

## ICARDA Country Brief Series

# Morocco



*Photo credit: Michael Baum (ICARDA), 2019. Pre-breeding in wheat in Marchouch, Morocco*

09/03/2022

With the analytical support of:



## AUTHORS

Elvin Carol Kohen

## SUGGESTED CITATION

Elvin Carol Kohen (09/03/2022). ICARDA Country Summary Series: Morocco. ICARDA

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## List of Abbreviations

AFESD	Arab Fund for Economic and Social Development
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CRP	CGIAR Research Program
ET	Evapotranspiration
GEAR	Global Engineering and Research
GDP	Gross Domestic Product
ICARDA	International Center for Agricultural Research in the Dry Areas
OICR	Outcome Impact Case Reports
INRA	Institut National de la Recherche Agronomique (National Institute for Agricultural Research)
MCGP	Morocco/ICARDA Collaborative Grants Program
MENA	the Middle East and North Africa
NARS	National Agriculture Research System
NENA	the Near East and North Africa
MIT	Massachusetts Institute of Technology
PWPP	Precision field-based Phenotyping Platform for Drought/Heat Tolerance-Morocco
SDG	Sustainable Development Goals of the United Nations
USAID	United States Agency for International Development
ULE	Ultra-low-pressure

## Introduction

The ICARDA country series provides a snapshot of the work ICARDA has done and what is ongoing in the different countries in which ICARDA operates. It highlights the projects implemented, the partnerships that ICARDA has formed for both project delivery and knowledge generation, the key research themes by ICARDA Scientists and features a summary of the impact ICARDA projects have delivered to the citizenry, especially the rural poor smallholder farmers.

## About ICARDA

Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is a non-profit, CGIAR Research Center that focuses on delivering innovative solutions for sustainable agricultural development in the non-tropical dry areas of the developing world.

We provide innovative, science-based solutions to improve the livelihoods and resilience of resource-poor smallholder farmers. We do this through strategic partnerships, linking research to development, and capacity development, and by taking into account gender equality and the role of youth in transforming the non-tropical dry areas.

## Agriculture in Morocco

Located in the northwest corner of Africa and bordered by the North Atlantic Ocean and the Mediterranean Sea, the climate of Morocco experiences maritime, mountainous, and Saharan influences, and therefore it is a country with a dominantly semi-arid and arid climate. With the contribution of increasing temperatures and declining precipitation, Morocco has been suffering from droughts. Especially after the 1980s, droughts have been increasing in frequency, affecting the value of agricultural production.

In most of the country, there are two main seasons: a hot and dry summer, a cold and humid winter<sup>1</sup>. Recent projections demonstrate expectations of temperature increase by 1.1°C to 3.5°C by the 2060s, while rainfall simulations show a decrease in the rainfall<sup>2</sup>.

According to FAO 2019 Data, the top five crops that contribute to the value of agricultural production are wheat, olives, potatoes, apples and tomatoes<sup>3</sup>. From an agro-ecological point of view, two major groups can be distinguished:

- The favorable areas: plains and hills with rainfall greater than 400 mm and large irrigated perimeters which have a relatively high productivity potential, but only accommodate a quarter of farms, on a third of the cultivated area.
- The most difficult areas: plains and semi-arid agricultural plateaus, mountains and steppes, areas<sup>4</sup>.

From an economical perspective, the agriculture and food sectors play a vital role in the GDP of Morocco. Together with fisheries and forestry, agriculture accounts for nearly 13% of GDP. Between 2008 and 2017, it grew by 7% on average, well above the 3.9% growth of Morocco's GDP in the same period. 33% of Moroccans are employed in the agriculture sector and poverty rates are above the national average in regions with large shares of agricultural GDP. Therefore, there is a need for improvement in Morocco's economy, agriculture and food are strategic sectors, especially in rural areas where youth unemployment reached 25% in 2018<sup>5</sup>.

## ICARDA in Morocco

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<sup>1</sup> [CA0203FR.pdf \(fao.org\)](#)

<sup>2</sup> [\(PDF\) Moroccan agriculture, climate change, and the Moroccan Green Plan: A CGE analysis \(researchgate.net\)](#)

<sup>3</sup> [FAOSTAT](#)

<sup>4</sup> [CA0203FR.pdf \(fao.org\)](#)

<sup>5</sup> [Promoting investment climate reforms in Morocco's agri-food sector \(oecd.org\)](#)

The presence of ICARDA in Morocco stretches back to 1977. This collaboration started with the exchange of germplasm for crop improvement, training and visits done between 1978-1985. Also, the breeding program reviews conducted in 1982 and 1986 led to the direct involvement of ICARDA in Morocco.

From 1994-2004, the collaboration expanded in various activities such as decentralized breeding, outsourcing, involvement in medium and long-term planning of ICARDA strategies, implementation of regional projects, using Moroccan knowledge in West Asia and North Africa and technical backstopping by ICARDA scientists to national projects. Besides, in 2004 the [Morocco/ICARDA Collaborative Grants Program \(MCGP\)](#) started. This program was jointly promoted by ICARDA and Institut National de la Recherche Agronomique (National Institute for Agricultural Research) (INRA) Morocco, aiming to provide the support needed to develop synergies between INRA and ICARDA scientists and therefore open avenues for attracting additional external assistance and funds. Under this initiative, five MCGP projects are developed to address genetic resources conservation, conservation agriculture, and biotechnology backstopping<sup>6</sup>.

This long-term collaboration served for exchange germplasm and visits, publications, screening for pest and disease resistance, natural resources management and training.

## ICARDA Projects in Morocco

Below are summaries of all active projects in Morocco. For a summary table with exact dates, budget, and project manager, see Annex 1. (Table 1 in Morocco tables file).

### **Trait discovery and deployment through mainstreaming the wild gene pool in barley and grass pea breeding programs to adapt to climate change (2016-2021 | \$788,000 | [MEL Page](#))**

Barley and grass pea are among few crops with the potential to withstand drought, heat, salinity and can contribute to sustaining the livelihoods of poor communities living in the drylands, used for food and feed purposes. However, their productivities are low due to major foliar diseases and pests (barley) and to Orobanche (grass pea). Pre-breeding through introgression of useful genes from wild relative species to overcome these limitations offers opportunities for ensuring substantial genetic gains.

### **CGIAR Research Program on Livestock Agri-Food Systems (2017-2021 | \$7.8 million | [MEL Page](#))**

Active in Ethiopia, Morocco, and Tunisia, the goal of LIVESTOCK is to create a well-nourished, equitable and environmentally healthy world through livestock research for development.

