

Maize diversity in France and management of the French collection : Biological Resource Centre (BRC)

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Mangement of Maize genetic resources

- ↪ Organization in the 80th
- ↪ Programme populations sources: PPS
- ↪ Creation of Promais association between breeding private firms
- ↪ Constitution of the French network with INRA and Promais
- ↪ Sharing of materials introduced or prospected before 1993
 - by INRA stations since 1950 and
 - by a part of private partner collections
- ↪ Mainly temperate material expect Caribbean populations



The French maize network in the international context

- ↪ 2001 : International Treaty for Plant Genetic Resources for Food and Agriculture
- ↪ 2005: TIRPAA signature by 40 countries
- ↪ 2006: Setting up of Maize MTA specially for distribution outside of the network
- ↪ Avril 2009: availability of the national Maize collection to the Multilateral System with sMTA
- ↪ 2014: Nagoya protocol
- ↪ Eurisco maize French collection: 453 accessions



National Network

↳ Genetic Resources of interest for agriculture

- ❖ Creation of BRG
- ❖ Constitution of networks for the main cultivated species and a charter per network
- ❖ Public and private partners
- ❖ Designation of national collections

↳ Biodiversity:

- ❖ Institut Français de la Biodiversité (IFB) in 2000
 - Naturel Parks
 - Botanical Conservatories

