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Special Genetic Resources

IN THIS ISSUE

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edited by
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EDITO

Biodiversity represents the variability of living organisms from all sources. It includes diversity within species, between species and of ecosystems. Biodiversity for food and agriculture is a major resource for ensuring food security with quality nutrition. Its major role lies in establishing balance within ecosystems for a sustainable environment.

Through this “Special Genetic Resources” issue, we will try to show the importance of the genetic diversity that the collections housed by INRA bring together and their roles in breeding programs for new productive varieties adapted to different biotic stresses and abiotic.

Faced with the unexpected appearance of the cactus mealybug in 2014, which caused the massive destruction of cactus plantations in several regions of Morocco, scientific research has been able to tap into genetic diversity to stop the advance of this pest by offering varieties that are resistant or tolerant to the cochineal. Rural populations derive significant income from the sale of cactus fruits and its use in human and animal food and in other pharmaceutical and cosmetic fields.

> “Biodiversity for food and agriculture is a major resource for ensuring food security with quality nutrition”

Aware of the importance of genetic resources, INRA has invested in the conservation of cultivated species and subspecies, as well as wild species related to cultivated species.

Currently, the living collections maintained in the various experimental fields bring together more than 2,700 accessions corresponding to more than 700 species, while the gene bank in CRRA Settat houses more than 69,000 accessions spread over 162 genera and 568 species.

The “Generation Green 2020-2030” strategy promotes the sustainability and conservation of genetic resources in Morocco. To this end, our institute is working and actively mobilizing its resources for the development of new collections of genetic material (e.g. argan and carob trees), and the building of a new Center for the conservation of genetic resources that includes plants, animals and microorganisms with the support of the Ministry of Agriculture and national partners (IAV HII, ENAM, ENFI, CNRST, ANPMA, UM6P and several public universities) and international (ICARDA, ICBA, FAO and other institutions and organizations).

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Special Genetic Resources

INRA gene bank:
A gene pool for the agriculture of tomorrow

Morocco is one of the richest countries around the Mediterranean in terms of plant genetic resources with around 4000 plant species. These resources represent the raw material for improving the productivity and quality of agricultural products and thus guaranteeing national food security. However, this heritage is under the pressure of direct and indirect human activities, in particular by the effects of climate change, and is threatened by genetic erosion or even extinction.

Concerned and aware of the situation, INRA has set itself the objective of preserving and enhancing Moroccan biodiversity. Thus, a gene bank was set up in Settat, and has all the necessary infrastructure to ensure the ex situ conservation of seeds of conventional species according to the international standards recommended by the FAO (+ 5 ° C for medium-term conservation. and -18 ° C for long-term storage). Currently, this gene bank houses a collection of 69,626 accessions spread over 162 genera and 568 species.

In addition to conservation activities, the gene bank also undertakes other activities, such as enriching its collection by organizing targeted collection operations, multiplication and regeneration to ensure the viability of the saved seeds; characterization and evaluation for a better valuation of the stored material, and finally, the distribution of seeds to meet the demands of national and international researchers.

Recently, the Settat gene bank proceeded and for the first time to deposit part of its collection (983 accessions representing 46 different species) at the Svalbard Global Seed Reserve in Norway (Cf. Newletter N °2) .

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Building of the new National Center for Genetic Resources

As part of the efforts made for the conservation of plant, animal, and microbial genetic resources, and in order to support Generation Green 2020-2030, INRA began in 2020 the building of a National Center for Genetic Resources (CNRG) over an area of 1220 m^2 at the level of the El Koudia field experiment in the Temara region. To carry its mission, the Center will be operated by 30 employees (researchers and technicians).

The CNRG has several responsibilities, including (i) research to consolidate the scientific bases of the genetic resource management systems recommended for the long term and guide the strategy of preserving local genetic resources in a context of environmental change; (ii) the management of genetic resources, in particular the principles and modalities of the organization, use and conservation of genetic resources; (iii) communication for the benefit of the scientific community of decision-makers and also the general public at national and international levels and (iv) national and international cooperation through the enhancement of Moroccan expertise and the association of other organizations in international activities relating to the preservation of genetic resources.