### **Ultra-Low Energy Drip Irrigation for MENA Countries (2016-2021 | \$609,000 | [MEL Page](#))**

This USAID-funded project being implemented in partnership with the Massachusetts Institute of Technology (MIT) and INRA-Maroc designs and field validate on/off-grid drip irrigation systems that can cut pumping energy in half and facilitate the dissemination of affordable, solar-powered drip irrigation solutions in the Middle East and North Africa (MENA) region, specifically Morocco. ICARDA and INRA are field-testing novel ultra-low-pressure (ULE) drip emitters created by the Global Engineering and Research (GEAR) Lab at MIT that can operate at pressures 75-80% lower than conventional products. This reduces pumping costs and opens new opportunities for cost-savings through system optimization and strategic pump control. In Phase 1 of this project, ULE emitters for tree crops were field validated in Morocco, resulting in a 52% reduction in overall pumping energy. In Phase 2, a novel method to optimize off-grid drip systems was demonstrated to produce more reliable, lower-cost systems than conventional practice. In Phase 3 (ongoing), ULE emitters for cash crops are

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<sup>6</sup> [Moroccan Collaborative Grants Program \(MCGP\) \(cgiar.org\)](#)

being field validated, low-cost pump controllers have been designed and are being field-tested, and a commercialization plan will be created, culminating in an initial rollout with industry partners. These innovations will realize highly affordable on/off-grid drip irrigation for the first time in the MENA region.

**Genomic Prediction to Deliver Heat Tolerant Wheat to the Senegal River Basin (Phase II) (2018-2021 | \$387,000 | [MEL Page](#))**

In Morocco, the project performs scientific backstopping in developing heat-tolerant crosses via speed breeding and genomic selection models to identify the best performing germplasm

**DIIVA-PR: Dissemination of Interspecific ICARDA Varieties and Elites through Participatory Research (2018-2021 | \$1.06million | [MEL Page](#))**

DIIVA-PR worked with 22 farming communities and 20 national breeders in a participatory strategy across four countries (Morocco, Lebanon, Senegal and Ethiopia) to demonstrate the value of crop wild relatives-derived lines of barley, durum wheat, and lentil for adaptation to climate extremes.

**CGIAR Research Program on Climate Change, Agriculture and Food Security (CAAFS) - Phase II (2017-2021 | \$230,000 | [MEL Page](#) )**

The overall goal of CCAFS is to catalyze positive change towards climate-smart agriculture (CSA)<sup>2</sup>, food systems and landscapes. CCAFS takes its mandate from the CGIAR vision: “a world free of poverty, hunger and environmental degradation”. Impacts are sought in three dimensions (CGIAR System Level Outcomes): 1. Reducing poverty 2. Improving food and nutrition security for health 3. Improving natural resource systems and ecosystem services<sup>7</sup>.

**Establishing and Operating a Regional Network for Field Measurement of Actual Crop Water Consumption (Evapotranspiration) (2018-2021 | \$716,000)**

ICARDA in collaboration with FAO and five countries in the region has established a regional evapotranspiration (ET) network to establish a reliable source of ground measurement of ET with the multiple goals of calibrating and validating RS-based ETa retrievals, calibrating and validating crop models with the ET and related datasets and also for regional synthesis in the context of regional water scarcity. The NENA-ETNet will have a special focus on calibrating CORDOVA-ET system using other field ETa methods of determination to decide if CORDOVA-ET method can be used as a regional standardized validation protocol. The participating countries are Jordan, Egypt, Lebanon, Tunisia, and Morocco. The participating countries have good capacity and facilities for ET measurements using energy balance methodologies, lysimeter and gravimetric methods.

**Promotion of Efficient and Nutritious Agri-food Systems in South Asia (2018-2021 |\$200,000 | [MEL Page](#))**

Food legumes play an important role in food and nutrition security in South Asia. Mainstreaming energy- and labour-saving traits in food legumes is desirable for efficient and nutritious agri-food systems in targeted countries, Bangladesh, India, Nepal and Pakistan. Keeping that in mind, ICARDA evaluated improved germplasm of lentil, chickpea, faba bean and grass pea for traits associated with machine harvestability, herbicide tolerance and fast cooking time besides nutritional value at two locations. This has resulted in identification of high yielding improved elite germplasm for sharing with National Agricultural Research Systems (NARS) partners. Seeds of these lines have been multiplied and shared with NARS partners in Bangladesh, India, Nepal and Pakistan in the form of international nurseries. The results have shown 5-80% yield advantage of promising lines. The identified lines of lentil, chickpea, faba bean and grasspea will further be evaluated in on farm

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<sup>7</sup> [CCAFS Phase II proposal Exec Summary.pdf \(cgiar.org\)](#)

demonstration before their release for large-scale seed production and cultivation in farmer fields. Adoption of these lines will help reduce the labour drudgery, save energy in cooking and improve the availability of nutrient rich foods in the region.

### **Supporting National Programs of Agricultural Research in the Arab Countries through Training (2019-2021 |\$975,000 | [MEL Page](#))**

Based on the ICARDA Decentralization plan and the investment made to ICARDA Research Platforms through the support of AFESD (Arab Fund for Economic and Social Development), ICARDA Capacity Development Unit manage a project funded by AFESD aiming to support and advance collaboration programs between ICARDA and the National Agricultural Research Programs in the Arab countries; in addition to contributing to funding postgraduate scholarships and fellowships in the fields of agricultural research and to support ICARDA's activities in organizing several training programs/courses to Young Arab Professionals to fulfill the needs of Arab countries from ICARDA's research. In Morocco through ICARDA Research Platform in Rabat and Marchouch Research Station focuses on diversification and sustainable intensification of rainfed cereal-based production systems, including integrated pest management.

### **Precision field-based Phenotyping Platform for Drought/Heat Tolerance-Morocco (2019-2021 | \$70,000.00)**

Wheat is widely grown under semi-arid conditions. The majority of the wheat in the developing world, more than 100 mills Ha, is affected by abiotic stress, as heat and water scarcity because of climatic and/or irrigation problems. The activity under CRP Wheat titled, "Precision field-based Phenotyping Platform for Drought/Heat Tolerance-Morocco (PWPP) / Implementation of high-throughput Phenotyping (HTP) on the Lysimeter Station (PhysioTron) will generate high-quality phenotyping data on abiotic stresses (drought, heat + drought), complementing the potential of new molecular selection technologies, and therefore, expanding the precision and prediction value of phenotyping/genotypic data for new germplasm emerging from the WHEAT and partner breeding pipelines.

### **CGIAR Research Program: GENDER Platform (2020 -2021 | \$130,000.00 | [Website](#))**

GENDER (Generating Evidence and New Directions for Equitable Results) is CGIAR's new platform designed to put gender equality at the forefront of global agricultural research for development.

