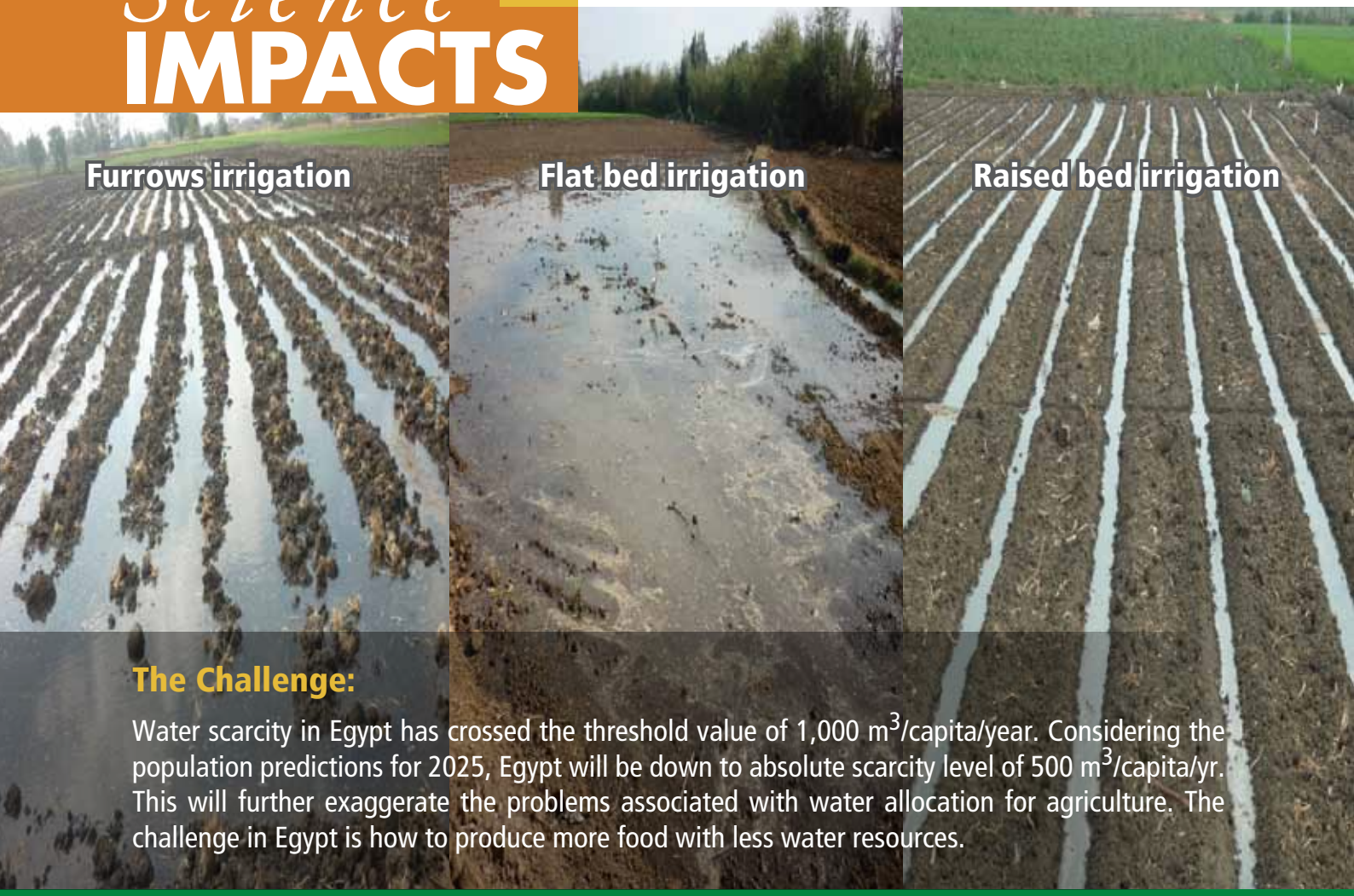
Science IMPACTS



The Challenge:

Water scarcity in Egypt has crossed the threshold value of 1,000 m^3/capita/year. Considering the population predictions for 2025, Egypt will be down to absolute scarcity level of 500 m^3/capita/yr. This will further exaggerate the problems associated with water allocation for agriculture. The challenge in Egypt is how to produce more food with less water resources.