↳ FRB: Fondation pour la Recherche sur la Biodiversité en 2008 → Blend

↳ French focal point 2017: GEVES

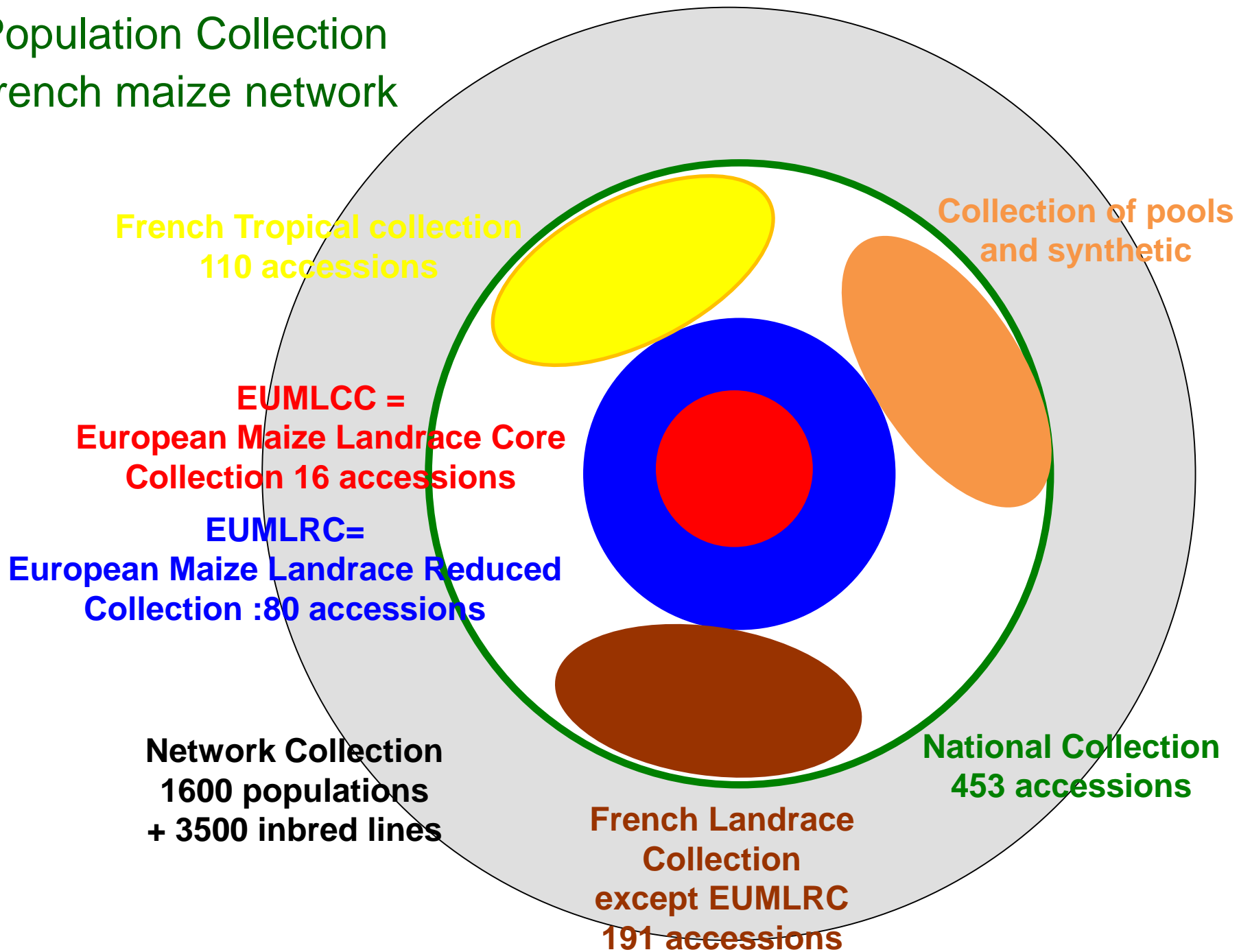


Zea French network

- ↪ one cultivated species: *Zea Mays*
- ↪ 1984 - 1993: Programme Populations Sources (PPS)
- ↪ 1998: national charter under the aegis of BRG
- ↪ Coordination: INRA Montepellier
- ↪ Partners public and private: INRA and Promais
- ↪ National Collection of 538 accessions
- ↪ 1997 - 2001: GENRES088 ⇒ European Populations
⇒ EU core collection
- ↪ 2019 : BRC GAMèT : Merger with other BRC holding
with seeds on Montepellier



Population Collection French maize network



Introduction of accessions

- Prospections and introductions since 1950 (mostly before 1993)
- Mainly European material
 - ❖ 30% France
 - ❖ 37% Europe
 - ❖ 15% North America
 - ❖ 10% South America
 - ❖ 7% others (Africa, Asia)
- Regular introductions



Identification control



Control sample



Ear control



Conservation

- Germination control
- 30 lots of equilibrium samples of 200 kernels per population and 50 kernels per inbred lines
- Slow dehydration until 7%
 - ⇒ conservation from 15 to 30 years
- Conservation in sealed aluminum bags
- Gene banks:
 - ❖ active bank in cold chamber (5°C)
 - ❖ safety bank in freezers (-20°C)
 - ❖ safety bank at wholesale (-30°C)



Distribution

1600 populations maintained in total

- ✓ 275 from Metropolitan France, 112 from Caribbean
- ✓ 63 synthetics
- ✓ Other introductions

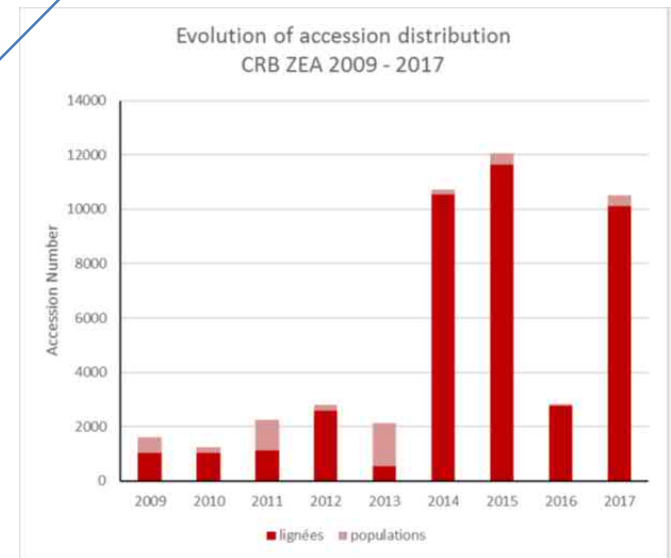
First two categories (+ 15 inbred lines) define the French National collection, declared in TIRPAA available to everybody with SMTA since 2009