In addition to its mission and the role of concertation between all stakeholders in the field of genetic resources, the main objective of the CNRG is the inventory, characterization, conservation, and use of phyto-genetic resources, animal genetic resources and microorganisms. This through (i) support for national genetic improvement programs; (ii) the exchange of information and genetic material through the exploration, input, and management of data; (iii) The collection, preparation, packaging, distribution, storage, regeneration and updating of passport data; (iv) the introduction of new species to enrich the genetic range of our collections; and (v) creation of a database on the characterization of species and/or conserved breeds.

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Safeguarding the Moroccan cactus value chain

Endowed with great ecological and socioeconomic importance, the cactus represents a cultivated plant perfectly suited to the development of arid and semi-arid areas of Morocco. Since the launch of the Green Morocco Plan (PMV) in 2008, the cactus has been surrounded by great interest and has benefited from the support and accompaniment of the Ministry of Agriculture and farmers. The projected areas of cactus planted by the PMV for 2020 was reached in 2014, with the development of several packaging and processing units for its valuation in cosmetic, therapeutic, human consumption and animal feed products. However, these efforts were reduced with the appearance, for the first time in 2014 in Sidi Bennour, of a wild and devastating mealybug; Dactylopius opuntiae. From this completely destroyed site, the cochineal spread rapidly and in an unpredictable way to other production areas completely wiping out the cactus in certain areas known for this cultivated plant.

In the absence of control means to stop the spread of this cochineal and its ravages, the Ministry of Agriculture set up a national emergency plan to fight against the cactus parasite in 2016. In parallel with the actions of chemical treatments, uprooting and burying of totally infested plants, the program considered a research component that was assigned to INRA. This program was carried out by a mixed team from INRA and ICARDA whose efforts focused on three main areas of control: biological control, the use of biopesticides and the selection of plant material from cacti resistant to cochineal. This team was supported by the various central and regional structures of the Ministry of Agriculture. It should be noted that all the lines of research identified by the Ministry of Agriculture as part of the emergency plan have had encouraging and unprecedented results. In this article, we will shed light only on the achievements in the selection of cactus varieties resistant or tolerant to cochineal.

From a one-hectare plot in the Province of Sidi Bennour, in the heart of an area totally infested by the cochineal, resistance trials have been conducted since 2016 by planting 747 cladodes belonging to 249 ecotypes from the collection housed at INRA in Agadir in three environments: in the laboratory, under shade and in the open.

Starting cactus woodland

Breeding work resulted in the identification of eight varieties resistant to the cochineal. These are the varieties Marjana, Belara, Karama, Ghalia, Angad, Cherratia, Akria and Melk Zhar which, all having undergone the tests to verify the stability of their resistance, have been registered in the official catalog and cactus parkland was developed at the ORMVAD Experimental Station in Zemamra. From this starting plant material resistant to cochineal, tens of thousands of cactus plantlets were propagated and were used to establish eleven (11) new pre-base "platforms", spread over 105 ha.

Among these new platforms, there is the one installed at the INRA Experimental Domain in Tassaout and which was visited by Mr. Aziz Akhannouch Minister of Agriculture in February 2021, accompanied by a large delegation of officials. This visit was an opportunity to inquire about the state of progress of the national program and to review the projections of multiplication of the eight varieties, the state of vegetative and health development of the 8 ha platform planted in 2019 and which will be extended to 24 ha on instruction from the Minister.

Once certified, the plant material developed will be used for the production of cactus plantlets in sachets to support the relaunch of the sector as part of "Green Generation 2020-2030" which provides for the planting of cactus over 120,000 hectares in the 2030 horizon.

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Official visit of Tassaout cactus platform -INRA .

