Raising the value of pulse farming through the development of new products and innovative ingredients

Summary

There is a need to increase not only the consumption, but also cultivation and knowledge of pulses given their health benefits, potential for developing innovative foods, the need to establish a "gourmet" market and the amount of pulses imported annually. In this context, this project aims to make use of the research carried out to date and knowledge from different research groups, bearing in mind the current market situation for pulses, to develop new high value-added products which can compete with those developed from animal proteins, thereby increasing the need for pulses and opening up new market channels in innovative formats, thus promoting not only pulse consumption but also their cultivation.

Objectives

- The main objective of the project is to develop new products with a high rate of innovation and high added value using flours and other new ingredients obtained from pulses. This will not only open up new trade opportunities for producers and farmers, but also increase pulse farming and consumption. The new products will be suitable for people who do not consume animal products or who are allergic to gluten, and will meet the needs of consumers who are increasingly aware of the link between food, health and well-being.

Description of the actions carried out in the project

The actions carried out in the framework of the project are:
Action 1: Characterisation study of raw materials and optimal varietal selection.
Action 2: Obtaining pulse flours, study of their nutritional, techno-functional and bioactive properties.
Action 3: New applications of pulse flours in the food industry. Action 4: Development of new protein-rich plant products.
Action 5: Study of the recovery of by-products obtained from processing pulses for the development of new foods.
Action 6: Development of predictive models using near-infrared technology as a tool for sample analysis and quality control.

Final results and practical recommendations

A total of 14 seeds of pulse varieties produced in Catalonia, some of them with PDO quality labels (Ganxet bean, Santa Pau bean, Genoll de Crist bean, ull ros bean, menut chickpea, menut destrio chickpea, pardina lentil, Histal broad bean, Sofia broad bean, Fabiola broad bean, black peas, fenugreek, Narbon bean and peanut) were assessed and characterised for their nutritional and technical properties as flours and their suitability for producing new products classified into categories (gluten-free baked products, spreads, meat analogues, hybrid meat products, ready-to-eat products, plant-based drinks, sauces, desserts). Potential techno-functional results have been obtained, determining the capacity for oil retention, water retention, water absorption, swelling, emulsifying, foaming and gelling in flours of different particle sizes. The techno-functional properties of chickpea, broad bean, black pea and bean flour are highlighted. In nutritional terms, both the protein content (25-35%) and antioxidant potential are outstanding in all the seeds.

The assessments and pilot tests led to the development of a total of 16 products, 7 of which have been selected for industrial testing.

In the context of action 3, the potential of these flours for developing new products was assessed. Of particular note is a small chickpea flour used for gluten-free pizza dough, which received high consumer acceptance, and a vegan béchamel. Two hybrid meat models (cold meat and sausages) from pea protein and chickpea flour and an analogue cooked chickpea meat model were developed. In addition, pardina lentils and Ganxet beans were used to make two vegetable spreads. The techno-functional properties of chickpea flour mean it can be used to obtain an egg-like product that has been used in the production of vegan omelettes. A study was also carried out on the hydrolysis of Ganxet bean flour to obtain hydrolysates with a high antioxidant capacity.

In the context of action 4, new protein-rich products, such as cheese analogues and vegetable drinks, were developed. Two processes were developed using chickpea flour to obtain a cheddar-type vegetable cheese and a cured vegetable cheese through fermentation and texturisation processes. The products were well accepted in organoleptic tests. In addition, the suitability of the broad bean, ull ros bean, black pea and peanut in the production of a flavoured vegetable drink shows the potential of pulses for new plant-based drinks. From the results of action 4, by-products such as okara and aquafava were recovered to produce new products and food ingredients in action 5. Aquafava has been used in different pastry products as an alternative to eggs and as a texturising agent in sponge cakes, mousses and meringues. The okaras with the highest potential resulting from the production process of black pea and peanut vegetable drinks have been incorporated to obtain vegetable meatballs.

Finally, in the context of action 6, suitable prediction models were developed using near-infrared technology for predicting oil content in Argal's vegan sausage mix, using it as a rapid or process quality control.

The results contribute to improving the economic performance of pulse producers through their recovery in the agri-food industry, as they are valuable materials for developing new fashionable products and opening up new markets for both gluten-free and protein-rich products.

Conclusions

The main conclusions from the project are:

1. A total of 14 seeds of pulse varieties produced in Catalonia, some of them with PDO quality labels (Ganxet bean, Santa Pau bean, Genoll de Crist bean, ull ros bean, menut chickpea, menut destrio chickpea, pardina lentil, Histal broad bean, Sofia broad bean, Fabiola broad bean, black peas, fenugreek, Narbon bean and peanut) were assessed and characterised for their nutritional and technical properties as flours and their suitability for producing new products classified into categories (gluten-free baked products, spreads, meat analogues, hybrid meat products, ready-to-eat products, plant-based drinks, sauces, desserts).
2. The different assessments and pilot tests have led to the development of a total of 16 products classified as follows, of which seven have been pilot tested to establish a commercial strategy. The products are:

- Gluten-free pizza dough with chickpea flour (selected)
- Pardina lentil spread
- Ganxet bean spread
- Vegan béchamel sauce with chickpea flour
- Egg-free potato omelette with chickpea flour (selected)
- Hybrid frankfurter sausages with pea protein and chickpea flour (selected)

- Cooked chickpea meat analogue
- Hybrid sausages with pea protein and chickpea flour (selected)
- Plant-based drinks with black peas and peanuts
- Plant-based cheddar cheese with chickpea flour (selected)
- Plant-based mature cheese with chickpea flour (selected)
- Chickpea aquafava for the production of sponge cake and Japanese Swiss roll
- Chickpea aquafava for meringue
- Chickpea aquafava for vegan lemon mousse
- Fermented chickpea aquafava drink
- Black pea okara meatballs (selected)

3. Adequate prediction models have been developed using NIR technology for the prediction of oil in Argal's vegan sausage paste, to be used as a rapid or process quality control.

