

The production of proteins from plant sources is more environmentally sustainable in terms of lower greenhouse gas emissions, enhanced European agrobiodiversity and reduced inputs of fertilizers and water compared to animal-based proteins. PROTEIN2FOOD has tested and optimised several resource-efficient and cost-effective **plant proteins crops** that were grown in **multiple European environments** (Denmark, the Netherlands, Italy). These crops contained either high-quality protein (quinoa, amaranth, buckwheat), or were – mostly legumes – high in protein (lupin, fava bean, chickpea, lentil, grass pea, soybean, pea). The work in PROTEIN2FOOD aimed to develop insights into the most efficient crop genotypes and the associated best agronomic management practices in the various climatic regions of Europe.

Main Achievements

A literature review was carried out to evaluate the impact of genotype, environment and crop management interactions on protein crop yield. An **interactive map** was developed, providing information on more than 70 crop genotypes, produced under 7 agricultural management systems and in 3 environments.

From 2016 to 2019, field trials were carried out with more than 220 cultivars in various European temperature zones where, the **most productive genotypes** of grain legumes and high-quality protein crops were selected. The **agronomic practices** to cultivate such genotypes in various European environment were evaluated to define protocols for optimal, sustainable agronomic crop growing, while being able to stabilise and improve protein quality and yields.

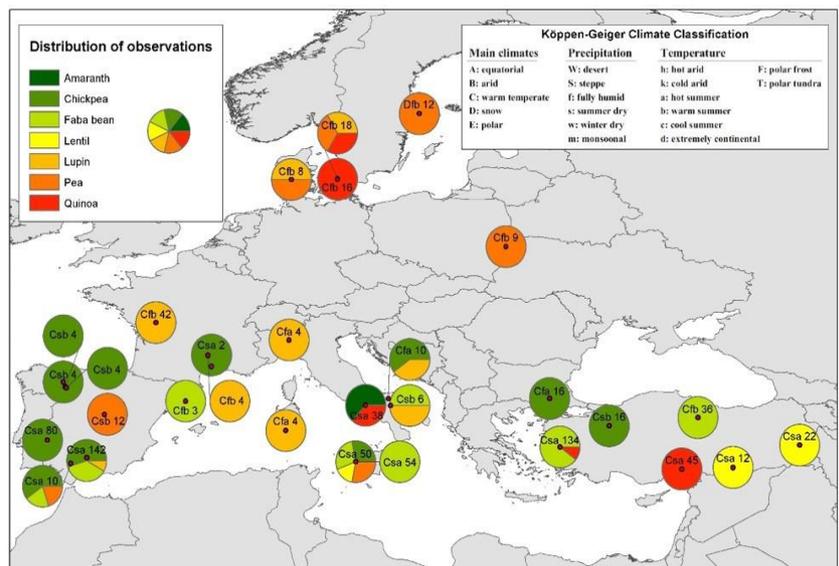


Image 1. The interactive map contains information on all observations of crops, by Köppen-Geiger climate classification zones and by study sites. Each circle represents the climate classification and the total number of observations for each study area.

“A high level of tolerance to drought and salinity was detected for quinoa and amaranth - both can be cultivated in marginal environments”

A unique aspect of PROTEIN2FOOD is the cultivation of non-traditional crops, such as quinoa in Romania, to increase crop diversification. Other important results were achieved with the **development of genetic markers in fava bean and quinoa**, and through the development of a **3D imaging protocol**, allowing for analysis of the internal structure of the protein-rich seeds.



Recommendations

- PROTEIN2FOOD provides the knowledge needed for **optimisation of agronomic systems** and supporting EU policies on more sustainable food systems.
- Using **crops in rotations** (faba bean/quinoa and amaranth) and in intercropping (lentils and oats), will help to bind nitrogen, reduce the need for fertilisers, and increase protein crops simultaneously.
- Further **breeding** of these protein crops is necessary to achieve high yields that are competitive with mainstream protein crops.
- **Action from all actors** in the agro-food sector and a strong **support from government** and public organisations are needed to increase promotion and production of protein-rich crops for human consumption in Europe.

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Impacts

More protein crops for food in Europe

The knowledge gathered in PROTEIN2FOOD on best agronomic practices for protein crops, the benefits of crop rotation, the effects of nitrogen fixation and soil phosphorus mobilisation by legumes will be transformed into growth guidelines for each protein crop. This should be a great help for farmers introducing these crops into their production system.

Increased agrobiodiversity in Europe

Europe's agrobiodiversity can be enhanced through the availability of improved cultivars with high quality and quantity protein and the introduction of the different varieties into new environments. The development of genetic markers and the screening of local ecotypes will increase agrobiodiversity and help Europe become less dependent on imported protein crops.

Better seeds for higher yields

The PROTEIN2FOOD research on seed genetics and morphological characteristics is fundamental for more productive and higher quality protein crops. The outcomes are relevant to researchers, breeders and farmers, giving them insights into adopting and growing high quality plant protein in specific environments, which in turn increases the quality of plant proteins produced in Europe.

References

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For more information visit: <https://www.protein2food.eu>



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grants agreement No 635727.