Can be ordered throughout SIREGAL information system

Rk. INRA also maintains a working collection of approx. 4200 inbred lines at Saint Martin de Hinx station

The screenshot shows the GnpIS interface with a table of accessions. The table has columns for Accession number, Accession name, Taxon, Biological status, Country, and Basket. The first 10 rows are visible, showing various accessions from France (FRA) and Africa (AFR).

| # | Accession number | Accession name | Taxon | Biological status | Country | Basket |
|----|------------------|----------------|-------------|----------------------|---------|--------|
| 1 | ES0601020 | AS | Zea mays L. | Traditional landrace | FRA | + |
| 2 | AS2_005 | AS2_005 | Zea mays L. | - | - | - |
| 3 | ES0601023 | AS3 | Zea mays L. | Traditional landrace | FRA | + |
| 4 | ES0601020 | AS4 | Zea mays L. | Traditional landrace | FRA | + |
| 5 | ES0601022 | AS5 | Zea mays L. | Traditional landrace | FRA | + |
| 6 | ES0601024 | AS6 | Zea mays L. | Traditional landrace | FRA | + |
| 7 | ES0601021 | AS7 | Zea mays L. | Traditional landrace | FRA | + |
| 8 | ES0601022 | AS8 | Zea mays L. | Traditional landrace | FRA | + |
| 9 | ES0601020 | AS9 | Zea mays L. | Traditional landrace | FRA | + |
| 10 | ES0601020 | AS10 | Zea mays L. | Traditional landrace | AFR | + |



Distribution statistics



The International Treaty

ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE



Last updated: 15/12/2014

The Treaty

Text of the Treaty

- ▷ Governing Body
- ▷ Contracting Parties
- ▷ About us

The Programme

Farmers' Rights

- ▷ The Benefit-sharing Fund
- ▷ Multilateral System
 - Inclusions received
 - Annex 1
 - Art. 15 Agreements
 - Benefits of the MLS
 - What is the MLS?
- ▷ What is the SMTA?
 - Third Party Beneficiary
- Sustainable Use
- Global Information System

Meetings and Events

- Governing Body Sessions
- Inter-Regional Meetings

Collections in the Multilateral System

The Secretariat makes available through this website information on material included in the Multilateral System of Access and Benefit-sharing by Contracting Parties, the International Agriculture Research Centres of the Consultative Group on International Agricultural Research (CGIAR), other International Centres and natural and legal persons within the jurisdiction of Contracting Parties. A sample Letter of Notification of Inclusion of Material in the Multilateral System can be downloaded from this page in four languages: AR EN FR ES

Type of holder

Natural or legal person ▼

Apply

Association pour l'Etude et l'Amélioration du Maïs (Pro-Maïs), and the National Institute for Agricultural Research of France (INRA)

The "Association pour l'Etude et l'Amélioration du Maïs", and the National Institute for Agricultural Research of France (INRA) have informed the Secretary of collections of Maize with a total number of 500 accessions which are included in the Multilateral System of the Treaty.

The information on the management of these genetic resources can be found at: http://www1.montpellier.inra.fr/zea_french_network

Date of the notification: 24/03/2009

Updated number of accessions: 533

Read the notification

Website: Site National de Conservation des Ressources Génétiques du Maïs

Multilateral System

What is it?

Benefits of the MLS

Collection included

Article 15 Agreements

Data and Charts on the MLS

The SMTA

What is it?

Negotiation of the SMTA

Online Reporting System

Operationalization

The Third Party Beneficiary

Capacity Building Programme

Information Technology Tools



Multiplication of populations

- Within the network
- 2 to 3 populations per year and per partner
- control crosses
 - ❖ 200 full-sib crosses pleins-frères per population :
200 males + 200 females
 - ❖ harvest of 200 ears per population (min 100)



Improving quality

↪ Quality of BRC

- diagram of management : reception, conservation, distribution and multiplication
- Improving traceability for reception, distribution: barcode
- To an accreditation ISO 9001 ou AFNOR
- Setting up CRB-Tools software



↪ Databases

<http://xcrop.inra.fr/>

<http://urgi.versailles.inra.fr/siregal>

↪ Website

<http://florilege.arcad-project.org/fr/collections/collection-mais>



Administration CRB_Id v.1.69b / CRB Zea [Maïs - Graines]

Fichier Localisations Familles Echanges ?