### **Training Materials for Agricultural Extension Agents to Integrate and Utilize RICCAR Data into a Crop Model such as APSIM and identify Context-Based Climate Adaptation Option (CBCAO) (2021| \$40,000.00)**

The UN-ESCWA who is the main agency providing the regional downscaled climate product (RICCAR) wanted to valorize the RICCAR data for operational use to help various MENA countries design their National Adaptation Plans. A crop model (e.g. APSIM) that can be driven by RICCAR data is the best possible option to identify the apt climate adaptation option suited for each context. We developed a comprehensive training module targeted to non-expert users to use RICCAR data to run APSIM to identify context-specific solutions. The training module is quite different from the routine APSIM training modules and is one of its kind. Using three examples [1] Morocco (Supplementary Irrigation in Rainfed Systems), [2] Iraq (Enhancing Water Productivity in Irrigated Systems) and [3] Jordan (Crop Diversification to Enhance Soil Carbon), we gave a step-by-step comprehensive training on how much these options are beneficial to adapt to a changing climate.

### **CtEH Contribution to ICARDA (CAPEX) (2021 | \$445,800.00)**

ICARDA has over the past few years made great advancements in the modernization of its breeding programs, and specifically wheat breeding, by use of breeding data management software and digitization, improving the use of machinery and barcoding. However, more investment is needed to

achieve a better rate of digitalization and modernization to help accomplish a good rate of genetic gain for the wheat improvement programs. ICARDA is the focal center for the global wheat program in Central and West Asia and North Africa (CWANA) and uses several stations throughout the region with most breeding activities taking place at the ICARDA station in Merchouch (Morocco). ICARDA has much to offer to the global wheat breeding communities targeting breeding for heat and drought tolerance. Two of the fundamental drivers of breeding are operation efficiency and selection accuracy and intensity. These two drivers are directly correlated to the genetic gain in the breeder's equation. This proposal focuses on the two drivers by: (1) using an automatic drip irrigation system and a precision planting process to reduce errors and increase efficiency in planning and planting to improve the breeding operation efficiency; and (2) by equipping the CRP Wheat Drought Station with a tractor-mounted high throughput phenotyping system to improve the selection accuracy. Both of these were established in the winter season 2021-22.

### **New Generation Variety Testing for Improved Cropping on European Farmland (InnoVar) 2019-2024 | \$605,000**

InnoVar (ICARDA Agreement No. 200166) is an EU Horizon 2020 project coordinated by the UK. There are many countries from the EU and European continent are involved. Only Morocco is exceptional, located in the North Africa region.

ICARDA is collaborating with EU partners on durum wheat for refining testing protocols for Distinctness, Uniformity and Stability (DUS) and for Value for Cultivation and Use (VCU), which are used for plant variety protection/variety registration.

In Morocco, Moroccan National Program is not involved officially. ICARDA is involved in this EU project as an International Organization. However, we want to interact with ONSSA, Morocco ('Office National de Sécurité Sanitaire des Produits Alimentaires). However, because of the Covid19 pandemic, we could not able to interact with them.

### **Camelina: A Cash Cover Crop Enhancing water and soil conservation in Mediterranean dry-farming systems (4CE-MED) (2020-2023 | \$218,000)**

ICARDA is working on a potential oilseed crop called Camelina (*Camelina sativa* L.), which can be deployed in crop rotations and conservation agriculture to break the existing system of a cereal crop after cereal cropping system. In this project, we work with local (Moroccan) stakeholders (researchers, farmers, research for development agencies, students, etc.).

### **Conservation of pollinator diversity for enhanced climate change resilience (2017-2022 | \$7.8million | [MEL Page](#))**

Morocco is the benchmark country of the IKI project. The project is implemented by ICARDA in collaboration with national partners, namely INRA and ONCA, but collaboration goes beyond (e.g., ONSSA, CBD focal point). Within the project, Morocco joined the Coalition of the willing on pollinator protection.

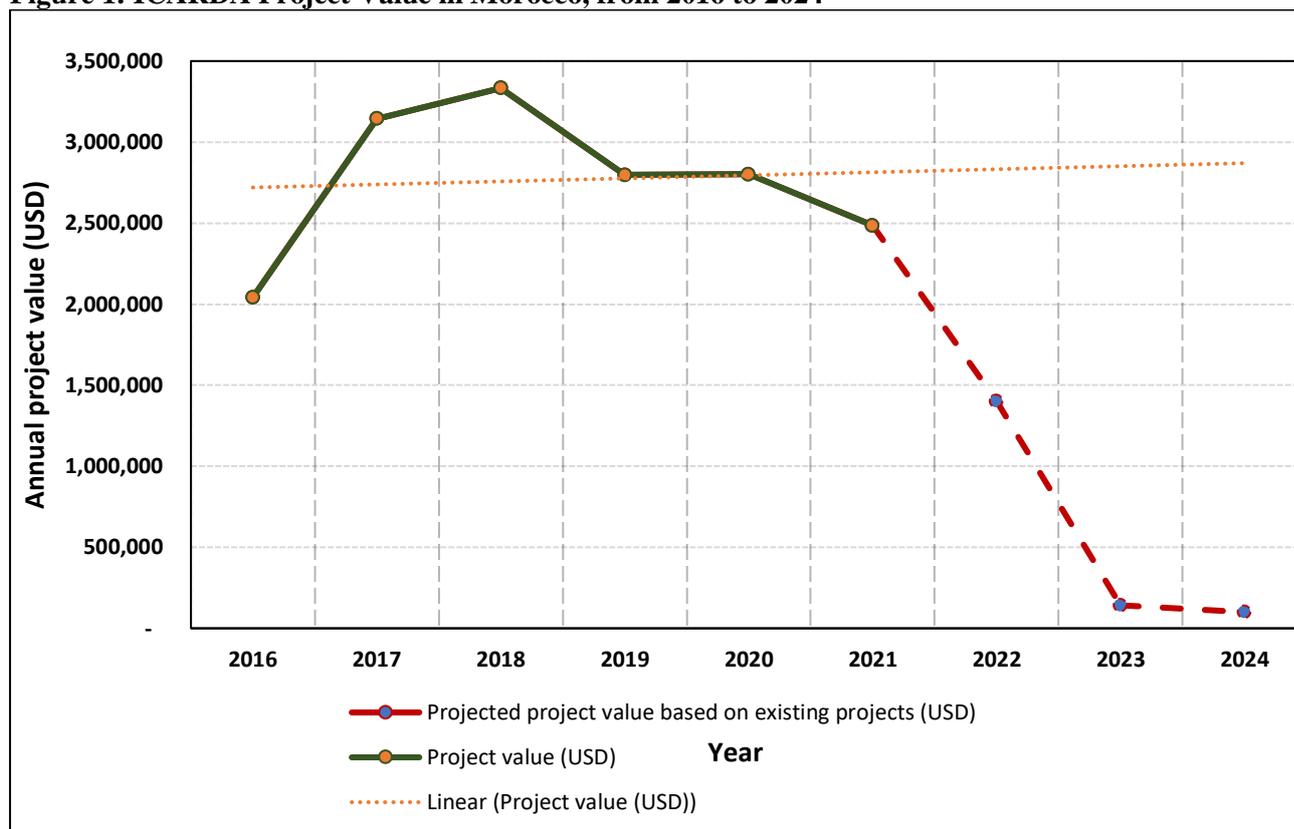
### **Assessment of water-harvesting scaling-up potential for the NENA Region (2021 -2022 | \$250,000)**

The project aims to quantify the water harvesting potential for scaling up across the NENA region by 1- collecting, generating and streamlining the rich database and knowledge gateways required to assess the water harvesting potential at a regional scale 2- assessing and developing a digital map of the water harvesting potential based on spatially explicit modeling and multi-criteria analysis taking into consideration site-specific factors. It also aims at developing a GIS web-based interface to support stakeholder decision-making for target-specific scaling of interventions and investment by developing a web-based dynamic interface tool that can identify SLM practices to support decision-making for site-specific interventions and implementation through a community-based participatory and transformative learning approach.

