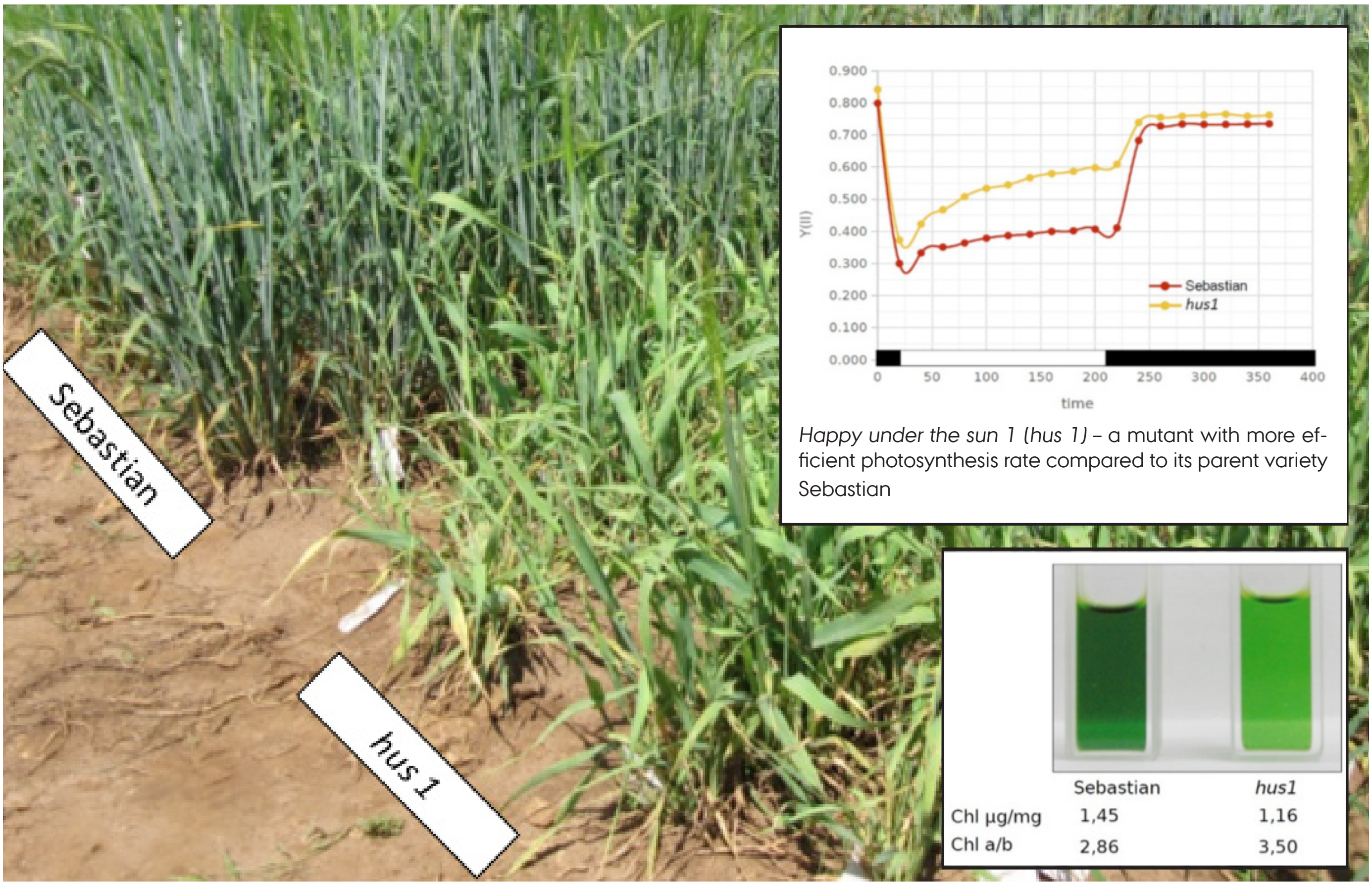
BarPLUS

MODIFYING CANOPY ARCHITECTURE AND PHOTOSYNTHESIS TO MAXIMIZE BARLEY BIOMASS AND YIELD FOR DIFFERENT END-USES



Happy under the sun 1 (hus 1) – a mutant with more efficient photosynthesis rate compared to its parent variety Sebastian

The mutant uses higher amount of energy for the photochemistry in photosystem II and has diminished photoprotection. It has the lower content of total chlorophyll and different chlorophyll a to b ratio than Sebastian variety. In addition, it has a very peculiar thylakoid protein composition typical of a mutant adapted to environmental stress conditions.