World Collection of Olive Tree in Marrakech

The olive tree genetic material at the global level has approximately 1,200 accessions identified and recorded in the different olive-growing countries. However, this material is subject to genetic erosion due to the massive use of a small number of varieties in the production areas. Considering the interest of these genetic resources, operations of collection and conservation of this material carried out with the support of the International Olive Council (IOC) are in progress at the level of three international collections: Cordoba (Spain), Marrakech (Morocco) and Izmir (Turkey). The collection of INRA Marrakech, installed since 2003 in the experimental domain of Tassaout and which covers an area of 17 ha, currently contains 591 accessions from 14 countries: Algeria, Cyprus, Croatia, Egypt, Spain, France, Greece, Italy, Lebanon, Morocco, Portugal, Slovenia, Syria and Tunisia. The various research works carried out on this collection concern studies of varietal behavior and the phenotyping - genotyping association.

The Tassaout olive tree collection represents an important reservoir of genes to be exploited in genetic improvement programs at INRA and this through the selection of new varieties that are productive in terms of olives and oil, resistant or tolerant to different biotic or abiotic stresses and of good quality.

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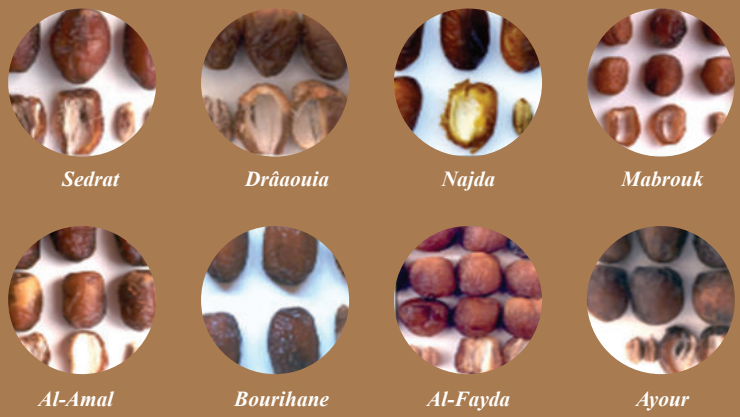
INRA's contribution to the conservation of phoenicultural genetic resources

In Morocco, selection based on fruit quality was not a priority since there are excellent cultivars such as Majhoul and Boufeggous. The major challenge was rather to select cultivars with good fruit quality, but above all, resistant to Bayoud. Over the past thirty years, several varieties of date palm have been bred. After obtaining Ayour, Hiba, Tanourte, Al Baraka, Tafoukte, Mabrouk and Khair and exploiting the Najda variety, seven new varieties resistant to Bayoud were selected. They are Darâaouia, Sedrat, Al-Amal, Al-Fayda, Bourihane, Mabrouk and INRA-3010 and two resistant males Nebch-Bouskri and Nebch-Boufeggous. Some of these varieties such as Sedrat, Al-Amal and Darâaouia have very high performance.

With the aim of enriching the varietal mix offered to farmers and safeguarding the biodiversity of Moroccan palm groves, INRA researchers are currently carrying out research aimed at the selection, propagation and conservation of Moroccan and foreign genotypes. of agro-economic interest.



INRA attaches great importance to the development of collections of phoenicultural genetic material. Thus, the Experimental Domain "Nebch" in Zagora, created in 1964, contains more than 7000 date palm plants representing more than 50 genotypes. In addition, a large area will be devoted within the new experimental farm in Errachidia to the creation of a new platform which will house the main Moroccan and foreign genotypes. These collections are mainly used to safeguard the phoenicultural biodiversity and constitute the genetic basis for the development of varietal creation programs.

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Citrus fruits genetic resources at INRA

The agro-morphological variability of citrus fruits is considerable, it concerns both pomological and organoleptic characteristics as well as resistance to biotic and abiotic factors and opens up very broad prospects for the use of genetic resources in varietal improvement.

