Innovation Cluster for Plant Proteins

Contributing to the food industry's 'green transition' by developing effective approaches to plant protein production from the farm to the fork.

EAFRD-funded projects

Location: Tallinn, Estonia

Programming period: 2014-2020

Priority: P2 - Competitiveness

Focus Area: Farm performance, restructuring & modernisation

Measures: M16 - Cooperation

Funding:

Total budget:	798 562 (EUR)
EAFRD:	574 965 (EUR)
National/Regional:	143 741 (EUR)
Private:	79 856 (EUR)

Timeframe: 01/06/2019 - 30/04/2023

Project promoter: MTÜ Taimste Valkude Innovatsiooniklaster

Email: tiia.reede@tftak.eu

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Summary

The Innovation Cluster for Plant Proteins project was promoted by the Estonian non-profit organisation, MTÜ Taimste Valkude Innovatsiooniklaster. Over four years, the project explored which crops would be best suited for plant protein production in Estonia. It identified the most appropriate technological approach to extract plant protein from seeds and how to make the best, most consumer-friendly, meat- and milk-like products from plant protein powder. The aim of the cluster project was to valorise protein-rich crops and process them into value-added products in line with customer demand. The project activities incorporated four distinct research and innovation aspects, including crop selection and suitability for protein isolation; isolation, concentration and characterisation of plant proteins; development of extrusion technology for plant proteins; and development of technology for fermented plant milks. Fostering the collaboration between the cluster members (farmers and processors) and the scientific stakeholders were important project features.

Project results

- Twelve cluster members (farmers and processors) and sixteen scientists (from the Food and Fermentation Technology Development Centre and from the University of Life Sciences) collaborated in the project.
- Overall, the project contributed to the green transition in food production.
- New innovative technologies helped reduce the negative environmental impacts of food production.
- Developed new innovative consumer-friendly plant-based food products.
- Improved stakeholders' understanding of development opportunities.
- Three brochures on the research activities were published (accessible in libraries both electronically and in hard copy).

Key lessons and recommendations

- It is important to focus on cooperation. Working together increases the chances of success and facilitates the implementation of changes more effectively. Also be mindful that cooperation with the public sector is important.
- Allow time for project administration and related bureaucracy.

Context

The cluster "Improving the production and supply chain of Estonian plant protein" connected scientists, intermediaries, farmers and food producers.

Protein-rich crops (legumes and cereals) grown in Estonia are mostly used as animal feed or are exported. The cultivation of leguminous plants is essential for maintaining field fertility, as it helps to restore the nitrogen reserves of the soil. Legumes with high nutritional value are currently mostly used as animal feed. Considering the nutritional composition of these cultures, there is potential to use them in the food industry to produce innovative products for the local and world market. This offers an opportunity to make semi-finished or finished products with high added value, the income derived from which is much higher than exporting just the fruits.

EU countries have relatively high meat consumption per person. In Estonia three to four times more meat is consumed than is recommended, and at the same time the consumption of pulses and cereals is low. Products made on the basis of plant proteins are good sources of protein, fibre, vitamins and minerals, and do not contain saturated fat or cholesterol.

There are many analogues of dairy and meat products based on soy and wheat available on the market from abroad, but the consumer trend favours local production, where the origin of the products is known, and the consumption is supporting Estonian agriculture.

Objectives

The main objectives of the project were to assess and process protein-rich plant crops into products with high added value, and to find out which plant cultures would be best suited for growing in Estonian climatic conditions.

The project also sought to identify the best technological approach to extracting plant protein from the seeds, and to find ways of processing plant protein so that it is a suitable raw material for the production of plant-based meat products. For example, this included determining how to process plant protein into milk-like yoghurt, cheese, and dessert products.

Importantly, the project also explored a more sustainable use of resources, based on the fact that 90% more agricultural land is needed to produce feed for meat production than to grow the same amount of alternative plant protein.

Activities

Project activities included:

- Crop selection and testing the suitability for protein isolation: based on previous studies, a range of crop varieties suitable for cultivation in Estonia were pre-selected. This was followed by carrying out field trials with hemp, oat, fava bean and green pea, in cooperation with the Estonian University of Life Sciences, Estonian Crop Research Institute and agricultural producers, over a period of three years. The purpose was to determine the effect of various factors such as variety, growth year, and growing technology on yield. The suitability of less cultured but protein-rich crops (millet and lentil) as a source of plant protein was also assessed. The yield of crude protein per hectare, the amino acid composition of the protein, and the content of inhibitors hindering protein uptake were determined.