Raised-bed planting in Egypt: an affordable technology to rationalize water use and enhance water productivity

Research on water management to achieve higher productivity in irrigated agriculture has identified raised-bed systems as an important component of improved wheat production package. Through this farmers in Egypt have successfully achieved higher yields while ensuring savings in irrigation water. This technology was disseminated for sustainable agricultural intensification on a large scale in 22 governorates, as part of a nation-wide campaign by the Egyptian Government on self-sufficiency in wheat production.

Effects of climate change are evident in Egypt, like loss of agricultural land, temperature rise and growing water scarcity. According to a 2013 report by the United Nations Development Programme (UNDP) in association with the Egyptian Government and various other UN agencies, agricultural production could decrease by 8-47% by 2060, with employment losses of up to 39%.

Issue: 6-FEB 2016

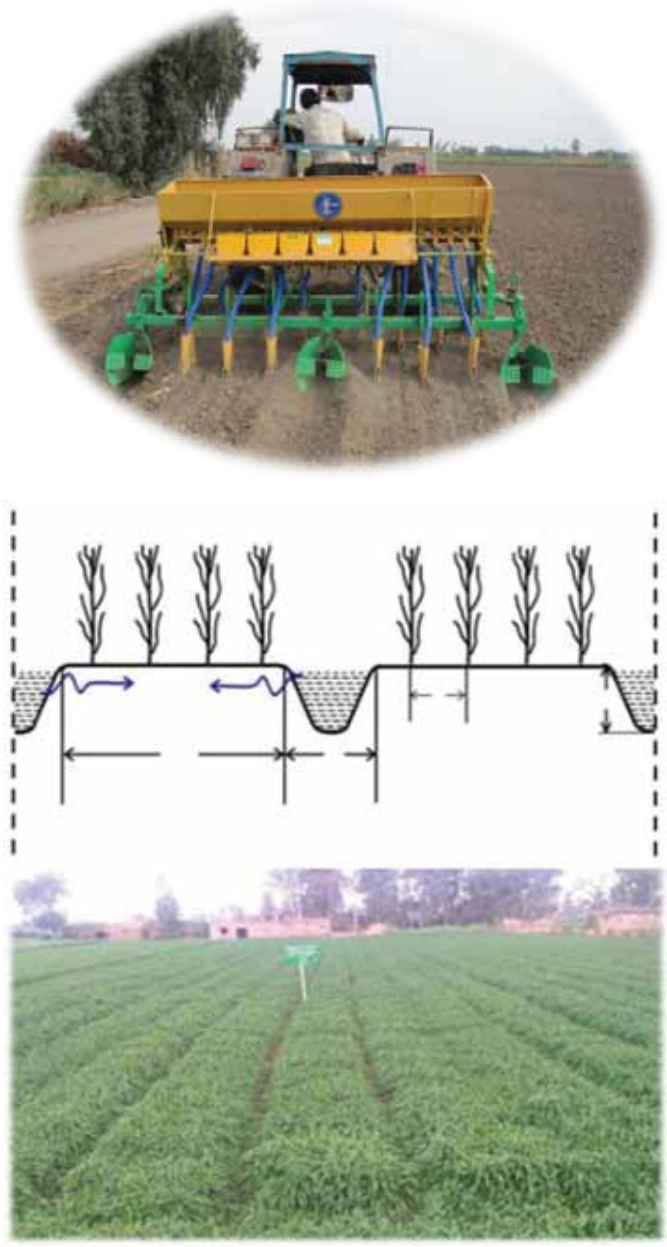
Research programs to ensure water savings

To optimize the management of scarce water resources, together with community participation, a project on 'Options for coping with increased water scarcity in agriculture in WANA' developed and tested water management options that increase water productivity, optimize water use and are economically viable, socially acceptable and environmentally sound. It was funded by International Fund for Agricultural Development (IFAD), Arab Fund for Economic and Social Development (AFESD), and OPEC Fund for International Development (OFID) and managed by ICARDA.