INRA's citrus genetic material collections have been installed since the 1960s in the main citrus-growing regions of Morocco, in particular in the INRA experimental areas at El Menzeh and Sidi Allal Tazi (Gharb), Afourer (Tadla) and to Melk Zhar (Souss). These collections, which contain more than 500 citrus accessions, serve to preserve the diversity of citrus fruits of the genus Citrus and other genera and species within the Rutaceae in the long term, and benefit programs for the creation and selection of new varieties and rootstocks. Indeed, several varieties of citrus have been selected from these collections, in particular varieties of nucellar origin, the case of Valencia Late nucellar, as well as several variants, in particular, the Nadorcott mandarin. These collections were also the basis for the selection of five variants of orange trees, the creation of nine varieties of mandarin trees, including three triploid varieties, as well as thirty new hybrid rootstocks by directed crossing. Several new hybrids of mandarin and rootstocks from these collections are also being evaluated at the INRA center of Kenitra, a center specialized in research on citrus fruits. Citrus varietal improvement programs would, depending on the species, make it possible to extend the length of the ripening period, produce seedless varieties and easy-to-peel fruits, improve resistance to cold and chemical composition of the fruit, control of postharvest behavior and resistance to most citrus diseases and pests.

Field conservation is an effective and practical method for maintaining genetic diversity in citrus. This type of storage makes it possible to monitor the behavior of varieties under natural environmental conditions and to provide the plant material necessary for research work for immediate or future use. In addition, the national citrus germplasm could underpin a new conservation strategy by rejuvenating of the collection, an operation that is currently underway at the level of the INRA center of Kenitra. In order to enable Moroccan citrus growers benefit from its new citrus varieties, INRA will launch a call in the near future for competitions for seven citrus varieties, four mandarins (Al Mahdia, Al Gharbaouia, Al Maamora and Mabrouka), two triploid mandarins (Hana and Aya) and an early orange tree (Shamssia).

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Pamplemoussier


Mandarinier


Kumquat


Pomelo


Cédratier


Limettier

Species	Collection/Experimental field			
	El Menzeh	Allal Tazi	Melk Zhar	Afourer
Mandarinier	77	14	14	9
Tangelos	19	1	1	4
Clémentinier	14	6	7	1
Orange	141	23	33	25
Citronnier	39	5	5	3
Limettier	26	3	3	4
Pamplemoussier	17	0	0	0
Pomelo	11	4	4	4
Kumquat	6	0	1	0
Agrume à essence	43	0	0	0
Porte-greffe	109	3	0	20

Aïn Taoujdate: A hotspot for tree genetic resources at INRA

In order to carry out its mission of conservation, management and enhancement of arboreal genetic resources, INRA has made the experimental area of Ain Taoujdate a unique site that was created in 1936in 1936. Due to its vocation and the richness of the arboreal collections housed within it, this experimental station is considered as one of the richest and most diversified in terms of species, genotypes and varieties at the level of our institute. This ex-situ collections site brings together more than 17 different species resulting from surveys carried out throughout the country, from introductions from abroad and from genetic improvement programs undertaken at INRA.

The various research programs carried out at INRA tend to conserve the national fruit tree heritage against genetic erosion and the selection and development of new productive varieties, of good quality and adapted to the pedoclimatic conditions of the country for the great benefit of our national agriculture.

Studies on genetic resources in collections at INRA focus, among other things, on the evaluation of genetic diversity, productivity, fruit quality, resistance to stress (biotic and abiotic), adaptation to climate change and aspects of technological development.

At present, INRA has a large number of varieties and rootstocks of different selected species, mainly almond, apricot, fig and pomegranate. In this regard, large databases have been established and relate to the different collections, all of which are collected at the end of morphological, physiological, biochemical and molecular characterization work to be exploited at several levels, mainly in future research programs of INRA in arboriculture to improve the sustainability and competitiveness of fruit production in Morocco.

Based on the richness of these collections, INRA offers promising research opportunities in the fields of genetics, agronomy, plant protection, development and consequently contributes to the development of the national arboricultural sector.