## ICARDA project value in Morocco

Figure 1 depicts the value of ICARDA projects in Morocco from 2016 to 2024, based on past and current projects. We see that from 2016 to 2018, there is an annual increase of more than a million-dollar in project value in Morocco. As depicted by the projected project value, if there were no new projects or funds brought into Morocco, there would be a rapid decline in total project value in 2022. Note that the purpose of the graph is to illustrate trends and not to provide precise budget data; several assumptions were made to create the graph, including: (1) All budget data in OCS at the time of data pull was up to date, (2) for multi-country projects, funds are distributed equally among countries, (3) project spending is equally divided across all years.

**Figure 1: ICARDA Project Value in Morocco, from 2016 to 2024**



**Figure 1: Trajectory of ICARDA project value in Morocco (Source: MEL, December 2021)**

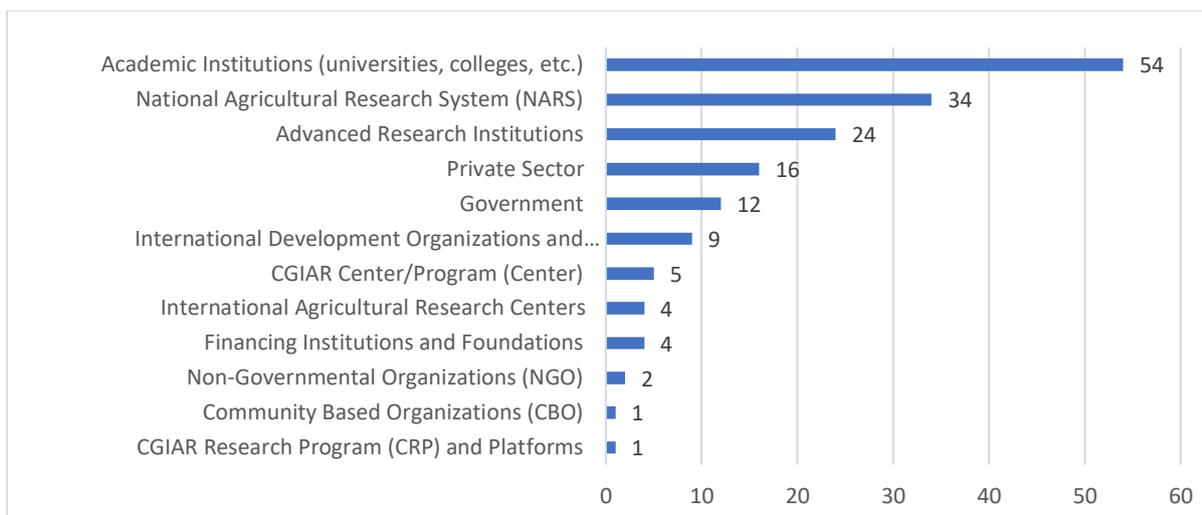
## Partnerships

ICARDA engages several local, national, regional and international entities as a means of ensuring effectiveness and efficiency of knowledge generate and project delivery at scale. This section highlights the partners with which ICARDA has worked both in project delivery and knowledge generation and dissemination.

### Project delivery partners

Over the years, ICARDA has partnered on projects with over 150 entities in Morocco, that can be stratified into 12 types. Academic institutions, National Agricultural Research Systems (NARS) and advanced research institutions were the most involved types.

**Figure 2: Project Delivery Partners for Morocco**

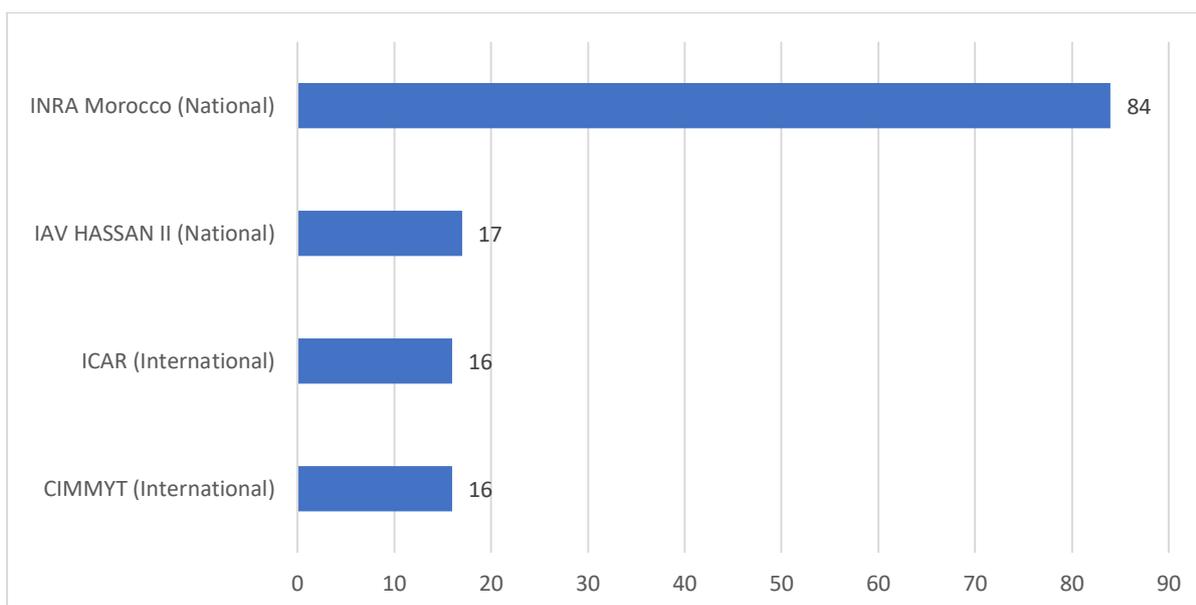


(Source: MEL 2021, Elaboration: MEL)

### Knowledge generation partners

ICARDA has a total of 99 partners in the generation and dissemination of scientific knowledge, producing a total of 602 knowledge generation and dissemination products over the last 5 years. The top four partners contributing to the most knowledge products are shown below (Figure 3).