Accessions

| Transit | Gervex | Accessions | N° associé | Provenance | Date réception | Production |
|-------------------------------------|--------|-----------------|----------------|------------|----------------|------------|
| <input type="checkbox"/> | | FRA0410002R2013 | Saint Jean pie | FRA | 07/03/2014 | |
| <input type="checkbox"/> | | FRA0410003R1996 | Weckelsheim | FRA | 01/01/1996 | |
| <input type="checkbox"/> | | FRA0410003R2007 | Weckelsheim | FRA | 01/01/2007 | |
| <input type="checkbox"/> | | FRA0410005R1994 | Wartzenau | FRA | 01/01/1994 | |
| <input type="checkbox"/> | | FRA0410006R1995 | Bade | FRA | 01/01/1995 | |
| <input type="checkbox"/> | | FRA0410006R2007 | Bade | FRA | 01/01/2007 | |
| <input type="checkbox"/> | | FRA0410010R2007 | Estarville | FRA | 01/01/2007 | |
| <input type="checkbox"/> | | FRA0410011R1998 | Sost | FRA | 01/01/1998 | |
| <input type="checkbox"/> | | FRA0410012R1994 | Portet | FRA | 01/01/1994 | |
| <input type="checkbox"/> | | FRA0410014R1999 | Massat | FRA | 01/01/1999 | |
| <input type="checkbox"/> | | FRA0410015R2003 | Lacaune | FRA | 01/01/2003 | |
| <input type="checkbox"/> | | FRA0410016R1996 | Berry 1 | FRA | 01/01/1996 | |
| <input type="checkbox"/> | | FRA0410017R1996 | Barisis | FRA | 01/01/1996 | |
| <input type="checkbox"/> | | FRA0410019R1996 | Liesse | FRA | 01/01/1996 | |
| <input checked="" type="checkbox"/> | | FRA0410020R1997 | Campan Galac | FRA | 01/01/1997 | |
| <input type="checkbox"/> | | FRA0410020R2007 | Campan Galac | FRA | 01/01/2007 | |
| <input type="checkbox"/> | | FRA0410022R1999 | Esterne | FRA | 01/01/1999 | |
| <input type="checkbox"/> | | FRA0410022R2008 | Esterne | FRA | 01/01/2008 | |
| <input type="checkbox"/> | | FRA0410023R2000 | Laruns | FRA | 01/01/2000 | |
| <input type="checkbox"/> | | FRA0410023R2008 | Laruns | FRA | 01/01/2008 | |

Nouveau Détails Supprimer Fermer

FRA0410020R1997

FRA0410020 Campan Galade



Modifier Supprimer OK Annuler

Famille: Maïs
 Accession: FRA0410020R1997
 Variété: CAMPAN GALADE
 Nom latin: Zea mays
 Type de protection: Aucune
 Bordereau de réception: 2013 038
 Pays de provenance: France
 Date de réception: 01/01/1997
 MTA associé: Aucun
 Numéro associé: Campan Galade

Accession présente au catalogue Accession en transit

Lots

Statut juridique: Date de la première introduction de la variété: 01/01/1997 (BR 2013 038) FRA

Type de protection: Aucune

Souveraineté: Etat d'origine

Régime de propriété: Public

Droit à commercialiser: Eventuellement restreint par le contrat CDB

Accès variabilité génétique: Eventuellement restreint par le contrat CDB

Le statut juridique affiché est basé sur les informations saisies dans CRB_Id et n'est donné qu'à titre indicatif: il ne vous dispense pas de consulter une personne compétente dans ce domaine avant toute diffusion de matériel.