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Pistachier


Pacanier

Species	Number of varieties and clones	Origin
Almond tree	339	Morocco (10%) Foreign (90%)
Peach tree	229	Foreign
Fig tree	216	Morocco (95%) Foreign (5%)
Caprifiguier	30	Morocco
Olive tree	317	Morocco (5%) Foreign (95%)
Apricot tree	150	Morocco (95%) Foreign (5%)
Plum tree	37	Foreign
Pomegranate tree	33	Morocco (40%) Foreign (60%)
Apple tree	48	Morocco (10%) Foreign (90%)
Pecan	15	Morocco
Carob tree	14	Morocco
Cherry tree	33	Morocco (10%) Foreign (90%)
Avocado tree	29	Étranger
Walnut	5	Morocco (10%) Foreign (90%)
Pistachio	22	Morocco (10%) Foreign (90%)
Pear tree	44	Morocco (10%) Foreign (90%)
Vine	101	Morocco (10%) Foreign (90%)
Exotic	7	Foreign

Pastoretum INRA for the rehabilitation of pastureland in arid and desert areas

In Morocco, the pasturelands cover around 62 million hectares and are mainly found in arid and semi-arid areas. The flora in these lands is characterized by its diversity and its vulnerability. The Overgrazing, the negative effects of climate change and the recurrent droughts that these ecosystems continually suffer from have accelerated the degradation of these ecosystems. The consequences are a very significant reduction in area and pastoral production, and a significant decrease in floristic diversity.

In addition, rangeland rehabilitation programs in arid areas have opted almost exclusively for the exotic species Atriplex nummularia and little interest has been reserved for the enhancement of native species despite their ability to adapt to local biotopes and their various uses (pastoral, fodder, aromatic, medicinal, ecological, etc.). Thus, these native species are now clearly threatened by extinction.

Taking into account its role in the preservation of pastoral biodiversity, INRA has established a pastoretum of more than a hundred indigenous and exotic species and ecotypes on two platforms; in Oujda and Errachidia. This pastoretum allows the monitoring and study of the phenology and biology of different species in addition to the production of seeds and plant material necessary to conduct research related to the propagation nutritional value of pastoral species. This genetic reservoir at the service of researchers is also an educational demonstration platform for pastoralists, schoolchildren and students to raise their awareness of the importance of preserving pastoral biodiversity and the threats of genetic erosion.

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Artemisia ifraneusis J. Didier


Artemisia atlantica var. maroccana Maire


Artemisia reptans Chr.Smith


Rhanterium adpressum Coss. & Durieu


Colutea atlantica Browicz


Caroxylon villosum (Delile) Akhani & Roalson


Anabasis oropediorum Maire


Globularia arabica Jaub. & Spach

▲ Some species from the collection from Errachidia

▼ Some species from the collection from Oujda

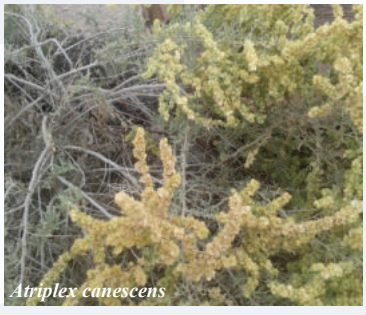

Moricandia suffruticosa


Withania frutescens L.


Stipa tenacissima L.


Anthyllis cytisoides L.


Artemisia herba alba Asso


Atriplex canescens


Salsola vermiculata L.


Periploca laevigata

Aromatic and Medicinal Plants: genetic resources to be protected

Morocco constitutes an original natural setting offering a complete range of bioclimates favoring a rich and varied flora with a very marked endemism, particularly for aromatic and medicinal plants. The latter constitute a precious heritage and increasingly prized for its various uses. However, the geographic extent of some species is steadily shrinking due to climate change, unsustainable harvesting practices, and increasing demand nationally and internationally. Hence the importance of preserving and safeguarding these plants, particularly endemics, through the constitution of a basic collection of species of high economic, ecological and environmental value.

Short-term Ex situ conservation is designed through two living collections of around a hundred species have been installed at Rabat (Guich) and at the Laannoceur experimental domain near Sefrou. The latter presents edapho-climatic conditions close to the natural habitat of most species. These two collections are continuously enriched by introductions following collections made throughout the territory of the Kingdom.