**Figure 3: Top 4 Knowledge Generation Partners of Morocco**

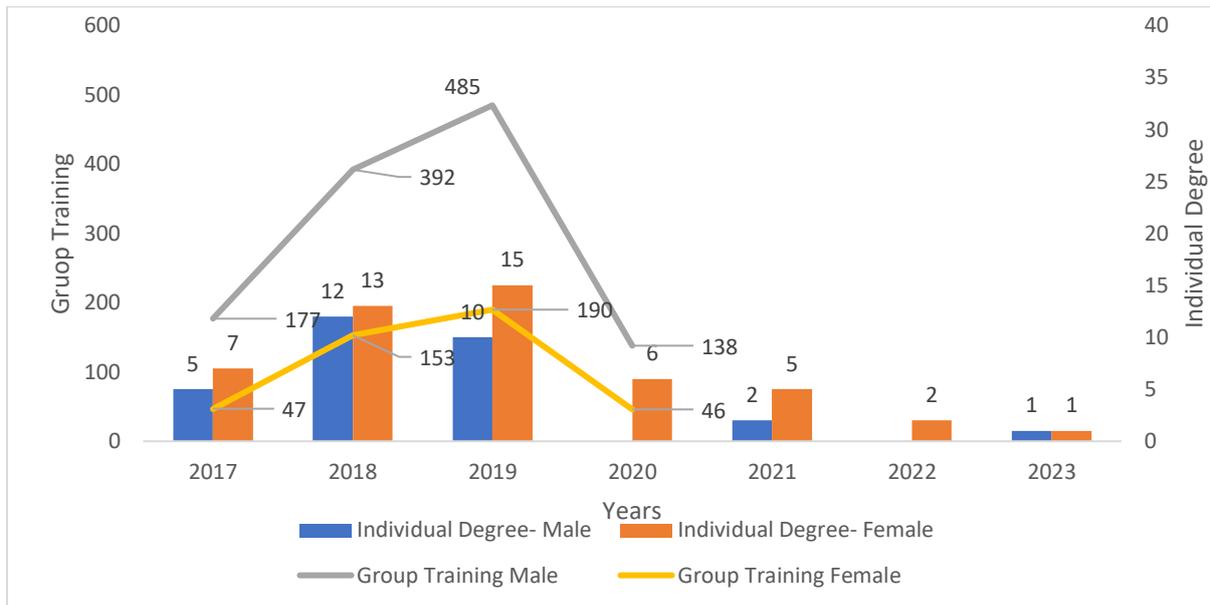


(Source: MEL 2021, Elaboration: MEL)

### Capacity Development

Capacity development is a fundamental component of ICARDA's strategy and contributes to the achievement of several goals and targets. Building the capacity of partner institutions, and beneficiaries can greatly contribute to the sustainability of ICARDA's work. In Morocco, ICARDA capacity development work has involved the training of 2,037 men and 70 women through short-term group training, and 14 individual advanced degree training (**Error! Reference source not found.**).

**Figure 4: Capacity Development Activities in Morocco**

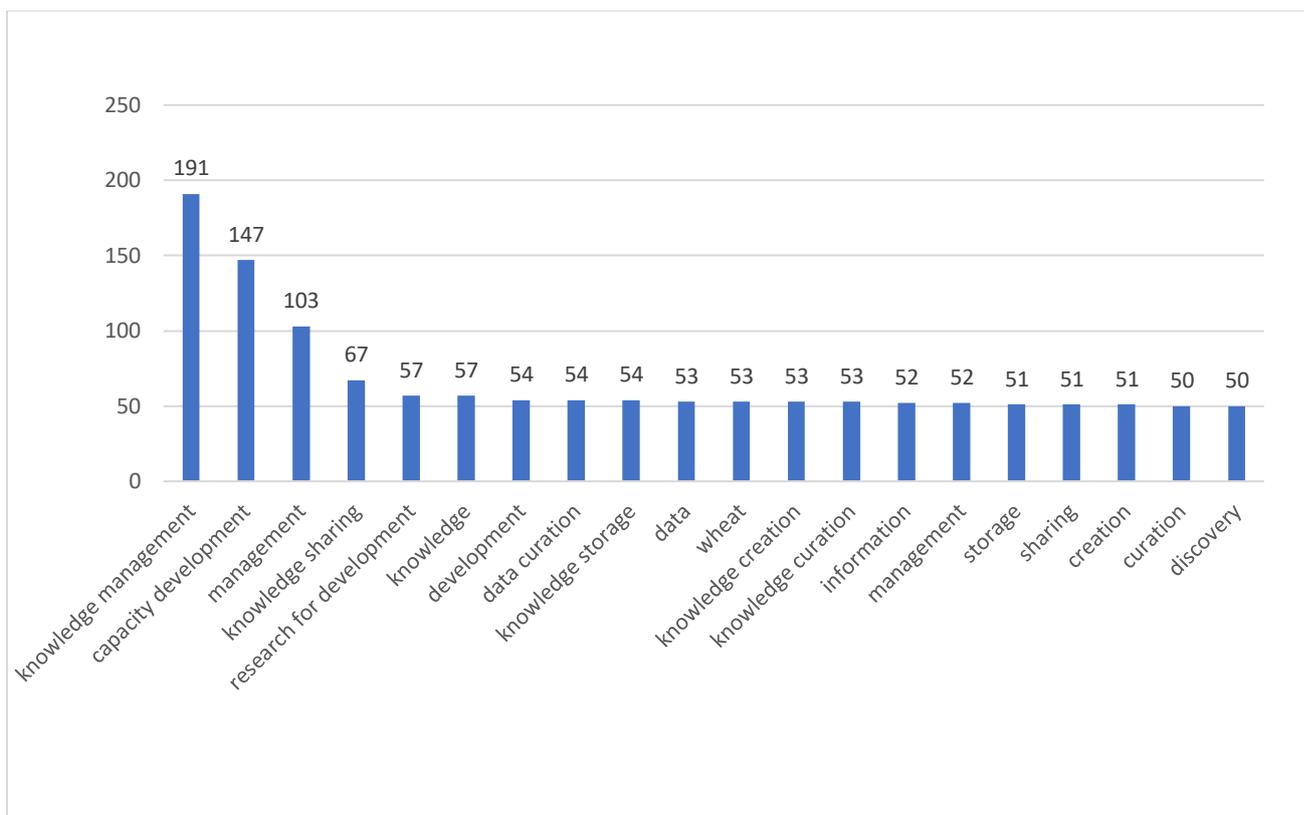


(Source: MEL 2021, Elaboration: MEL)

### Research themes

The research themes ICARDA scientists have worked on concerning Morocco are key insights on ICARDA’s priorities within Morocco and can be a useful precursor to where the most impact may be created. Out of the 1,618 keywords used on Morocco knowledge products, the most used keywords are shown in Figure 5 below. A strong theme is visible on the development, curation, and management of knowledge and data.