Improving quality

- CRB-Tools
- CIRAD
- Software for management of BRC
- Improving traceability for reception, distribution
- To accreditation ISO 9001 ou AFNOR

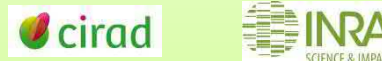


Espèces tropicales

Espèces tempérées et méditerranéennes



Guadeloupe, Martinique,
Guyane, la Réunion



Montpellier



Ploudaniel, Angers,
Bordeaux, Clermont-
Ferrand, Dijon...

OLGA

MultiCrop
CRBTool

MultiCrop

SIReGal

Web Services

Mise à jour 2019

<http://florilege.arcad-project.org/fr/collections>

Portail général
Synthèse globale



ECPGR Maize Meeting, Serbia, December 2019



Préservation des ressources génétiques
et recherche scientifique sur le maïs

PROmaïs

ASSOCIATION POUR L'ÉTUDE ET L'AMÉLIORATION DU MAÏS



L'association

Programmes de recherche

Ressources génétiques

Variétés de pays

Histoire et sélection du maïs

Une association
dédiée à la génétique
du maïs



Des programmes
de recherche
sur la biodiversité
du maïs



La conservation
des ressources
génétiques
du maïs



273 variétés
anciennes de maïs
accessibles à tous

Le maïs et les hommes
une longue histoire
de culture et d'amélioration



<http://pro-mais.org/>

PHOTOTHÈQUE

AGENDA

CONTACT

MENTIONS LÉGALES

ACCÈS MEMBRES



- Log in
- Preferences
 - All species
 - Small grain cereals
- Main
 - HOME
- Global queries
- TAXONS
- Queries
- ACCESSION
 - Simple
 - Passport
- Documentation
 - USER GUIDE
 - HOW TO ORDER
 - DATA SUBMISSION
 - FAQ
 - GENETIC RESOURCES
 - MODULE NEWS
 - RELEASE NOTES
- Other GnplS data
 - DATA SUBMISSION
 - GNPIS PORTAL
 - GENOMES
 - SEQUENCES
 - GENETIC MAPS
 - POLYMORPHISMS
 - PHENOTYPES
 - ASSOCIATION
 - GENETIC RESOURCES
 - PLANT SYNTENY
 - TRANSCRIPTOMIC
- Miscellaneous
 - EXTERNAL LINKS

Siregal

Genetic resources

Siregal, the Plant Genetic Resources Information System of the National Institut for Agronomical Research (INRA), France presents accessions managed by INRA Biological Resource Centers (BRC) and some of the French networks for crop genetic resources. Some of these accessions can be ordered.

The BRC are not commercial suppliers of plant material. They distribute in general small amounts of plant materials mainly for research, development and biodiversity preservation activities.

The main data associated to accessions are of two types:

1. multilocus passport descriptors (common to all plant species): taxonomy, country of origin, biological status (wild, mutant, hybrid), ploidy level, etc.
2. specific data (may be different for each species): phenology, agronomy (maturity, colour, ...), agronomy (yield, quality, ...), resistance to diseases, etc.

You can access the [project web page](#) and the [Siregal](#) displaying of genetic resources.

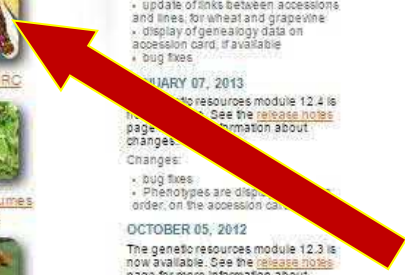
| Fruit species | Model species | Vegetable species | Crop species |
|--|--|--|--|
|  Grapevine BRC |  Arabidopsis BRC |  Melon BRC |  Small grain cereals BRC |
|  Citrus fruits BRC |  Medicago truncatula BRC |  Lettuce BRC |  Maize BRC |
|  Chestnut BRC |  Pepper BRC |  Green legumes BRC |  Maize BRC |
|  Cherry BRC |  Potato BRC |  Allium BRC |  Maize BRC |
|  Plum BRC |  Brassica BRC |  Forage and turf BRC |  Maize BRC |
|  Almond BRC |  Yam BRC | | |