In addition, a national germplasm is made up of 300 accessions for seed conservation. The majority of species belong to the Lamiaceae and Asteraceae family with several genera represented in these collections.

The table below summarizes the genus, species and number of accessions collected and its form of conservation in the different collections.

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Genera	Species	Numbre of accessions	Form of conservation
Cladanthus	*Cladanthus scariosus*	11	Plants, Seeds
	Cladanthus mixtus	120	Seeds
	Cladanthus eriolepis	4	Seeds
Thymus	*Thymus broussonetii*	10	Plants, Seeds
	Thymus rhombicus	4	Plants, Seeds
	Thymus leptobotrys	3	Plants
	Thymus zigys	2	Plants, Seeds
	Thymus vulgaris	1	Plants, Seeds
	Thymus satureioides		Plants, Seeds
Origanum	*Compactum*	10	Plants, Seeds
	elongathum	1	Seeds
	vulgaris	2	Plants, Seeds
	onites	1	Plants, Seeds
Myrtaceae	*Myrtus communis*	2	Plants, Seeds
Artémisia	*Artémisia herba alba*	1	Plants, Seeds
	Artémisia atlantica var maroccana	1	Plants, Seeds
	Artémisia mésatlantica	1	Plants, Seeds
Capparis	*Capparis spinosa*	1	Seeds
Calamintha	*Calamintha nepeta*	1	Plants, Seeds
Corydothymus	*Corydothymus capitata*	1	Plants, Seeds
Mentha	*Mentha cervina*	1	
	Mentha pepirita		
	Mentha viridis	17	Plants, Seeds
	Mentha suaveolens subsp. Timijja	2	Seeds
	Mentha longifolia	2	Seeds
	Mentha sueaveolens subsp suaveolens	2	Seeds
	Mentha gattefossei	1	Seeds
	Mentha pulegium	4	
Salvia	*Salvia officinalis*	1	Plants, Seeds
	Salvia elegans	1	Seeds
	Salvia hispanica	1	Seeds
Lavendula	*Lavendula angustifolia*	2	Plants, Seeds
Crataegus	*Crataegus monogyna*	1	Plants
Moringa	*Moringa oleifera*	1	Seeds
Laurus	*Laurus nobilis*	2	Plants
Verbena	*Verbena officinalis*	1	Plants
Simmondsia	*Simmondsia chinensis*	1	Plants, Seeds
Nigella	*Nigella sativa*	1	Seeds
Nepeta	*Nepeta cataria*	2	Plants
Tanacetum	*Tanacetum annuum*	10	Seeds

Plants Seeds

The “Jardin d'Essais Botaniques” of Rabat: A space for plant biodiversity

Originally, the Rabat Botanical Garden (JEB), whose creation dates back to 1914, had for vocation the study of acclimatization trials of plant species introduced in Morocco. Plants have been the subject of successive introductions during the 20th century, which has resulted in the current diversity of plant collections housed within it.Thus, the JEB has played a fundamental role in the development of cultivated species in modern Moroccan agriculture, as has the introduction of several tropical species from different continents, in particular ornamental plants, aromatic and medicinal plants, and exotic fruit trees (avocado, anona, guava, feijoa…).

Designed in thematic squares, the JEB now contains around 650 species of ornamental plants (trees, shrubs and lianas), fruit trees, succulents, indoor and aquatic, in addition to and an arboretum of great genetic diversity made up of thirty families spread over forty species. The existing species present at the JEB are provided with labels indicating their scientific and vernacular names and their origin. Currently, the focus is on the conservation of existing species, the reintroduction of other types of native, rare or endangered plants, and all other species with an important botanical role. A visit to the trial garden allows the visitor to follow the evolution of the plant kingdom by demonstrating the diversity of pteridophytes (ferns), gymnosperms (conifers) and angiosperms (flowering plants).

