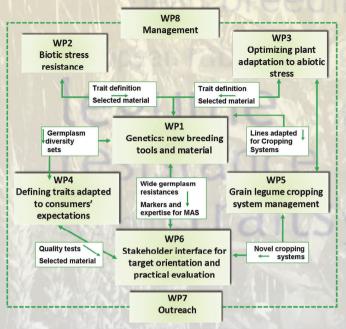
Project structure





Project Consortium





















































UNIVERSITY of York







LEGumes for the Agriculture of TOmorrow

http://www.legato-fp7.eu/

Strategic aim

The overall aim of LEGATO is to contribute to the sustainable reintroduction of grain legumes in European cropping systems:

- -Working on the major European grain legumes, pea, faba bean, and with specific objectives on white lupin, lentils and grass pea.
- -Focusing on the identification and testing of novel legume breeding lines possessing valuable characters such as disease and pest resistance, tolerance to abiotic stresses (such as water shortage and heat at the end of the cycle) and quality for human consumption.
- -Optimizing the selection of these lines for low-input agriculture and in innovative legume-centred cropping systems, intercropping and multivarietal mixtures, and testing the benefit of inoculation with rhizobium.
- -Enabling a quantum leap in the use of marker-assisted selection in legume plant breeding, through the exploitation of comprehensive genomic resources which have recently become available.
- -Communicating and exploiting the breadth of knowledge obtained to the gamut of stakeholders.



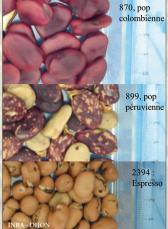
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Legumes in Europe

Despite the nutritional value in terms of protein they provide for both humans and for livestock, the cultivation of grain legumes in Europe has been constantly decreasing over the last 40 years. It has become urgent to reverse this trend, since legumes play a key role in developing future sustainable farming systems, notably but not exclusively in terms of their potential to mitigate the adverse effects of agricultural production on the environment through: their unique ability to fix atmospheric N2 via a symbiotic relationship with soil bacteria (Rhizobium) and therefore to have no requirement for N-fertilizers, their diversifying effect in cereal-rich cropping systems and hereby reducing the requirement for pesticides.

Grain legume seeds are rich in protein (up to 40%) and could improve Europe's autonomy for this commodity, as it imports around 70 % of its requirements in protein-rich products used for feeds (20-25 Mt of meals + 15 Mt of soybean seeds). In addition to proteins, legume seeds are rich in slowly digestible starch, soluble sugars, fibre, minerals and vitamins as well as secondary metabolites such as isoflavonoids, and can play a major nutritional role with the further benefit of anticancer and other health-promoting compounds. Thus, grain legumes are valuable and health-promoting sources of protein for human consumption, currently underused in Europe, but with an increasing geopolitical importance in view of soaring world protein prices.

However, several factors, including less investment in breeding, have combined to result in yields and profitability of legumes being lower and more variable than those of other crops. This reduces their attractiveness to farmers, and has limited their availability for consumers to a level far below their potential.

Objectives

At the pre-competitive level:

- 1. Screen and exploit the phenotypic and genetic diversity offered by legume collections
- 2. Identify genes conferring desirable traits: determination of yield and yield stability, resistance to biotic and abiotic stress, legume seed composition, nutritional and gustatory qualities
- 3. Develop genetic markers and pre-breeding material for fast breeding of varieties possessing desirable traits
- 4. Develop fast and efficient selection tools for quality traits based on spectroscopic models

At the agronomic level:

- 5. Design and assess ex-ante (by multicriteria analysis) the sustainability of novel legume-based cropping systems adapted to local needs, and test their effects on productivity, yield stability, quality aspects, N acquisition and biotic stress management
- 6. Determine the requirements for inoculation with rhizobium in pea and faba bean, and select adapted and efficient strains
- 7. Identify novel lines of grain legumes with desirable traits, and generate pre-breeding material combining these traits that will be provided to end-users (including SMEs) to be continued and finalized for variety registration

At the stakeholder level:

- 8. Prioritise the quality traits relevant for consumers through consumer sensorial analysis of innovative legume based food products such as fortified cereal breads (with flours containing mixtures of cereals and grain legumes)
- 9. Identify current and future consumer food habits and expectations, in terms of sustainability, nutritional and health-promoting qualities, to optimize marketing
- 10. Disseminate information, innovative genotypes and agronomic practices towards stakeholders and scientific community



Results and impacts

MAIN RESULTS

INNOVATION

- COMPREHENSIVE SCREENING OF GENETIC RESSOURCES
- NEW PLANT BREEDING TARGETS
- INTRODUCTION OF UNEXPLOITED GERMPLASM
- NEW CROPPING SYSTEMS



LEGATO will generate breeding and management tools to reinforce the cultivation of legumes in European agriculture

BREEDING FOR CULTIVATION

Application of novel techniques for characterization, sequencing and selection Selection of new lines resistant to main pests and diseases, tolerant to biotic stresses such as water shortages and heat, with higher and more stable yields

CROPPING SYSTEMS New legume lines will be

optimized for low-input systems Innovative cropping systems will be designed and assessed: legumecentred systems, multivarietal sowing, intercropping Inoculation with Rhizobium will be reevaluated

QUALITY AND CONSUMPTION

Evaluation and genetic characterization of factors affecting legume acceptability for consumption (nutritional and organoleptic)

New tools for rapid assessment of quality characteristics



Increase of economic profit for farmers

Reduction of use of agrochemicals and N fertiliser (reduction of costs)
Increased and more stable yields

Increase of the interest by consumers and food industry

New products with higher quality and special characteristics, potential for labeling...

AUGMENTATION OF LEGUME CULTIVATION AND CONSUMPTION IN EUROPE

FOOD SECURITY AND SELF-SUFFICIENCY

Increase of European own supply for food and feed proteins

Reduction of external dependence in a context of increasing world consumption, soaring prices and market uncertainty

AGRICULTURAL SUSTAINABILITY

Reduction of negative impacts of agriculture (less phytochemicals and N fertilisers)

Reduction of energy consumption (N fertilisers)

Better economic returns for farming: maintain of rural activity

CONSUMERS HABITS

Contribute to an improved diet offering a high protein, high soluble fibre and low cholesterol component

) Reinforce food security and safety

Promote proximity consumption

IMPACTS