**Figure 5: Most Used Research Theme Keywords on Morocco**



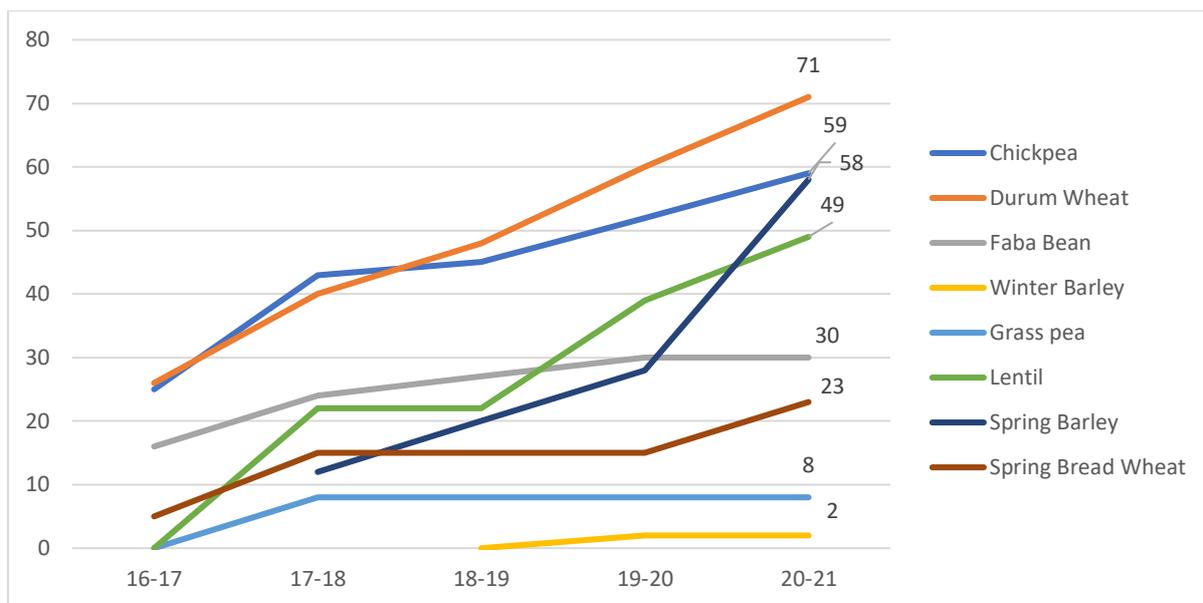
(Source: MEL 2021, Elaboration: MEL)

## Variety Development

As part of the varietal nursery development process, ICARDA conducts a number of multi-location trials to ensure that the varieties developed as well adapted and suitable for different agro-ecological zones within its areas of operation. Egypt has produced a total of 300 trial lines since 2017 (Figure 6). Cumulative data indicates steady production of durum wheat variety , with an increase in spring barley production over the past few years.

**Figure 6: Cumulative Variety Development between 2016-2021 in Morocco<sup>8</sup>**

<sup>8</sup> Please note that the analysis does not include values of Winter Barley which is missing for the periods 2016-2017 and 2017-2018, and Spring Barley within the period 2016-2017; as the numbers were not extracted.

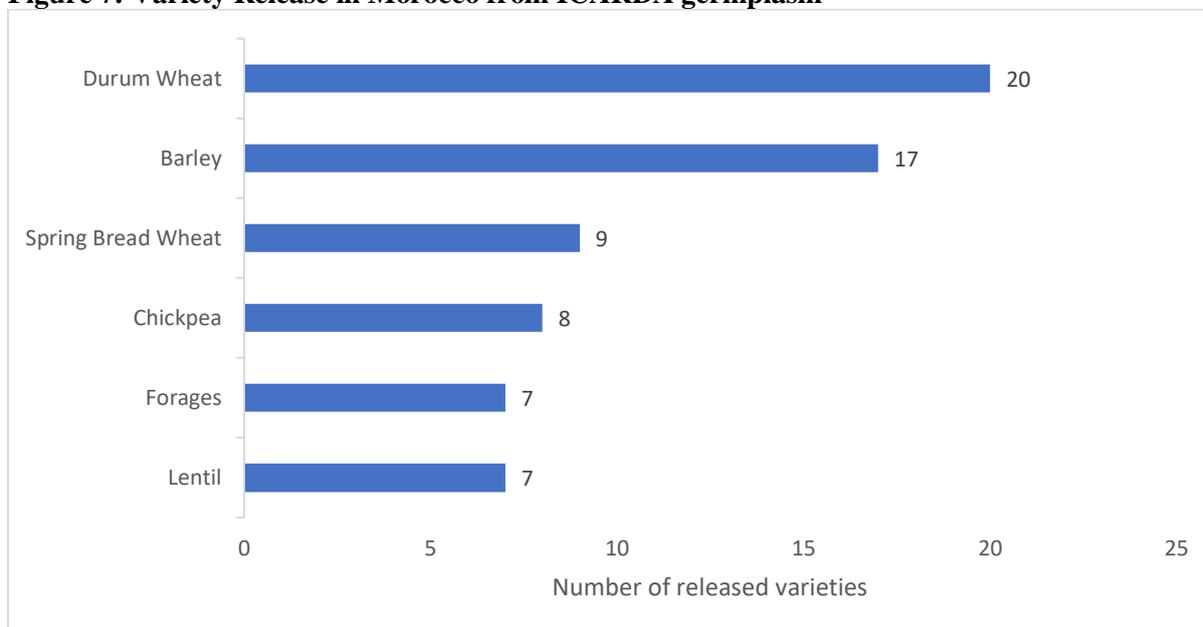


(Source: International Nurseries Data Management System (INDMS) 2021)

## Variety Release

Variety release is a key prerequisite for taking crop technologies to scale through wide distribution networks. ICARDA has contributed to the release of 68 varieties of 6 crops in Morocco. The crops include durum wheat, barley, spring bread wheat, chickpea, forages and lentil.