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- Isolating, concentrating and characterising plant proteins: the aim was to provide an overview of the possibilities of isolating, purifying, and concentrating the plant proteins under research. The possibilities of degrading the inhibitors and the suitability of proteins for processing were mapped. Furthermore, information was obtained about the effect of their separation on protein structure and peptide and amino acid content.

- Developing extrusion technology for plant proteins: the third area of research concerned the development of technologies that would enhance the value of domestic legumes and cereals by extrusion. The focus was on developing new and innovative products based on consumer preferences. Here, it was important to develop new technologies that would help to extrude both single protein sources and a mixture of protein sources. At the same time, extrudability, in turn, determined the selection of suitable crops. In this context, the sensory and microscopy analyses were key to examine the suitability of the final products for the consumer.
- Developing technology for fermented plant milks: The fourth project activity focused on developing technologies for the fermentation of Estonian legume and cereal milk. Again, it was important to develop new and innovative products in line with consumer preferences. Because the fermentation with lactic acid bacteria helps to increase the digestibility and nutritional value of food products, the research prioritised the development of technology for the production of fermented legume- and cereal-based dairy-like products, with a positive impact on their flavour and aroma profile.
- Plant proteins were also treated with enzymes to release fermentable sugars from polysaccharides (lowering GI), and to support the degradation of inhibitors. Yoghurt, pudding and cheese analogues were developed and various recipes were tested. The results of this research helped improve the technology, whereby additional components were selected and their stability assessed.
- Finally, option appraisals for packaging and shelf-life tests were undertaken.

Key stakeholders/members of the cluster project were farmers and processors in Estonia. The Food And Fermentation Technology Development Centre Ltd. and Estonian University of Life Sciences Institute of Agricultural and Environmental Sciences Polli Horticultural Research Centre were also involved.

Main results

- Three major events were organised (project information day, conference, information day at the experimental station), attracting approx. 200 people.
- Twelve cluster members (farmers and processors) and sixteen scientists (from the Food and Fermentation Technology Development Centre and from the University of Life Sciences) participated in the project.
- Fourteen meetings/discussions of cluster members took place during the project.
- Three master's theses and one doctoral thesis were completed.
- Three brochures on the research activities were published. The material can be accessed in libraries both electronically and in hard copy:
  - "Selection and suitability of agricultural crops for protein isolation"
  - "Isolation, concentration and characterisation of plant proteins"
  - "Extrusion technology and development of plant milk analogues"
- The project contributed to the green transition in food production, as food produced from plant proteins leaves a smaller carbon footprint than food derived from animal proteins.
- New innovative technologies were introduced, helping to reduce the negative environmental impacts of food production.
- New innovative consumer-friendly plant-based food products were developed.
- The understanding of opportunities among the various stakeholders was improved through discussion panels and joint discussions that were held at the end of each project phase.
- The project engaged young people, who were mainly engaged in research, but were also involved in the technological side of the companies.

Key lessons and recommendations

- Focus on cooperation. Working together increases the chances of success and facilitates the implementation of changes more effectively.
- Be mindful that cooperation with the public sector is important. The project could have included more activities aimed at promoting health and raising awareness in general.
- Be positive about project success. In the project's case, the consumer research helped clarify effectively whether the innovative products were acceptable to the consumer.
- Allow time for project administration and related bureaucracy, which is time-consuming and can affect financing decisions and loans.
- Remember that cluster / project members should make their financial contribution to the project right from the start, and this should include the costs for information events and a media campaign.

- While the project's activities can be transferred to other regions, the specifics of the project experiments must be adjusted according to the new target region.

Quote

"Being a research partner of "Innovation Cluster for Plant Proteins" has taken plant protein research to a new level in TFTAK (Centre of Food and Fermentation Technologies). Our cross-disciplinary efforts, alongside collaborations with partner companies, have expedited our learning curve and have yielded insights for effectively implementing and commercialising innovative techniques that optimise locally cultivated crops. This collaboration has not only enriched our understanding but also magnified the potential for pioneering plant-based protein solutions, holding significant practical promise for the Baltic and Nordic regions."

Aavo Sõrmus, Member of the Board of the Center of Food and Fermentation Technologies - Project partner

Additional information:

www.tvik.ee/en/

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