Egypt & ICARDA

Working together for enhanced food security and increased water productivity in the Nile Valley and Sub-Saharan Africa region

Egypt-ICARDA ties are marked by an ever growing research partnership that, since 1979, has been successfully delivering solutions to improve livelihoods and enhance food security in the region through more productive wheat, barley, and legume crop systems, efficient use of scarce water, integrated crop-livestock systems, sustainable land practices, and enabling policies.

Agriculture in Egypt

Only a tiny fraction of Egypt's total land area is suitable for agriculture, yet this small space is among the world's most agriculturally productive regions, contributing significantly to the nation's economy. Egypt has a relatively high population growth rate, making both water use and food security key challenges. With per capita annual availability of water one-fifth of the global average, water management is a critical issue. Salinity is another growing problem for farmers, particularly those in the fertile Nile River Delta region.

Key facts

- Total population: 84 million
- Land suitable for agriculture: 3.5%
- GDP from agriculture: 14%
- Annual population growth: 1.8% per year
- Labor force employed in agriculture: 55%
- Annual water consumption: 78 billion m^3
- Water use for agriculture: 85% of total consumption

ICARDA
Science for Better Livelihoods in Dry Areas

Nile Delta farmers participating in wheat research reaped a bountiful harvest through the Water Benchmark Project (2009–2013)

A long and fruitful partnership

ICARDA's partnership with Egypt dates from 1979 when, together with Sudan, it launched the Nile Valley Project, the center's first research initiative in the region. Over the years, the project expanded into Ethiopia, Eritrea, and Yemen, growing into a much larger regional initiative, the Nile Valley and Sub-Saharan Africa Regional Program, with a range of research and capacity development activities in partner countries.

Today Egypt is the hub for ICARDA's Nile Valley and Red Sea Regional Program, which strategically aligns its activities with Sudan, Eritrea, and Yemen. Egypt is also a key player in ICARDA's new decentralization strategy as the thematic research location for sustainable intensification in irrigated systems. The initiative is building on the ongoing collaborative research on wheat improvement at the Agricultural Research Center (ARC), where high-input irrigation can allow wheat to express some of its highest yield potentials in the world – a promising outcome for food security in drylands.

Egypt is also one of the research sites for Dryland Systems, CGIAR's global research program led by ICARDA, and is a financially contributing member of CGIAR for collaboration with ICARDA.

Water and land management for greater productivity and sustainability

ICARDA's support to resource management has been longstanding. In 1997, under a contract with the Egyptian Ministry of Agriculture and Land Reclamation, ICARDA assisted the Matrouh Resource Management Project, funded by the World Bank, on the north-west coast of Egypt. The project helped improve conservation of water, soil, and vegetative cover of the area, and created income generating opportunities through barley-forage cropping systems for the Bedouins on rangelands. Today the work has diversified.

Saving irrigation water for smallholder farmers: raised bed planting

Farmers in the Nile Delta traditionally practice 'flood and furrows' or surface irrigation. The whole cultivated area of closely spaced furrows is flooded, which uses excessive water and inputs and is expensive.

Through the Irrigation Benchmark Project, funded by AFESD, IFAD, OFID and Egypt, ICARDA, ARC, NWRC, and Zagazig University together developed and introduced a far more efficient irrigation package that uses widely spaced furrows with broad 'crop strips' coupled with improved agronomic practices. A major breakthrough was innovating a multi-crop raised bed machine for small to medium sized farms that mechanized raised bed soil formation and planting for smallholders. The efficient machine offers impressive reductions in water use and cost, and increase in yields, with testing on maize, wheat, and sugarbeet.

The raised bed package is being widely disseminated through the Arab Food Security Project, funded by AFESD, KFAED, and IsDB, as well as the Government of Egypt, scaling out the technology to 22 governorates in the country. As the simple technology is catching on, ICARDA is also working with Egyptian manufacturers to make the machine available in other countries, such as Eritrea, Ethiopia, Iraq, Morocco, Sudan, and Tunisia, through their NARS.

Combating salinity and expanding Egypt's New Lands

Irrigation waters from the waterways and canals fed by the Nile River are the backbone of Egypt's agriculture. ICARDA is working with the Egyptian institutes and authorities to help meet its growing demands for food production by harnessing these waters for greater productivity and sustainability through the nation's dual strategy of intensification on existing cultivated land and expansion into the desert (the 'New Lands') using water savings from the 'Old Lands'.

The partnership is using an integrated approach, from the farm to main canal levels, including identifying institutional and technical barriers to better water management, introducing low water-use farming methods, and building the required capacity from farmers through to policy-makers. The work, funded by the Governments of Australia and Egypt, contributes to research through a better understanding of the conditions of salinity, and the links between water management practices and the movement and accumulation of salt. Modeling of the whole central delta is building a clear picture of how much water can potentially be 'saved' for use in the New Lands. The project is a collaboration of Egypt's ARC and NWRC, with ICARDA and IWMI (both CGIAR centers).

Mechanized raised bed planting – doing more with less

The technology demonstration on farmers' fields in the Al-Sharkia province reaped the following benefits on an average basis:

- Saving in applied irrigation water by 25%
- Increase in grain yield by 30%
- Increase in water use efficiency by 73%
- Saving in the quantity of seed used by 30–50%
- A reduction in overall farming cost by 25%.

Mechanized raised bed technology, developed by ICARDA-Egypt partnership, is improving water and land productivity in the Nile Delta region and beyond

Water and food security: a global call to action for policy-makers

In June 2013, ICARDA and Egypt jointly launched a global call to action for decision-makers across the world's dry areas on the urgency of policy on water management through a landmark event held in Cairo. The event, supported by FAO, IFAD, and Canada's IDRC, gathered delegates from 30 countries and sowed the seeds for a new partnership to coordinate efforts at national, regional, and international levels on policies for water and food security.