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Project period:	03/2016 - 02/2019
Topic:	Plant breeding and genetics, Genetic resource, Plant production and horticulture
Keywords:	barley, biomass, genetic resources, plant architecture
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Website:	https://barplus.wordpress.com/ http://faccesurplus.org/research-projects-1st-call/barplus/

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SUSTAINABLE AND RESILIENT AGRICULTURE FOR FOOD AND NON-FOOD SYSTEMS

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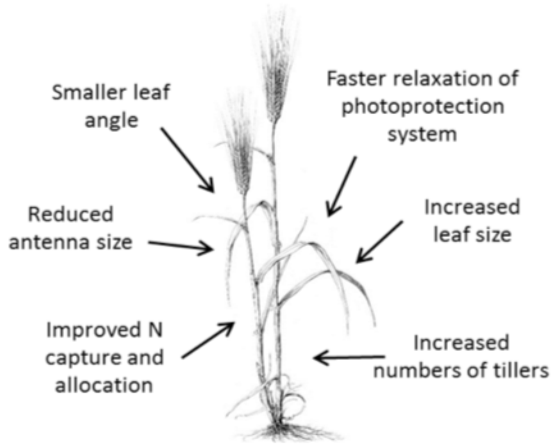
BACKGROUND

Barley is a major crop worldwide, with Europe producing the greatest share (~60 MT/yr). Beside grains, barley plants produce an almost equivalent amount of straw that in the past was considered as a secondary product of minimal value. The majority of the genetic progress to increase yield was obtained through a change in biomass partitioning from straw to grains and the current plant architecture has been mainly driven by the necessity of increasing the harvest index. Nevertheless, the increasing demand for renewable materials makes straw, and especially barley straw characterized by the largest content of carbohydrates among cereals, a valuable product for its potential conversion into biofuels and other products. Indeed, barley crop residues are desirable feedstocks because of their low cost, immediate availability, no competition with food, and relatively concentrated location in the major grain growing regions. Given this perspective, this consortium believes that the current barley plant architecture, together with photosynthesis performance, should be revised to maximize the farmer income (grain value plus straw value).

OBJECTIVE

BarPLUS would identify genes, alleles and lines needed to increase barley plant biomass, without penalty on grain yield, in the agro-climatic and management scenarios predicted for 2030 in Southern (Spain and Italy) and Central (Germany and Poland) Europe.

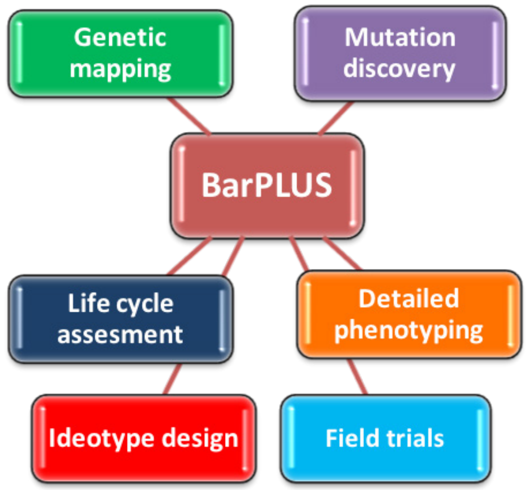


METHODOLOGY

This goal will be achieved through:

- Modifications in plant architecture - tillering, leaf size and angle,
- Photosynthetic process improvement, either intrinsically or indirectly through maximizing radiation use efficiency.

BarPLUS takes advantage of genetic, physiological and molecular biology tools combined with in silico modeling to produce knowledge on genes and alleles and provide lines to breed a new barley ideotype.



RESULTS AND KEY FINDINGS

During the first half of the experimental plan, BarPLUS has identified genes, alleles and lines characterized by the traits with the potential to increase biomass production. This knowledge has been achieved by taking advantage of the unique resources of mutants and exome resequencing data available for barley. The genetic material, in combination with modelling and LCA studies, is used as a starting point to generate a dual-purpose barley variety suitable for the agro-climatic and management scenarios predicted for 2030 in Southern (Spain and Italy) and Central (Germany and Poland) Europe.

KEY PUBLICATIONS

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- Schmidt Rivera, X.C., Bacenett, J., Fusi, A., Niero, M. (2016) The influence of fertiliser and pesticide emissions model on life cycle assessment of agricultural products: The case of Danish and Italian barley. Science of the Total Environment, DOI: http://dx.doi.org/10.1016/j.scitotenv.2016.11.183