In addition to its scientific and heritage missions, the JEB contributes to raising awareness of environmental issues. For more details, please consult the INRA edition published in 2017: The Botanical Garden, a living museum for science, environmental education and recreation.

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Conservation et gestion des Ressources Génétiques Animales locales au Maroc

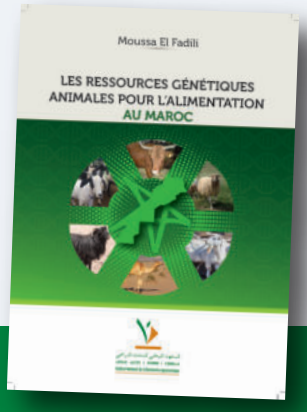
The diversity of indigenous Animal Genetic Resources (AnGR) constitutes an important source of resilience towards climate change, emerging diseases, and future changes in consumer demand for animal products. At the national level, the management of AnGR has been based mainly on in situ conservation programs (in breeding) through breeders associations and in state and research stations. Ex situ conservation at the level of artificial insemination centers has remained marginal.

Since the 1970s and to this day, INRA research program was mainly in local sheep, cattle and goat breeds AnGR. A lot of research has been carried out in the fields of INRA such as the Errachidia experimental area where the D'man (sheep) and Draa (goat) breeds have been studied, El Koudia experimental area where the Oulmes Zaers breeds (Bovin), Timahdite, Beni Guil, Sardi and Boujaad (Sheep) have been researched were the subject of research, and the experimental domain Deroua where the Sardi and Boujaad (Sheep) breeds were analyzed, and the experimental Boukhalef domain where the goats of the North were prospected. This research has enabled the production of knowledge and innovations in terms of zootechnical performance, genetic diversity and reproductive biotechnology of local breeds, but also the study of the breeding systems where they evolve.

INRA has also contributed to enriching the genetic heritage of sheep through the creation, characterization and in situ conservation of two new breeds of sheep: the INRA180 breed, already recognized and adopted by sheep breeders, and the Deroua breed. These breeds are intended to improve the productivity of sheep herds and to increase the number of marketable lambs in favorable and irrigated agricultural areas of Bour.

In addition, as part of its research program for the period 2021-2024, INRA has planned the characterization of new endangered indigenous genetic resources. These are the Siroua, Sargho, Tidili sheep breeds, goats and Camels inhabiting marginal areas (mountains, arid and desert), and whose numbers are in continuous decline. These breeds, which constitute a reservoir of genes for adaptation to difficult conditions, will undoubtedly play an important role in food security and the maintenance of rural populations.

INRA has published a book by Dr Moussa El Fadili which deals with all issues relating to AnGR in Morocco. The book is available at the INRA Library.



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THE EDITOR'S GUEST

Chajia Lahoucine
Ex researcher at INRA

For those who don't know you, who is Mr. Chajia Lahoucine?

I am an agricultural engineer specialized in horticulture, graduated from the IAV Hassan II. In 1979, I joined INRA to work at the Regional Center for Agronomic Research in Agadir as the head of Melk Zhar's Experimental Station to conduct agronomic research on vegetable gardens. It is in this area where the first research work on soilless crops to control nematodes was undertaken. In 1992, I obtained a master's degree in plant physiology from the Cadi Ayyad Faculty in Marrakech.

Could you briefly remind us of your contribution to the cactus and your first research work on this crop at INRA?

The undeniable contribution to the benefit of the cactus lies in defending this project ardently at a time when all interest was given to early crops. After an intial denial in 1997, this project was finally approved and endorsed in 1999 on condition that it be carried out at the Foum El Oued Experimental Station in Laâyoune. My first research work focused on the agronomic and morphological evaluation of cactus ecotypes collected locally with the aim of using them in genetic improvement programs in the years to come. Results of this research work were published in 2001 in the ecology journal "la terre et la vie" under the title «the cactus, a tool for managing drought in southern Morocco".

When were the first cactus surveys conducted and in which areas?

