

Potato genetic resources in Spain

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Potato collections in Spain

Plant genetic resources activities in Spain are globally organized by the Instituto Nacional de Investigación Agraria (INIA) and in particular by one of its institutes, Centro de Recursos Fitogenéticos (CRF). Collections of beans, maize, cereals and many other crops are maintained, evaluated and characterized in the station at Alcala de Henares near Madrid. However, the situation is different for potato. Germplasm collections of potato are maintained in collaborating institutes or private companies. The largest collection with 604 accessions is held at NEIKER (former CIMA, Centro de Investigación y Mejora Agraria), which has been traditionally, as the Station for potato improvement (Estación de la Mejora de la Patata), the cradle of seed potatoes in Spain. Other remarkable collections are maintained at the Public University of Navarra (UPNA), the Instituto de Agrobiotecnología y Recursos Naturales (116 accessions) and the public enterprise APPACALE (213 accessions), which produces seed potatoes and also performs potato breeding in Spain.

The accessions in these germplasm collections consist of modern and old cultivars from Spain and elsewhere, *Solanum* wild species, tetraploid and diploid breeding clones, as well as somatic hybrids involving in part wild species and some transgenic potato clones (Table 1). Old Spanish potato varieties are also maintained.

The accessions are maintained mainly *in vitro* and as tubers. Some wild species are maintained as seeds at NEIKER, and APPACALE maintains part of its material as microtubers (Table 1).

Table 1. Potato germplasm collections in Spain and their maintenance

	NEIKER	UPNA	APPACALE
Cultivars	288	30	151
Wild species	65	0	22
Clones 4?	50	4	12
Clones 2?	139	5	28
Others	62 (somatic hybrids, transgenics)	77 (transgenics)	–
Total no. of accessions	604	116	213
Maintenance			
<i>In vitro</i>	190	116	194
Tubers	414	0	78
Others	27 (seeds)	0	70 (microtubers)

Characterization and evaluation

Most of the genotypes in NEIKER's collection are characterized and have been evaluated agronomically for several years. The characteristics include common characters such as tuber form, eye depth and flower, sprout, skin and tuber flesh colour. Evaluation criteria for agronomic characters consist of vegetative cycle, yield parameters, resistance to viruses, nematodes and *Phytophthora*. The quality for industrial processing as French fries, chips, or for cooking has also been examined in many accessions. Evaluation at UPNA includes molecular characterization, and at APPACALE accessions are evaluated particularly for processing quality and PVY resistance under local conditions (Table 2).

Table 2. Characterization and evaluation of the collections

NEIKER	UPNA	APPACALE
A. 152 cultivars , Arkaute (Alava) cycle, yield parameters, skin colour, tuber flesh colour, tuber form, dry matter, processing quality (French fries, chips, cooking), resistances (PVYn, <i>G. pallida</i> 2/3, <i>P. infestans</i>)	A. 77 transgenics Molecular characterization	A. 40 cultivars Processing quality
B. 65 wild species , Arkaute (Alava) Resistances (PVYn, PLRV, PVS, PVM, <i>G. pallida</i> 2/3, <i>P. infestans</i>)		B. 49 accessions Resistance to PVY
C. 61 diploid clones , Arkaute (Alava) cycle, yield parameters, skin color, tuber flesh colour, tuber form, dry matter, resistances (PVYn, <i>G. pallida</i> 2/3, <i>P. infestans</i>)		

Documentation

All institutions record characterization and evaluation data of their accessions in databases (Table 3). NEIKER is preparing additional documentation about their germplasm collection on the Internet.

Table 3. Documentation of the collections

NEIKER	UPNA	APPACALE
Databases (Microsoft Excel [?] /Access [?]) Internet < http://www.Neiker.net > (in preparation)	Database (Access [?])	Database (Excel [?])

Interinstitutional cooperation, management and funding of the collections

These institutions work in close collaboration to maintain and exchange germplasm or to avoid duplication of entries. Moreover, collaborative links with the main potato collections worldwide have been established in order to provide information and to exchange plant material.

Management of the potato collections and funding sources are summarized in Table 4.

Table 4. Management of the collections

	NEIKER	UPNA	APPACALE
Cleaning of accessions	yes (thermotherapy, meristem culture)	no	yes (thermotherapy, meristem culture)
Virus testing	yes (ELISA)	no	yes (ELISA)
Safety-duplication	4 duplicates <i>in vitro</i> , in 2 different chambers	4 duplicates (vessels with 9 plantlets), in 2 chambers	4 duplicates, as microtubers
Sanitary controls	periodically by visual symptoms	visual controls	periodically by visual symptoms
Funding	Basque Government, INIA	UPNA	APPACALE
Rationalization	no duplications, collaboration with Appacale and UPNA	special media allowing plantlets to grow up to 24 months without regeneration	reduced number of duplicates

Research activities

The germplasm collections are used for several research and development activities mainly related to potato breeding at the tetraploid and diploid level and using, besides classical breeding by crossing, somatic hybridization or genetic transformation techniques. Furthermore, NEIKER intensively applies DNA marker technology for variety identification, linkage mapping and QTL analysis for important traits, while UPNA is interested in the production of pharmacological compounds of interest via transgenic potato plants (Table 5).

Several other institutes in Spain carry out research and development activities on potato.
Table 5. Research and Development activities using germplasm collections

NEIKER	UPNA	APPACALE
1. Evaluation of accessions (resistances, physiological characteristics, agronomic and industrial evaluations)	1. Production of pharmacological compounds of interest in transgenic potato plants	1. Breeding of new varieties
2. Use of <i>Solanum</i> wild species for sexual and somatic hybridizations in order to transfer resistances or other characters of agronomic or industrial interest	2. Role of hexokinase as glucose sensor and gene expression regulator in carbohydrate metabolism	2. Complementary studies for the breeding programme
3. Breeding of new cultivars based on characterized germplasm accessions	3. Development of a bioassay for <i>in vitro</i> tuberization in order to determine maturity classes of new potato clones	
4. Mapping of resistance genes		
5. Application of molecular markers for germplasm characterization, linkage mapping and QTL analysis		