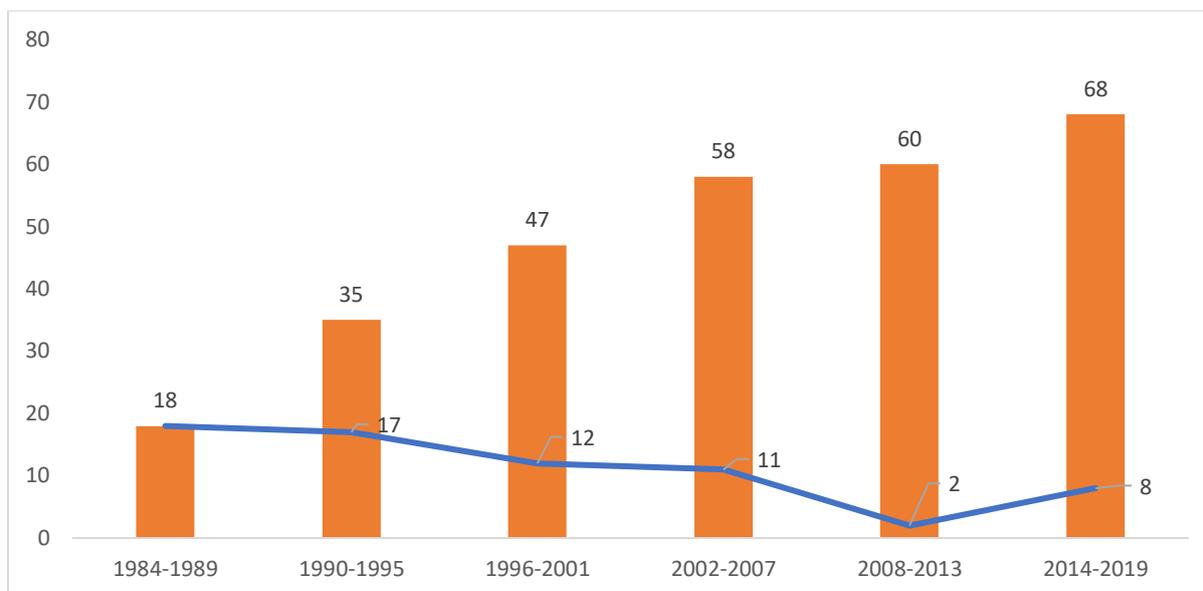
**Figure 7: Variety Release in Morocco from ICARDA germplasm**



(Source: INDMS 2021)

The release of ICARDA-germplasm varieties by the Moroccan government has shown a decrease since 1979, and an increase from the period 2008-2013 to 2014-2019. (Figure 8). In the 1980s and 1990s, the variety release showed maximum values.

**Figure 8: Trend of ICARDA germplasm release in Morocco**



(Source: INDMS 2021)

## Impact assessment of some technologies promoted by ICARDA in Morocco

Below are summaries of the research conducted on the impact of ICARDA-promoted technologies and practices in Morocco, sourced from three Outcome Impact Case studies in Morocco:

### Adoption and Impacts of Improved Wheat Varieties in Morocco

**Intervention:** This paper aims at providing credible evidence for the current levels of adoption of improved wheat varieties and their impacts. The paper also provides evidence on farmer utilization of seeds and evaluates the validity of the blame on access to seed as the most important factor constraining wider adoption and impacts of more recently released wheat varieties in Morocco.

**Impact:** The results clearly show that IV is potent in removing both overt and hidden biases and dealing with the problem of endogenous treatment, which shows that unobservable factors such as skills of the farmers who have adopted the technology are important in explaining the differences in net wheat income.

**Study title & source:** Adoption and Impacts of Improved Wheat Varieties in Morocco. 2017. ([MEL Link](#))

### Adoption and Impacts of Improved Varieties and Seed Demand Analysis

**Intervention:** There is very limited information about the national level adoption of improved wheat varieties in Morocco. With the exception of some estimates based on secondary data, the same is true for household, regional and national level seed use. Using a nationally representative sample of 1,230 farm households from 21 provinces distributed across 56 districts and 292 villages and a variety of methods including descriptive statistics, the Heckman selection model, duration analysis, propensity score matching and endogenous switching regression, this study attempted to provide: 1) accurate estimates of current national and provincial adoption levels of improved varieties with special attention to their release date; 2) analysis of factors influencing the decision and speed of adoption of improved wheat varieties; 3) estimates of impacts on livelihoods indicators particularly yield, wheat net income and wheat consumption; and 4) estimation of farm, provincial and national level seed demand.

**Impact:** The adoption of improved wheat varieties leads to improvements in livelihoods indicators including: 482kg/ha (49%) increase in yields, 1324 MAD/ha (48%) higher net income and 29.6 kg/capita/year (60%) increase in wheat consumption. Given an average area per farm household under the improved wheat varieties of 1.6 ha, the typical adopter farm households are obtaining 771 kg extra wheat production and 2118 MAD (US\$246) additional net income - all clearly showing that the improved varieties are contributing to livelihoods improvements. Nationally, the adoption of the improved varieties has led to 17% higher annual production, net wheat income gains of about 9.1 billion MD or US\$1.1 billion per year and about 17kg/capita/year of extra wheat availability for consumption from domestic production

**Study title & source:** Adoption and Impacts of Improved Varieties and Seed Demand Analysis. 2018 ([MEL Link](#))

### **Political Economy of the Wheat Sector in Morocco: Seed Systems, Varietal Adoption, and Impacts**

**Intervention:** This study documents the wheat seed system, its adoption and impacts in Morocco, through support provided by the CGIAR Research Program (CRP) on Wheat and the European Union-International Fund for Agricultural Development (EU-IFAD) Project. The experiences documented in this book are expected to inform stakeholders – including policy makers, researchers, farmers, private and public commercial farms, and development partners – about the status, challenges, and opportunities in the wheat sector in Morocco. Additionally, it paves the way for the development of more efficient intervention options for the future.

**Impact:** The Moroccan wheat sector involves several actors interrelated in many ways; and each has specific interests and aspirations. Any attempt to improve the performance of the wheat sector in the country requires an approach that simultaneously addresses prevalent bottlenecks through a multifaceted intervention involving policy, and institutional and technological changes. The success of such interventions will depend on many factors: how best they target the major aspects of varietal development, evaluation, release, protection and licensing, seed production and commercialization, seed quality and certification, wheat production and marketing, and access to certified seed and new varieties

**Study title & source:** Political Economy of the Wheat Sector in Morocco: Seed Systems, Varietal Adoption, and Impacts. 2018. ([MEL Link](#))

## **Innovations**

### **Development and utilization of primary winter synthetics to incorporate important new traits in winter wheat varieties (2018)**

**Innovation:** A new technique was used to develop synthetic winter wheat varieties with resistance to disease and drought, and high grain mineral content.

**Stage of innovation:** Stage 3: available/ ready for uptake (AV); synthetic germplasm has been developed, characterized, published and offered to CIMMYT cooperators through IWWIN (International Winter Wheat Improvement Network), available here: <http://www.iwwip.org/Nursery>.