The first surveys undertaken by INRA date back to 1999 with the support of Mr. Boujghagh Mohamed, genetic improvement engineer at the CRRA in Agadir. The first areas surveyed were the regions of southern Morocco ranging from Souss-Massa to Tata via Biougra, Ait Daoud, Tiznit, Aït Baâmrane, Sbouya and Lakhssass, to cover in a second phase of collection the areas of Taroudant, Ouarzazate, Errachidia, Rich and Meknes. The third stage of prospection concerned the areas of the Atlantic coast ranging from Agadir to Tangier, ending with surveys in the areas of Chefchaouen and Ouazzane. Due to my early retirement, we were unable to reach the pre-Rif and Rif and Oriental areas.

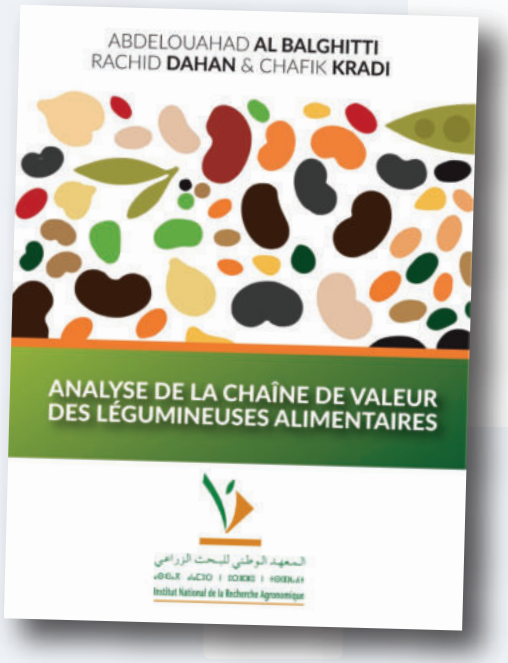
Thanks to the cactus collection housed in Melk Zhar, the genetic solution has borne fruit in warding off the plague of the cochineal. Tell us who dictated this desire to collect genotypes at a time when there was no threat to the cactus?

As researchers, we are always concerned with preserving the genetic heritage of all the plant species in our country, and the cactus is not the least. To avoid any possibility of loss of certain rare species or certain ecotypes for any reason whatsoever, care was taken to duplicate the collection housed in Foum El Oued as an additional security measure. Today we can rejoice that this fortuitous work in its time to bear fruit and has made it possible to identify some species resistant to this cochineal and from there to contribute to the efforts to regenerate our cactus plantations in Morocco.

Any last words ?

As a final word, I would like to say to all my colleagues still working at INRA to double their efforts and undertake innovative and promising research for our agriculture. And to persevere, to be ambitious and to believe in their projects and their abilities.

BOOK RELEASE



This book presents an analysis of the value chain of pulses. It covers analysis of agricultural policies, organization, characterization of production systems, marketing and valuation. The analysis also covers all players along the chain to the consumer, which is the main source of demand. The authors who contributed to this book belong to INRA, IUR, ESCAE and MAPMDREF. They are Fatima Zohra Benmoussa, Ismail Badraoui, Mohammed Boughlala, Abderrahim Bentaibi, Abdelali Laamari, Redouane Arrach, Aziz Fadlaoui, Tarik Saikouk. The editors are Abdelouahad Al Balghitti, Chafik Kradi and Rachid Dahan.

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AGENDA

Visit of the INRA seed variety demonstration platforms

As part of the promotional activities of its new released varieties of cereals, food legumes and oilseeds, INRA organizes visits to its demonstration site during the period April - May 2021. These platforms are implemented in 5 INRA's field experiments representing the main production areas: Saïs (Douyet), Zaër (Marchouch), Tadla (Afourer), Chaouia (Sidi El Ayedi) and Haouz (Tassaout). The goal of these platforms is to highlight genetic breeding progress made to develop new varieties and allow different stakeholders to inquire about their agronomic, physiological and technological qualities, in order to increase the rate of their use and ownership by farmers and societies seed companies. Those interested in visiting these plateforms are requested to contact the heads of INRA regional Centers where the demonstration site are located.

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