An irrigated Benchmark site was selected in Egypt (in El-Makata Old Lands, El-Bustan New Lands and El-Serw Marginal lands). With the farmers' participation, farm surveys and analyses were conducted to assess the actual water productivity for multi-cropping systems. Sources of inefficiency in water use were also determined. Field trials were conducted at selected locations and farmers' fields to generate data required for modeling water productivity and sustainability of improved water management.

Research was carried out to test new irrigation systems like raised-bed planting and deficit irrigation on the main crops in different environments. This research took into consideration several parameters including crop water requirement, irrigation frequency, crop/soil/water relationships and crop productivity. On comparing the results to conventional farming techniques, it was found that under deficit irrigation (20% and 30% of full irrigation) water use could be reduced while increasing the agricultural production, water productivity and farmers' income. Saving 20% of water used in irrigation could generate a net benefit of about 80 million USD/year for the national economy.

Encouraged by the water saving performance of raised-bed system in Egypt, as displayed in the first phase of this project (2004-2006), the technology was further tested and fine-tuned as part of an IFAD funded project titled 'Improving the Livelihoods of Rural Communities in the Dry Areas: Sustainable Crop and Livestock Management', from 2010- 2013, under the Nile Valley and Sub-Saharan Africa Regional Program. Technical, institutional, and policy options were identified, adapted and evaluated for integrated crop and livestock management for sustainable increases in productivity and rural incomes and reduced vulnerability to climate change.



An affordable multi-crop raised-bed machine for small-medium sized farms

Mechanized raised-bed technique (left) as compared to furrow (right)

In collaboration with partners from Agricultural Research Center (ARC), National Water Research Center (NWRC), and Zagazig University, scientists from ICARDA conducted research on modifying the local grain drills and developed an affordable multi-crop raised-bed machine for small to medium sized farms. The modified local grain drill was used to establish broad bed furrows with appropriate width and height while simultaneously planting seeds on those beds. Through this research a prototype was developed and made available to the private sector. This has generated avenues of public-private partnership for the local manufacturing of raised-bed machines at affordable prices. The intervention at the Egypt site evaluated mechanization of raised-bed irrigation technology. A crop production package was introduced comprising early maturing varieties, efficient water use cultivars with intercropping systems (where applicable), crop health and fertilization regime, and improved management practices. It also included agronomy and on-farm efficient water management options.

Promising results and wide-scale dissemination

Results indicated applied water saving of about 1,300 m^3/hectare and farmers income increased by more than 10%. Water productivity potential went up to 1.5 kg wheat/m^3 from 1.0 kg/m^3. Through the promotion and adoption of this tested technology, water saving in Egypt for only wheat cultivation could reach more than 1.5 billion m^3/year. With farmers' adoption of such intervention at a large scale, for winter and summer crop rotation, at least 6 billion m^3 of applied water could be saved in the county's water system.

A multi-partner project on 'Enhancing Food Security in Arab Countries', funded by AFESD, the Kuwait Fund for Arab Economic Development (KFAED), the Islamic Development Bank (IsDB) and OFID, further helped in disseminating this technology to farmers in Al-Sharkia province. The use of raised-bed techniques in farmers' fields resulted in 25% saving in irrigation water, 30% increase in wheat yield and 74% improvement in water use efficiency (average of four years 2011-2014).