News

- JUNE 04, 2014**
The genetic resources module 14.1 is now available. See the [release notes](#) page for more information about changes.
Changes:
 - adding links to query form on the home page
 - improvement of BRC card
 - improvement of distribution slip on Accession card
- FEBRUARY 05, 2014**
The genetic resources module 13.3 is now available. See the [release notes](#) page for more information about changes.
Changes:
 - creation of a home page for GnplS genetic resources
 - adding visuals for Siregal (website dedicated to BRC) and for accessions managed by BRC
 - layout for "how to order" documentation
- SEPTEMBER 06, 2013**
The genetic resources module 13.2 is now available. See the [release notes](#) page for more information about changes.
Changes:
 - possibility to search accessions either relating to a particular BRC or independently of a BRC
 - update of links between accessions and lines, for wheat and grapevine
 - display of genealogy data on accession card, if available
 - bug fixes
- JANUARY 07, 2013**
The genetic resources module 12.4 is now available. See the [release notes](#) page for more information about changes.
Changes:
 - bug fixes
 - Phenotypes are displayed in order on the accession card
- OCTOBER 05, 2012**
The genetic resources module 12.3 is now available. See the [release notes](#) page for more information about changes.
Changes:
 - bug fixes
- JULY 10, 2012**
The genetic resources module 1.7.3 is now available. See the [release notes](#) page for more information about changes.
Changes:
 - bug fixes
 - interface improvements
- APRIL 03, 2012**
The genetic resources module 1.7.2 is now available. See the [release notes](#) page for more information about changes.
Changes:
 - Improve taxon associated information
 - bug fixes
- MARCH 06, 2012**
The genetic resources module 1.7.1 is now available. See the [release notes](#) page for more information about changes.
Changes:
 - bug fixes

SIReGal

<https://urgi.versailles.inra.fr/siregal/siregal/grc.do>



Maize



- project: <http://www.montpellier.inra.fr/gap/resgen88/>
- website: http://www1.montpellier.inra.fr/zea_french_network/



- Déconnexion
- Recherche
- Catalogue
- Panier - vide
- Présentation
- À propos de...

Accession 22 (population)

Nom : Aleu (FRA0410013, PPS13, FRA0400244)
Taxonomie : >> genus:Zea >> species:mays
Collection(s) : Collection Nationale Française
Lieu(x) de collecte : >> continent:Europe >> country:France >> province:Midi Pyrenees >> district:Ariège >> site:Aleu
Lieu(x) d'introduction : >> continent:Europe >> country:France
Disponibilité : OK

- Caractères de passeport :**
- 2.10 collection source: farm land
 - 2.11 sample status: Landrace
 - 2.3 collecting date: <1960
 - 2.6 collecting site: Aleu
 - 2.7 latitude: 42.883 °
 - 2.8 longitude: 1.267 °
 - 2.9 altitude: 794 m
 - accession_maintenance: oui
 - offspring: G3.85. F8.85. RF8.86
 - other number: PPS0013
 - photo témoin: FRA0410013 Aleu (Témoin)
 - photo: FRA0410013 Aleu (epi)
 - remarks: collection of INRA Clermont Ferrand Collected before 1960



- Caractères agronomiques :**
- 4.1.10.0 root lodging: 1 [1(low) to 5 (100% lodged)]
 - 4.1.10.1.0 vegetative lodging: 1 [1(low) to 5 (100% lodged)]
 - 8.1.5.0 ustilago maydis susceptibility: 3 [1(<10%) to 9 (>40%)]

- Phenological characters:**
- 4.1.0 precocity [p0 (very early) to p6 (very late): P1
 - 6.1.17 stay green: 6 [1 (dry) to 9 (green)]

- Forage characters:**
- 12.2.1 forage yield: 11.63 kg/m²
 - 9.4.11 milk forage units (m4 model andrieu&aufrère method 1993): 0.82 ufl

- Ear characters:**
- 4.2.4 number of kernel rows: 10.35 kernel rows
 - 6.2.10 ear shape: Cylindrical
 - 6.2.13 cob weight: 16 g
 - 6.2.14 kernel per ear: 239.98 k/ear
 - 6.2.2 ear length: 14.1 cm
 - 6.2.4 ear diameter: 3.62 cm
 - 6.2.9.1 cob color (primary): White

