Breeding for economically and environmentally sustainable wheat varieties

An ambitious project for a competitive and sustainable agriculture supported by the French initiative “Investments for the Future”

- 9 years (2011-2019)
- 34 million € (total cost)
- 28 French partners: 15 public research laboratories, 1 technical institute, 1 competitive cluster, 1 company specialized in project management and technology transfer, and 10 private companies
- International collaborations with the IWGSC, WISP project, ProWeizen alliance, CRP WHEAT programme, the Wheat Initiative.

An integrative approach from genomics to breeding

BreedWheat proposes to facilitate (1) the translation of knowledge and molecular resources into breeding, and (2) the exploitation of genetic resources to increase the genetic diversity of the wheat gene pool.

1- High throughput SNP discovery and genotyping, structural polymorphisms, and target gene isolation

- More than 350K SNP identified
- A ultra-high throughput 420K SNP genotyping array designed (including 280K available to the wheat community)
- Genotyping of more than 7,800 wheat accessions, ~2 billion data points produced and analysed
- The most densely populated genetic map ever produced for wheat, comprising more than 307 000 SNPs
- A chromosome 1B sequence produced (currently being used to improve the whole-genome reference sequence developed by the IWGSC)

2- Genetics and ecophysiology of wheat adaptation to biotic and abiotic stress in the framework of sustainable agricultural systems and climate change

- A list of temperature, Nitrogen and Sulfur differentially expressed genes identified
- Phenotyping of ~48,000 plots in ~3 years - yield and yield components & grain protein composition (GPC)
- Nitrogen Use Efficiency (NUE)
- resistance to fungal diseases (FHB, STB)
- response to high temperature/drought
- Association genetics for yield & GPC, NUE, biotic and abiotic stress associated traits

3- Characterization and exploitation of genetic variability to identify novel alleles for target traits and develop pre-breeding material

- Sampling of 4,600 wheat accessions representing the worldwide diversity (list and phenotyping data available to the community)
- Design of an adapted winter panel (450 accessions) for novel abiotic and biotic stress association studies
- Novel European Elite Germplasm with improved stress tolerance (creation of 9 advanced back-cross populations)

4- Development, comparison and socio-economic evaluation of innovative methods and cost efficient breeding platforms

- An R-based pipeline, BW Genomic Selection, designed to predict breeding values (comparison in a real size breeding program in course)
- Definition and evaluation of new ideotypes
- Evaluation of socio-economic impacts of new breeding practices

5- Data integration and dissemination to end users

- New tools to integrate different polymorphisms and store association and genomic selection studies
- New breeder’s oriented portal INRA URGi Wheat portal https://wheat-urgi.versailles.inra.fr/

For more information: breedwheat@inra.fr

This project receives funding from the French Government managed by the Research National Agency (ANR) in the framework of the investments for the Future (ANR-10-BTBR-03), FranceAgriMer and the French Fund to support Plant Breeding (FSOV)