The joy of achieving higher yield using lesser water in raised-bed system

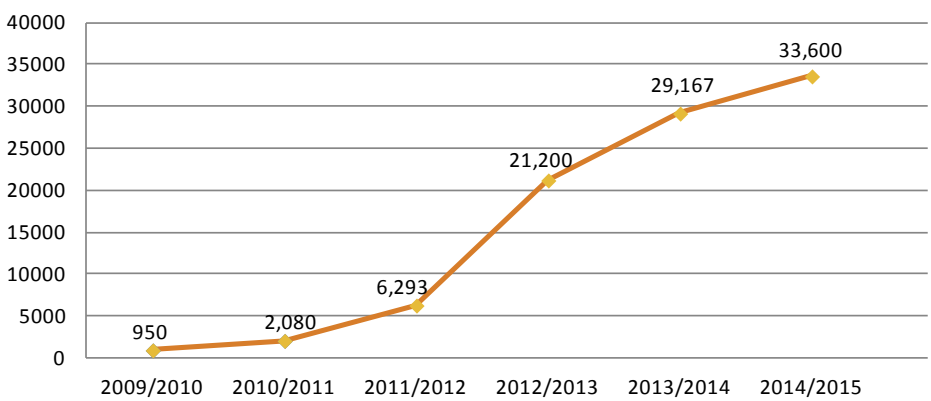
Advantages of raised-bed planting:

(Based on the average of 2011, 2012, 2013 and 2014, in Egypt)

- 30% increase in grain yield
- 25% saving in irrigation water
- 74% increase in Water Use Efficiency

In Al-Sharkia governorate, the area of raised-bed sown wheat has increased 35 times, from 950 ha in 2009/2010 to 33,600 ha in 2014/2015. In addition there was an increase in the use of certified seeds of new improved varieties. Al-Sharkia governorate's total amount of wheat delivered to the Ministry of Supply went up from 557,030 tonnes in 2009-2010 to 880,941 tonnes in 2013-2014, an increase of about 58%. Adjusted for the wheat acreage in both seasons, the additional amount of wheat produced was estimated to be 261,000 tonnes and has a calculated value of 52.2 million USD. In a country where 50% of its wheat demand was earlier met by imports, wheat production increased by 1.1 million MT.

The area of raised bed sown wheat (in ha) in Al-Sharkia governorate



A nation-wide Wheat National Campaign (WNC) was launched by the Egypt government in 2011-2012, supported with a government funding of 1.7 million USD. Mass dissemination approach was adopted and 1,900 demonstration fields of raised-bed system were implemented in 22 governorates of Egypt based on the same approach used in Al-Sharkia site.

A nation-wide Wheat National Campaign (WNC) launched by the Egypt government helped in the mass dissemination of raised-bed system

At the national level, in 2015 season, in all wheat governorates the total wheat area under raised-bed was 105,000 ha. Building on the promising results of improved raised-bed technology, farmers in Egypt have now found ways of sustainable water management to better adapt to climate change challenges. Their production yield and incomes have also increased in the process. The raised bed technology is being tested in farmers' fields in other countries of the region such as Morocco and Tunisia.

وزارة الزراعة واستصلاح الأراضي
Ministry of Agriculture and Land Reclamation
ARC
مركز البحوث الزراعية
Agricultural Research Center

ICARDA
Science for Better Livelihoods in Dry Areas

IFAD
Investing in rural people

ARAB FUND FOR ECONOMIC & SOCIAL DEVELOPMENT

Kuwait Fund
For Arab Economic Development

OFID
THE OPEC FUND FOR INTERNATIONAL DEVELOPMENT

USAID
FROM THE AMERICAN PEOPLE

CGIAR
RESEARCH PROGRAM ON
Dryland Systems

Contact Person: Dr. Atef Swelam, A.Swelam@cgiar.org **For publications,** Visit www.icarda.org or www.icarda.org/publications-resources