About the PGR networks in France: collaboration between users and the Genetic Resource Centre on small grains cereals

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INRA – UBP « Genetic, Diversity and Ecophysiology of Cereals »
Clermont-Ferrand – France –
GR context in evolution

- Climate changes
- Environmental conditions of production

Scientists

New tools to explore PGR diversity

Plant Genetic Resources

Breeders

Socio-economic evolution

Farmers, gardeners

European Plant Genetic Resources Conference 2011, Wageningen, The Netherlands, April 5-7, 2011
How to act, to better promoting genetic resources present in collections to answer both to socio-economic evolution of agriculture and to the developpment of basic scientific knowledge in genetic and genomic?

How to share responsability between actors managing GR? How to manage the collection in order to be able to propose adapted samples to different users?
The network of Genetic Resources Centres in INRA Plant Breeding Division

11 Resource Centres associated with species-specific research units working on crops or model species.

Missions:
- Centralization and preservation of GR
- Characterization of resources
- Stock management ensuring the quality control
- Data management
- Diffusion of knowledges and exchange/distribution of biological resources
- Definition of a policy of enrichment of the collections.

European Plant Genetic Resources Conference 2011, Wageningen, The Netherlands, April 5-7, 2011
Collections maintained in Small Grains Cereals Genetic Resources Centre (GRC)

- **Triticum**
  - 11,800 hexaploid wheats
  - 2,800 tetraploid wheats

- **Hordeum**
  - 6,550 barleys

- **Secale**
  - 86 ryes

- **Triticeae**
  - 1,200 triticales

- **Avena**
  - 1,200 oats

+ wild and related species (450 *Aegilops* sp.)

Total accessions conserved ≈ 25,000 accessions

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*European Plant Genetic Resources Conference 2011, Wageningen, The Netherlands, April 5-7, 2011*
INRA research network on small grains cereals

- **Rennes**: breeding, cytogenetics

- **Nantes** (CEPIA): structural biochemistry Starch, pentosans, proteins

- **Versailles**: Bioinformatics

- **Evry**: Polyploidy

- **Le Moulon**: Quantitative genetics, Dynamic management

- **Montpellier**: Durum wheat (evolutionary genetics, quality)

- **Toulouse**: Genomic Resources Centre

- **Clermont-Ferrand**: Genomics, Genetic resources, Genotyping platform, Genetics of quality, NUE, Disease resistance, Phenotyping, Breeding

- **Mons**: Breeding, NUE

- **Mons**: Breeding, NUE

- **108 FTP (38 scientists)**

- Molecular tools

- Genetic resources

- Grain quality

- Nitrogen use efficiency

- Disease resistance

European Plant Genetic Resources Conference 2011, Wageningen, The Netherlands, April 5-7, 2011
Management of small grains cereals genetic resources in France: Share of responsibility between actors

**UFS network**
- Phenotyping activities
  - *biotic and abiotic stress*
- Pre-breeding activities
  - *inter-specific crosses*
  - *enlargement of diversity*
- Specific multiplication

**INRA Clermont-Ferrand**
- Primary characterisation
- Seed batch
  - *multiplication*
  - *conservation*
  - *distribution*
- Data Management
- Molecular and technological characterisations

European Plant Genetic Resources Conference 2011, Wageningen, The Netherlands, April 5-7, 2011
Field and glasshouses facilities:

- Experimental farm (90 ha)
  - 2 ha (nurseries for primary characterisation and multiplication)
  - 200 m² glasshouses (wild species multiplications)

Specific lab for seeds management:

- 50 m² seeds laboratory
- 20 m³ drying room (20°C, 15% Hr)
- 100 m³ cold room (4°C, 30% Hr)
- 4 no-frost freezers

Permanent Staff
3FTP
Design reference collections for specific targets

GRC collections

Core Collection defined by INRA

Collections defined by the PGR Network management

INRA 372 CC

Scientists
The worldwide wheat core collection 372CC: a sample for scientific project

