# Legume Generation

# Enhancing innovation in European phaseolus breeding through the Legume Generation project

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*Phaseolus* beans are the second most important cultivated legume species in the world and the most important legume species for human consumption. Beans are also traditional food crops grown in Europe, with 18 geographical indications. The main goal of the Legume Generation project is to generate resources and innovative tools to boost *Phaseolus* breeding in Europe. This includes well-characterised materials, new varieties and genotypes, new marker locus and genotyping and phenotyping tools to breeders. Figure 1 shows our strategy to promote the genetic improvement of this species in Europe by this project.

## Progress and current activities

### 1. The available bean genetic resources

The project constituted an innovation community (BIC) that involved academic researchers, and breeders from University, Research institutes and seed companies. the result of projects as BRESOV, INCREASE, BeanAdapt, ToolBean, SustCrop, were collected to constitute the two panels of snap and bush beans BBS1 (200 lines) and BBS2 (197 lines). Both panels had 30 lines in common.

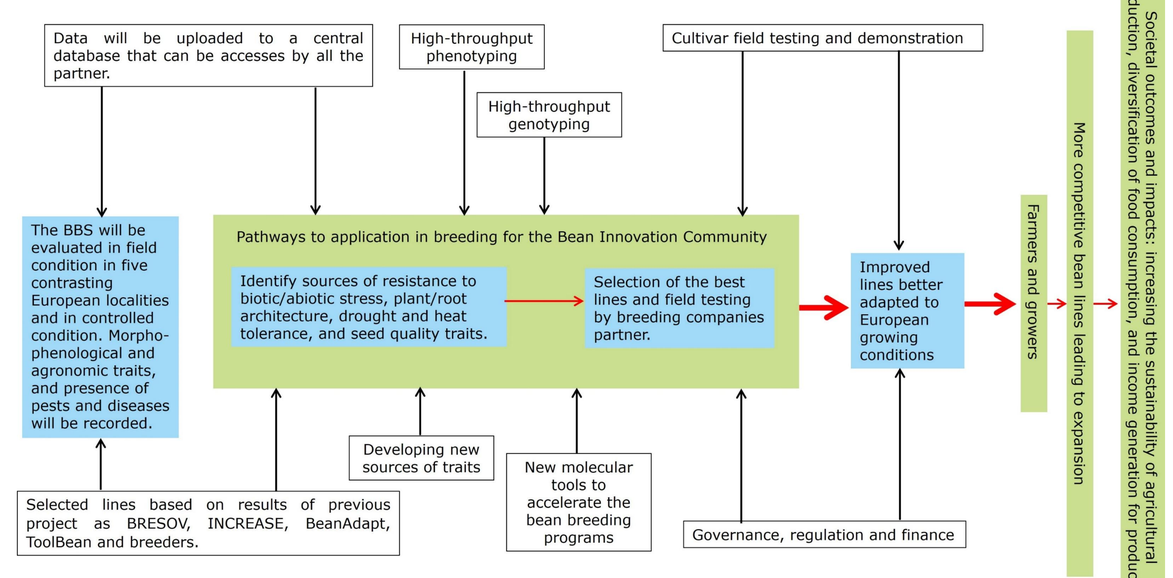


Figure 1. Pathways to application in breeding for the Bean Innovation Community

### 2. Screening diversity panels for traits

- **Morpho-agronomic phenotyping in MLFT of bean panels**. The BBS1 and BBS2 panels are been evaluated in three European localities with contrasting climatic conditions (Figure 2). Phenotyping is based on 16 standardised descriptors.

- **Evaluation for drought tolerance**. In indoor trials, 7 from 48 origins were identified as promising material for breeding, excelling by yield stability or good recovery after drought.

- **Evaluation for cold tolerance in germination.** A RIL population was tested for low temperature response during germination. Phenotypic variation is been mapped.

- **High temperature tolerance**. A RIL population will be tested for high temperature response during flowering. Phenotypic variation will be mapped.

- **Resistance to diseases common in European crops.** Combining field observations and controlled-condition testing, the response to diseases such as anthracnose, BCMV, and powdery mildew is being assessed. Resistance sources to anthracnose races 5 and 37 were identified

### 3. New resources and tools

- **Development of a MAGIC population to group genes and genetic studies.** A MAGIC population derived from eight genotypes has been developed. The parents were selected seeking maximum phenotypic and genetic diversity observed in previously projects.

- **Development of a population derived from an interspecific cross to introgress new genes in *P. vulgaris*.** A population derived from the cross *P vulgaris x P coccineus* was developed (135 lines). The population is bean phenotyping in organic field trials.

- **Identification of new loci controlling interesting trait in bean breeding**. Association analysis (GWAS) and QTL mapping are in progress to identify genomic regions involved in the control of analyzed traits. New anthracnose resistance genes derived form *P coccineus* were mapped.

- **Development of functional markers of major genes to accelerate improvement programs.** Using the available SNP genotyping, allelic markers based on melting temperature are been developing. Markers for genes involved in the seed coat color have already been developed.

### 4. User-friendly genetic markers

- **Testing new allelic markers in practical breeding**

- **Development of breeding programmes.** A programme is being developed to improve pyramiding of resistance genes to anthracnose, BCMV, BCNMV, and powdery mildew in the commercial class of fabada beans. Pre-breeding trials were also carried out to identify sources of resistance to anthracnose races 5 and 37, recently detected in northern Spain.

Imagen gallery
Field Trail
Lemnatec platform
Drought stress
Cold stress
Magic population sedes
Interspecific seeds

Figure 2.

Legume Generation (Boosting innovation in breeding for the next generation of legume crops for Europe) has received funding from the European Union through Horizon Europe under grant agreement No 101081329 and co-funding from UK Research and Innovation (UKRI) from the UK government's Horizon Europe funding guarantee. It also receives support from the governments of Switzerland and New Zealand.