Farmers and decision-makers come together to expand the use of new technologies, 2012

Improving crop systems and strengthening food security

A major thread in ICARDA's ties with Egypt has been the research and successes of the Nile Valley Project which focused on improving food security and increasing household incomes through generating and disseminating technology 'packages' for cereals and cool season legumes for over 25 years. Funded by IFAD, the initiative addressed major biotic and abiotic stresses that crops face in Egypt and introduced integrated solutions for more productive wheat, faba bean, chickpea, and lentil crop systems. Of unique value were the follow-up adoption and impact studies that helped identify barriers to greater technology uptake and assessed substantial gain in incomes for participating farmer families.

Improving wheat productivity

A major research thrust throughout, wheat improvement activities are now implemented under the ICARDA-ARC Wheat Improvement Program (ICARC-WIP) since 2009 to improve germplasm and crop management, and to develop the necessary national capacity.

Outcomes from the program are developing improved crop varieties that offer high yield potential, water use efficiency, heat tolerance, and multiple disease and pest resistance (especially to yellow and leaf rusts), ensuring production stability and higher incomes for farmers. The program makes the improved germplasm freely available, through international nurseries, to national wheat breeding programs in ICARDA's partner countries.

The WIP at Sids Research Station, funded by Egypt and ICARDA, has become a destination for scientists from Central Asia, North Africa, and Sub-Saharan Africa. Wheat cultivars developed at Sids are reaching 12 African countries through the SARD-SC project funded by the African Development Bank.

Promoting and reviving production of faba beans

One of the most successful strategies in the Egypt-ICARDA partnership in fighting poverty has been increasing the productivity of faba beans, a crop largely grown by subsistence farmers particularly in drought-prone areas. Results from the Nile Valley Project indicated an average increase in income of 173% and a doubling up of consumption of the high-protein beans in households that adopted the faba bean package. A new initiative launched in 2012 is now reviving the productivity of faba, which had begun to decline from disease and poor practices. The activities are part of a project funded by EU-IFAD in the West Asia and North Africa region. The project combined improved faba varieties and conservation agriculture with tremendous success on demonstration fields in five governorates across Egypt, triggering a national government campaign for reviving faba bean production, once the leading crop for the country.

New faba varieties 'Misr 3' and 'Giza 843' demonstrated success in fighting *Orobanche* and an increase in yield of ~ 22.5%.

Strengthening seed systems

ICARDA's research through the Matrouh project had developed high yielding, drought-tolerant barley varieties suited for the region's tough conditions. However, replacing the old varieties being used by

farmers is often a bigger challenge. To address this challenge, ICARDA launched a farmer-based seed multiplication and marketing project which highlighted the potential of the approach in increasing access to improved seeds for smallholder farmers. Today, as part of the Arab Food Security Project, ICARDA is building on those results to improve access to certified seed for smallholders. The activities led to an increase by 117% in the use of certified seeds by smallholders from the 2010/2011 to 2012/2013 cropping season.

Developing Egypt's young scientists and national capacity for a stronger agriculture future

Close to 2000 Egyptians have benefited during the period 1978–2014 from a comprehensive capacity building program offering courses, internships, non-degree, PhD and Master's degrees, aiming to develop young scientists for agricultural research in dry areas. Capacity building of farmers, extension staff, local scientists, and community workers integrated across all research activities has helped ensure continued uptake of knowledge and technologies, and sustained progress in Egypt. Skilled courses have included crop improvement, advanced biotechnology tools, water management, seed production, and use of GIS application.

Ongoing initiatives

- *Middle East Water and Livelihoods Initiative* – Improving livelihoods through sustainable water and land management. Funded by USAID
- *Wheat-Legume Cropping System for Smallholder Farmers in West Asia and North Africa* – Improving food security in the changing climates of dryland regions. Funded by EU-IFAD
- *Enhancing Food Security in Arab Countries* – Increasing the productivity of dryland production systems. Funded by AFESD, KFAED, and IsDB
- *Management of Water and Salinity in the Nile Delta* – Improving water management in the Nile Delta. Funded by ACIAR
- *ARC-ICARDA Collaborative Program on Irrigated Wheat-Based System and Small Ruminant-Based System.* Funded by Egypt through CGIAR, and ICARDA
- *Integrated Agricultural Production Systems for the Poor and Vulnerable in Dry Areas.* Funded by IFAD
- *CLIMED and Dairy: Understanding the traditional milk supply chain functioning in Cairo.* Funded by CIRAD
- *Cross-cutting M&E Functions and Knowledge Management for INRM within MENARID.* Funded by IFAD

Moving from research to development

The outcomes from the Egypt and ICARDA partnership are successfully scaling out for bigger impacts through uptake by development partners. For example, the improved irrigation system developed under the Irrigated Benchmark Project has been adopted by the East Delta Rural Development Project (financed by IFAD and the World Bank) and the Crop Intensification Project of Middle Egypt (financed by IFAD). In addition, the national extension system is transferring the package to six additional governorates in Egypt – amounting to substantial total gains in water savings and improved farmer incomes.

The Egypt and ICARDA partnership is further capitalizing on the numerous successes achieved to date by scaling them out to other countries for greater benefits across the region.

ICARDA's research programs in Egypt have trained 22 MS and PhD students

ICARDA works closely with several key partners in Egypt, including:
Agricultural Research Center (ARC), Ministry of Agriculture and Land Reclamation; National Water Research Center (NWRC), Ministry of Water Resources and Irrigation; Ministry of Scientific Research and Technology; Numerous educational and research institutions and colleges of agriculture of several universities; Water users associations; Farmers groups and farmer associations; Government level rural development institutions; Development projects funded by international donors; Private sector.