Leader of the Operational Group

ORGANISATION: Argal Alimentación, SA

Coordinator of the Operational Group

Other members of the Operational Group (grant recipients)

ORGANISATION: IRTA - Institute of Agrifood Research and Technology
ORGANISATION: Miquel Agustí Foundation
ORGANISATION: Estudis d'Hoteleria i Turisme CETT, SA

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

ORGANISATION: Cooperativa Agrícola El Progrés-Garbí

Geographical area(s) of application

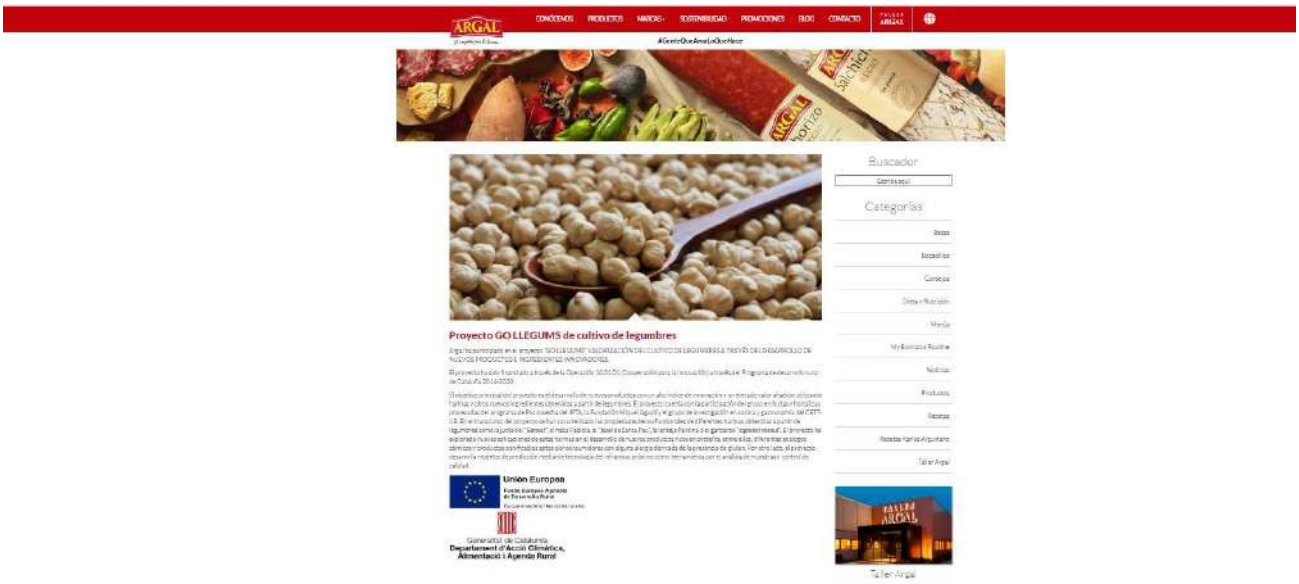
PROVINCE(S)	REGION(S)
All over Catalonia	All

Dissemination of the project (publications, conferences, multimedia, etc.)

- Publication Aguiló-Aguayo, I., Álvarez, C., Saperas, M., Rivera, A., Abadias, M., Lafarga, T. Proteins isolated from Ganxet common bean (Phaseolus vulgaris L.) landrace: techno-functional and antioxidant properties (2021) International Journal of Food Science and Technology, 56 (11), pp. 5452-5460.
- Presentation of the operational group on 10 February 2022, World Pulses Day on the IRTA social media.

- CETT participation at the Culinary Innovation in Academic Research Conference at Alimentaria 2022 with a presentation of the project by the CETT-UB Cuisine and Gastronomy Research Group.
- Publication on the IRTA Twitter account on 22 July 2022.

- Publication of the project on the Argal website on 25 July 2022.



- Presentation by IRTA researcher Ingrid Aguiló of the operational group on 7-8 June at the Free From Functional Food Expo in Barcelona
- Presentation of the operational group by IRTA researcher Ingrid Aguiló at the Pat Conference on 14 July 2022: Applications of alternative protein sources in the agri-food sector.

Project website

More information on the project	
PROJECT DATES	TOTAL BUDGET
Start date (month-year): July 2020	Total budget: €114,870.00
Completion date (month-year): September 2022	DACC funding: €45,833.13
Current status: Completed	EU funding: €34,575.87
	Own funding: €34,461.00

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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/1531/2019, of 28 May, announcing the call for the grant.

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