**Flour and dough quality**
- Bordes et al., (JCS 2011, In press)
- Balfourier et al., (TAG 2007, 114:1265-1275)

**372 CC**
- Bordes et al., (JCS 2008, 48:569-579)

**Phenotyping**
- Horvath et al., (TAG 2009, 119:1523-1537)

**Genotyping**

**Earliness**
- Le Gouis et al., (TAG 2011, submitted)

**Nitrogen Use Efficiency**

**Bread making quality**

**Grain proteins content**

**(support: FUI SDD)**

**(support: FUI QualiNble)**

**(support: ANR NOMAC)**

**(support: ANR Wheatgrowth)**

**(support: FSOV Low Nitrogen Efficiency)**
Design reference collections for specific targets

GRC collections

Core Collection defined by INRA

Collections defined by the PGR Network management

INRA 372 CC

National collection (FAO collection)

Scientists

Breeders and Farmers
Example of common evaluation work on GR within the French PGR network

Project: Molecular and agronomical characterisation of National bread wheat collection (2009-2011 – supported by French Min. Agric. Fish.)

WP1: 3 years field evaluation of 1785 bread wheats (leader: UFS private breeders)

WP2: genotyping 1785 acc. x 42 SSR (leader: INRA Clermont-Ferrand)

WP3: data analysis (common task)
Seed batches distribution in small grain cereals collections: Who are the users?

Seed distribution: +290% in 5 years
20% sent abroad
Specific requests from farmers

Users
- Brewer & farmer
- Farmer network
- Organic farm
- Baker & farmer

Species requested
- Bread
  - Wheat
- 4X Wheat
- Oat
- Aegilops
- Barley
- Rye

Biological status
- Modern varieties
- Breeder's line
- Population
- Old varieties
- Wild

Origin’s country of accession
- France
### Identification

- **Accession number**: 1117
- **Accession name**: AUTOMNE ROUGE BARBU
- **Synonyms**: BLE D' AUTOMNE ROUGE BARBU [Français], BLE BRUN D' HEIDENBERG [Français]
- **Subspecies**: Triticum aestivum aestivum
- **Pedigree**: variété locale
- **Biological status**: Traditional cultivar/tandrace
- **Comment**: -

### Origin

- **Geographical origin**: France
- **Holding institution**: UMR Génétique, Diversité et Ecophysiologie des Céréales, INRA-Clermont

### Evaluation data

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<th>Growth class</th>
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<td>Days to heading</td>
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<td>Scale of days to heading</td>
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<td>Plant height (cm)</td>
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<td>Scale of plant height</td>
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<td>Susceptibility to Puccinia recondita (Leaf rust) - Year 2000</td>
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<td>Susceptibility to Puccinia striiformis f. sp. hordei (Yellow rust) - Year 2000</td>
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<td>Wheat awnness</td>
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### Distribution

- **Presence status**: Maintained
- **Available**: Yes
- **Distributor(s)**: UMR Génétique, Diversité et Ecophysiologie des Céréales, INRA-Clermont
SIReGal, the Plant Genetic Resources Information System of the National Institute for Agronomical Research (INRA), France relies on a database gathering descriptions on several agronomically interesting plant species. The main stored data are of two types:

1. Multicrop passport descriptors (common to all plant species): taxonomy, country of origin, biological status (wild, mutant, hybrid...), pedigree...
2. Specific data (may be different for each species group): morphology (size, shape, colour, ...), agronomy (yield, quality, ...), resistance to diseases, ...

**Overview of the database content**

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<td>Phenotypes</td>
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Aknowledgement

- **UFS cereal section**
  - E. Margalé (Serasem)
  - F. Minard (RAGT)
  - J. Auzanneau (Agri-Obtentions)
  - P. Giraudeau (Secobra)
  - S. Dutriez (Caussade Semences)
  - S. Sunderwirth (Momont)
  - B. Duperrier (Limagrain-Verneuil)
  - V. Lein (Staaten Union)
  - J.M Delahaye (Lemaire Deffontaines)
  - S. Regnault (Unisigma)
  - P. Lonnet (Florimond Desprez)
  - S. Caiveau (Syngenta)

- **INRA GDEC Clermont-Fd**
  - L. Bardy (seeds multiplication, distribution)
  - A. Bouguennec (Triticale sp.)
  - E. Boulat (network coord.)
  - J. Bordes (data analysis)
  - J. Koenig (Avena sp.)
  - A. Lapierre (phenotyping)
  - F. Exbrayat (genotyping)
  - N. Guilhot (bioinformatics)
  - C. Poncet (genotyping platform)
  - B. Debote (experimental farm)

- **INRA URGI Versailles**
  - S. Durand (database)