- Kernel characters:**
- 4.3.1.1 kernel type (primary): Flint
 - 4.3.2.1 kernel color (primary): Yellow
 - 4.3.3 1000 kernel weight: 276 g
 - 6.3.1 kernel length: 9.37 mm
 - 6.3.2 kernel width: 10.41 mm

Multicrop database : <http://xcrop.inra.fr/>

Descriptions



↪ Passport data

In accordance with « Multicrop descriptors list 2001 » (ECP/GR Networks)

↪ Primary descriptors

In accordance with « descriptors for maize » between CYMMIT and IBPGR (now Bioversity International)

↪ Secondary descriptors

- physical et chemical composition of kernels
- Molecular markers
-



**DESCRIPTORES
PARA MAIZ**

**DESCRIPTORS
FOR MAIZE**

**DESCRIPTEURS
POUR LE MAIS**

PASSEPORT

1. DONNEES SUR LES INTRODUCTIONS

- 1.1 NUMERO D'INTRODUCTION (1.1)
Ce nombre est utilisé comme identificateur unique pour les introductions. Il est donné par le conservateur quand une introduction est introduite dans sa collection. Une fois affecté, ce nombre ne doit plus jamais être réaffecté à une autre introduction dans la collection. Si une introduction est perdue, son numéro n'est pas disponible pour une nouvelle utilisation. Les lettres doivent apparaître devant le numéro pour identifier la banque de gènes ou le système national (par exemple, MG indique une introduction provenant de la banque de gènes de Bari, Italie, PI indique une introduction provenant du système des Etats-Unis)
- 1.2 NOM DU DONNEUR (1.4)
Nom de l'institution ou de l'individu responsable de la donation du germplasm considéré
- 1.3 NUMERO D'IDENTIFICATION DU DONNEUR (1.5)
Numéro affecté à une introduction par le donneur
- 1.4 AUTRES NUMEROS LIES A L'INTRODUCTION (1.6)
Autre numéro d'identification connu dans les autres collections pour cette introduction, par exemple: le numéro d'USDA Plant Introduction (il ne s'agit pas du numéro de collecteur, voir 2.1)
- 1.4.1 Autre numéro 1
- 1.4.2 Autre numéro 2
- 1.5 RACE (1.2)
- 1.5.1 Race primaire
- 1.5.2 Statut de race primaire
- 1 Pure
- 2 Non pure
- 1.5.3 Race secondaire

Photos of populations



Salies de Béarn
FRA0410001



Grand Roux Basque 5
FRA0410641



Lourdions.C1
FRA0410823



Le Muret.2
FRA0411251



Control lots



ARCAD Projet

Grouping of Seed BRC in Montpellier

- One team for conservation of seeds in Montpellier:
BRC GAMèT
- Multi-institutions partners : INRA, CIRAD, IRD, botanical conservatories
- International visibility
- ❖ Purchase of equipments in common 2013-2015
- ❖ Common platform for access to genetic resources



✓ CRB Zea

- Maïs
- UE DIASCOPE vers UMR AGAP
- 1610 populations (Collection Nationale + Collection Réseau)
- 3200 lignées (Coll INRA à SMH - 40)
- 1 core-collection de populations françaises

✓ CRB Medicago

- *Medicago*
- 827 populations
- 1710 lignées fixées
- 5 core-collections emboîtées
- 667 Croisements et populations F2
- Populations de lignées recombinantes

✓ CRB-T

- Sorgho, Riz, Coton, Fonio, Maïs, Mil, Espèces forestières, Arachide

BRC GAMÉT : Graines Adaptées aux conditions Méditerranéennes et Tropicales



Rice
9000

Sorghum
2500

Fonio
170

Cotton
3500

Mil
37

Forest trees
7000

Groundnuts
30

Medicago
9500

Maize
4500





- Cold chamber 600 m³ with a stacker-crane, 4°C and 30% HR => seeds conservation: original, conservation and distribution samples, ears, pods...
- Freezers for reference lots and duplicates at - 25°C





Thank you for
your attention