**Source:**

<https://marlo.cgiar.org/summaries/Wheat/projectInnovationSummary.do?innovationID=464&phaseID=62>

### **4 new dual-purpose barley elite genotypes were shared with the Institut National de la Recherche Agronomique (INRA) in Morocco for validation and potential release**

**Innovation:** 4 new dual-purpose barley elite genotypes were shared with INRA Morocco to be planted in the 2020/21 season for validation and potential release. Dual-purpose means that they can be used

for green forage (grazing) and exhibit good recovery that provides a high yield for grain and straw at maturity for feed.

Stage of innovation: Stage 1: discovery/proof of concept (PC - end of research phase)

Source:

<https://marlo.cgiar.org/summaries/Livestock/projectInnovationSummary.do?innovationID=1770&phaseID=150>

## Policy Contributions

There were no policy contributions reported for ICARDA in Egypt reported in the CGIAR Results Dashboard.

## Suggested actions in contribution to agricultural livelihoods, food security and resilience of farming communities in Morocco

Currently, the main challenges in the agriculture sector in Morocco can be summarized as:

- **The complexity of business and regulatory environment:** There is a need for developing and enabling investment for agri-food considering many factors in consultation with a wide range of stakeholders, including relevant governmental actors, agricultural investors, workers and farmers, civil society organizations, local communities and marginalized groups.
- **Climate change, drought and water shortage:** Although irrigation is practiced on only 16% of the cultivated land in Morocco, it generates half of the agricultural GDP and 75% of agricultural exports.
- **Infrastructure and connectivity:** Despite the significant investments to enhance access to basic infrastructure in Morocco, the quality and quantity of infrastructure remain unequal between rural and peri-urban regions, creating transportation challenges for agri-food in medium-sized and small cities <sup>9</sup>.

Based on its expertise and strong experience in the country, ICARDA has identified the following concrete actions through which it can contribute to the achievement of SDG 2: Zero Hunger and SDG Goal 13: Climate Action and SDG Goal 17: Partnerships for the goals.

- Scarcity of water and arable land challenges on the greater agricultural production will depend on innovations.
- Drip irrigation and water-saving technologies are needed to strengthen resilience to drought and increased water scarcity due to climate change.
- Partnership and training have big roles in ICARDA activities in Morocco. The ongoing project “Camelina: A Cash Cover Crop Enhancing water and soil conservation in Mediterranean dry-farming systems (4CE-MED)” currently includes collaborations with local stakeholders including researchers, farmers, students, development agencies which demonstrate implementations of SDG Goal 17. Besides, the project “Supporting National Programs of Agricultural Research in the Arab Countries through Training” brings collaborations through training and education. The project “Conservation of pollinator diversity for enhanced climate change resilience” enhances collaboration with national partners, namely INRA and ONCA, but collaboration goes beyond (e.g., ONSSA, CBD focal point). This project also complies with SDG Goal 13 on climate.

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<sup>9</sup> [Promoting investment climate reforms in Morocco’s agri-food sector \(oecd.org\)](https://www.oecd.org/mexico/promoting-investment-climate-reforms-in-morocco-agri-food-sector/)

- Considering the collaborations, the partnership between INRA Morocco and ICARDA remains vital; not only for the innovations but also for the development of knowledge products.

## Annex 1: Summary of ongoing projects in Morocco (Source: MEL December 2021)

Project Name	Project Manager	Donor	Total Budget	Start Date	End Date
Trait discovery and deployment through mainstreaming the wild gene pool in barley and grass pea breeding programs to adapt to climate change	Ahmed Amri	Norwegian Agency for Development Cooperation - NORAD	787,322.00	2016-03-03	2021-06-30
CGIAR Research Program on Livestock Agri-Food Systems	Barbara Rischkowsky	CGIAR Fund Council - CGIAR - FC	7,837,918.00	2017-01-01	2021-12-31
Ultra-Low Energy Drip Irrigation for MENA Countries	Vinay Nangia	United States Agency for International Development - USAID	609,374.00	2016-09-20	2021-09-19
Genomic Prediction to Deliver Heat Tolerant Wheat to the Senegal River Basin (Phase II)	Filippo Maria Bassi	Swedish Research Council	387,276.00	2018-01-01	2021-12-31
DIIVA-PR: Dissemination of Interspecific ICARDA Varieties and Elites through Participatory Research	Filippo Maria Bassi	Norwegian Agency for Development Cooperation - NORAD	1,060,000.00	2018-06-30	2021-08-15
CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) - Phase II	Ajit Govind	CGIAR System Organization - CGIAR	230,000.00	2017-01-01	2021-12-31
Establishing and Operating a Regional Network for Field Measurement of Actual Crop Water Consumption (Evapotranspiration)	Vinay Nangia	Food and Agriculture Organization of the United Nations	716,610.00	2018-12-23	2021-11-30
Promotion of Efficient and Nutritious Agri-food Systems in South Asia	Shiv Kumar Agrawal	OPEC Fund for International Development	200,000.00	2018-10-01	2021-01-31
Supporting National Programs of Agricultural Research in the Arab Countries through Training	Charles Kleiner mann	Arab Fund for Economic and Social Development - AFESD	975,000.00	2019-01-01	2021-12-31
Precision field-based Phenotyping Platform for Drought/Heat Tolerance-Morocco (PWPP) 2020-2021	Andrea Visioni	International Maize and Wheat Improvement Center - CIMMYT	70,000.00	2019-05-01	2021-08-31
CGIAR Research Program: GENDER Platform	Dina Najjar	CGIAR System Organization – CGIAR	130,000.00	2020-01-01	2021-12-31

Training Materials for Agricultural Extension Agents to Integrate and Utilize RICCAR Data into a Crop Model such as APSIM and identify Context-Based Climate Adaptation Option (CBCAO)	Ajit Govind	United Nations Economic and Social Commission for Western Asia - UN-ESCWA	40,000.00	2021-09-22	2021-12-15
CtEH Contribution to ICARDA (CAPEX)	Zakaria Kehel	CGIAR System Organization - CGIAR	445,800.00	2021-08-31	2021-12-31
New Generation Variety Testing for Improved Cropping on European Farmland (InnoVar)	Sripada M. Udupa	European Union, European Commission - EU-EC	604,895.00	2019-10-01	2024-03-31
Camelina: A Cash Cover Crop Enhancing water and soil conservation in MEDiterranean dry-farming systems (4CE-MED)	Sripada M. Udupa	European Union - EU Belgium	218,000.00	2020-05-01	2023-10-31
Establishing and Operating a Regional Network for Field Measurement of Actual Crop Water Consumption (Evapotranspiration)	Vinay Nangia	Food and Agriculture Organization of the United Nations	716,610.00	2018-12-23	2021-11-30
Conservation of pollinator diversity for enhanced climate change resilience	Stefanie Christmann	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety	7,824,348.00	2017-06-01	2022-05-31
Assessment of water-harvesting scaling-up potential for the NENA Region	Chandrashekhara Biradar	Food and Agriculture Organization of the United Nations	250,000.00	2021-06-02	2022-05-30