrate filling, with processes to be carried out at the plant or in situ, where necessary.
- Analyse the behaviour of the sacks in nurseries and fields and determine the suitability of growing specific plant species in this medium.

Description of the actions carried out in the project

- Assessment of different fibre extraction systems.
- Characterisation of the fibres obtained.
- Preparation of nonwoven fabrics.
- Characterisation of the nonwoven fabrics.
- Design of the elements and pattern of the sack.

- Analysis of the assembly systems most suitable for manufacturing the sacks.
- Preparation of the data sheet for production of the sacks.
- Preparation of the first prototypes.
- Testing of the behaviour of the sacks in the nursery.
- Testing of the behaviour of the sacks in the field.
- Analysis of the results of the first prototypes.
- Preparation of the drawing and system to produce the sacks and fill them with earth.
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- Development of perennial and sedum with turf. Compost characterisation and selection plant

Final results and practical recommendations

Be able to replace the current sacks used in gardening, which are normally imported and are either not biodegradable or, if they are, do not meet the technical requirements. With the fibres obtained and an optimum sack design, this problem will be solved, while also developing the circular economy through the use of by-products from the activity of other Catalan agricultural cooperatives.

Conclusions

- A method has been developed to obtain fibres from the by-product of corn husks. These fibres have properties that make them suitable for use in textile applications, with characteristics similar to those of other natural fibres.
- Nonwoven fabrics have been developed from fibres extracted from the corn husks and characterised for their possible use in crop sacks. The main features of these fabrics are: composition 67% corn fibres and 33% cotton, weight ~330 g/m²; thickness ~2.6 mm; tensile strength ~27 N; elongation ~60%.
- Nonwoven fabrics have been developed from fibres extracted from corn husks and characterised by their potential application in turf. The main features of these fabrics are; 100% corn fibre composition, weight ~1100 g/m²; thickness ~8 mm; tensile strength ~35 N; elongation ~25%. These properties are similar to those of commercial nonwoven coconut fibre. However, in nursery growing trials, the nonwoven coconut fibre provided more satisfactory results.
- Obtaining agrotexiles made from corn husk fibres contributes to the recovery this by-product.
- The high biodegradability of these nonwoven fabrics made from extracted corn fibre has been demonstrated.
- As it is a biodegradable product made from an agricultural by-product, these nonwoven fabrics may be considered a product that contributes to the circular economy.
- In addition, they have the advantage of being a local product, derived from an agricultural by-product that currently has no market value.
- The resulting nonwovens have potential for application as agrotexiles in garden applications where rapid biodegradability is required, or in other applications where they are not subject to biodegradation conditions.

- The optimal fabric for the manufacture of biodegradable culture sacks has been determined as a nonwoven polylactic acid (PLA) fibre, weighing around 30-40 g/m², with a minimal resistance of ~20 N, and preferably in a natural dark colour (green or brown, similar to that of the earth).
- A new sack design has been produced with three channels and a shut-off valve to facilitate filling. This sack can be made with thread seams.
- The designed sack is a versatile solution and both the fabric size and material can be easily modified.
- Machinery has been defined for filling the sacks, consisting of a hopper, a structure and a worm-drive feed mechanism, which is easy to handle and involves low maintenance.
- The proposed sack-machine system allows the prepared sacks to be stored and filled on site without adding any closing mechanisms.

Leader of the Operational Group

ORGANISATION: Corma, SCCL

CONTACT E-MAIL: gfernandez@corma.es

Other members of the Operational Group (not recipients of the grant)

ORGANISATION: Polytechnic University of Catalonia

CONTACT E-MAIL: monica.ardunuy@upc.edu

ORGANISATION: Catalan Federation of Agricultural Cooperatives (FCAC)

CONTACT E-MAIL: rdi@fcac.coop

Subject area(s) of application

- Agricultural production system
- Agricultural practice
- Agricultural equipment and machinery
- Livestock farming and animal welfare
- Vegetable production and horticulture
- Landscape / Territorial management
- Pest and disease control
- Fertilisation and nutrient management
- Soil management
- Genetic resources
- Forestry
- Water management
- Climate and Climate Change
- Energy management
- Waste and by-product management
- Biodiversity and environmental management
- Food quality/processing and nutrition
- Supply chain, marketing and consumption
- Competitiveness and agricultural and forestry diversification
- General

Geographical area(s) of application

PROVINCE(S)	REGION(S)
Barcelona	Maresme

Dissemination of the project (publications, seminars, multimedia, etc.)**Social media:**

<https://twitter.com/cormascccl/status/1068107639584956416>

<https://twitter.com/RDIcoopagroCAT/status/1286259576459931650>

<https://twitter.com/coopagrariasCAT/status/1286245495770419200>

Press and website:

<http://www.cooperativesagrarias.cat/ca/noticies/2430-finalitza-el-projecte-del-grup-operatiu-sacs-.html>

Articles and posters:

-Article: C. GONZÁLEZ, L. GONZÁLEZ, F. PARÉS, H. Ventura, M. Ardanuy. "Estudio de aplicación fibras extraídas de subproductos agrícolas en agrotexiles". Poster presentation: 45th Symposium of the Spanish Association of Textile Chemists and Colourists (AEQCT) - online symposium 26 May 2020 <https://www.aeqct.org/news/45-simposium-2020-reto-textil-acciones-para-un-fu/>

-Poster: M. BEDÓS, M. ARDANUY, M. SIMON, H. VENTURA, L. GONZALEZ - LOPEZ, F. PARÉS, C. GONZÁLEZ-CASTAÑO, G. FERNÁNDEZ. Aplicación de fibras extraídas de subproductos agrícolas en agrotexiles para jardinería. Poster presentation: 8th National Congress of Agri-Food Cooperativism - 26-27 March 2020, Toledo (postponed). Presented at the 3rd Textile Industry and Sustainability Conference organised by Intexter-UPC.

C. GONZÁLEZ, L. GONZÁLEZ, F. PARÉS, H. Ventura, M. Ardanuy. "Estudio de aplicación fibras extraídas de subproductos agrícolas en agrotexiles". AEQCT magazine https://media.timtul.com/media/aeqct/Quimica%20Textil-234_20201022105016.pdf

Presentation of awards:

-45th Symposium of the AEQCT:
Video presentation at the closing event. Work awarded 1st prize for the best chemical and textile study, 4 June 2020.

-Prize at the 4th textile innovation awards 2020 cotton foundation (http://www.aitpa.es/?page_id=223)

Other press impacts:

<http://www.diarideterrassa.es/terrassa/2020/07/21/estudiant-upc-obte-premi-per/141528.html>

<https://terrassadigital.cat/sostenibilitat-i-valor-de-mercat-dels-residus-del-blut-de-moro/>

More information on the project

PROJECT DATES	TOTAL BUDGET
Starting date (month-year): June 2018	Total budget: €63,666.43
Completion date (month-year): September 2020	DARP funding: €25,402.91
Current status: Executed	EU funding: €19,163.59
	Own funding: €19,099.93

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Order ARP/133/2017 of 21 June, approving the regulatory bases for grants for cooperation for innovation by promoting the creation of European Association for Innovation operational groups in the areas of agricultural productivity and sustainability and the execution of innovative pilot projects by those groups, and Resolution ARP/1868/2017, of 20 June, announcing the call for the grant.

