



ICARDA

Science for Better Livelihoods in Dry Areas

International Center
for Agricultural Research
in the Dry Areas

Annual Report 2013

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Message from Director General and the Board Chair

2013 has been a fruitful year for ICARDA marked by research accomplishments and a sense of gratitude. Our longstanding partner countries provided important support in making decentralization of the Center's research a reality. This transition positions our research programs to more expressly target agroecosystem-based solutions, needed for wider impacts.

The effects of climate change are already being felt in the fragile agroecosystems of the drylands, as challenges are increasing for millions of smallholder farmers dependent on them. Scalable solutions are urgently needed to enable a sustainable food-secure future. The decentralization of ICARDA's research and capacity development from Tel Hadya, Syria, during 2013 perhaps comes timely. New research sites have been strategically established in Morocco, Ethiopia, Sudan, Egypt, Turkey/Central Asia and India to allow the Center's scientists to contribute more adequately to 10 CGIAR Research Programs, particularly the Dryland Systems program that ICARDA leads. The new setup is also powering up our approach of developing integrated solutions targeted to specific agroecosystems and their livelihood needs, through partnerships with the National Agricultural Research Systems (NARS) and other research institutions.

Our ties with NARS were further strengthened this year as host countries opened their doors, shared their research facilities and most of all, joined hands with the Center in our newly aligned research programs for the larger good.

We are also pleased to share the scaling out of some important research outcomes and their impacts in 2013. For example, the innovative adaptation of raised bed machines to small-scale farming – developed with farmers and private sector in Sharkia province in Egypt – delivers a 24% saving in irrigation water and is now being scaled out to other provinces and countries, such as Sudan, Ethiopia, Eritrea, Nigeria, Iraq, and Morocco.

In another significant progress in Africa, funded by the African Development Bank, heat-tolerant wheat varieties, developed in partnership with Sudan over many years, are beginning to enhance incomes and food security in Ethiopia's lowlands and in Nigeria, where yields are more than doubling. The results are encouraging Nigerian policy-makers to rethink their national strategy and reduce reliance on imports.



Camilla Toulmin, Chair, Board of Trustees
Mahmoud Solh, Director General (right)

For conservation agriculture, converting conventional seeders to 'zero till' machines with local private manufacturers is proving catalytic for the uptake of the sustainable practice in multiple countries – including Iraq, Jordan, Morocco. The innovation slashed the cost of seeders, making them far more affordable for smallholders in low-income countries.

The HSAD-Iraq program, funded by USAID, delivered on its promise of strengthening the country's agriculture sector in a short time through a range of strategic interventions like strengthening the key commodity value chain of date palms, improving certified wheat seed production, and guiding the reform of seed regulations for a robust seed system.

Also, the Dryland Systems program came into full swing in 2013, ready for collective learning, testing and delivery of systems solutions. The program launched 15 Innovation Platforms across the drylands, stretching from the West Africa Sahel to Central and South Asia. Multidisciplinary teams of researchers, policy makers, academia, NGOs and the private sector were mobilized for each platform and are now moving forward to find integrated solutions for drylands in this one-of-a-kind global challenge.

In sum, we are more energized and better positioned than ever before to bring larger impacts for smallholder communities in drylands.

Camilla Toulmin, Chair, Board of Trustees

Mahmoud Solh, Director General



Contents

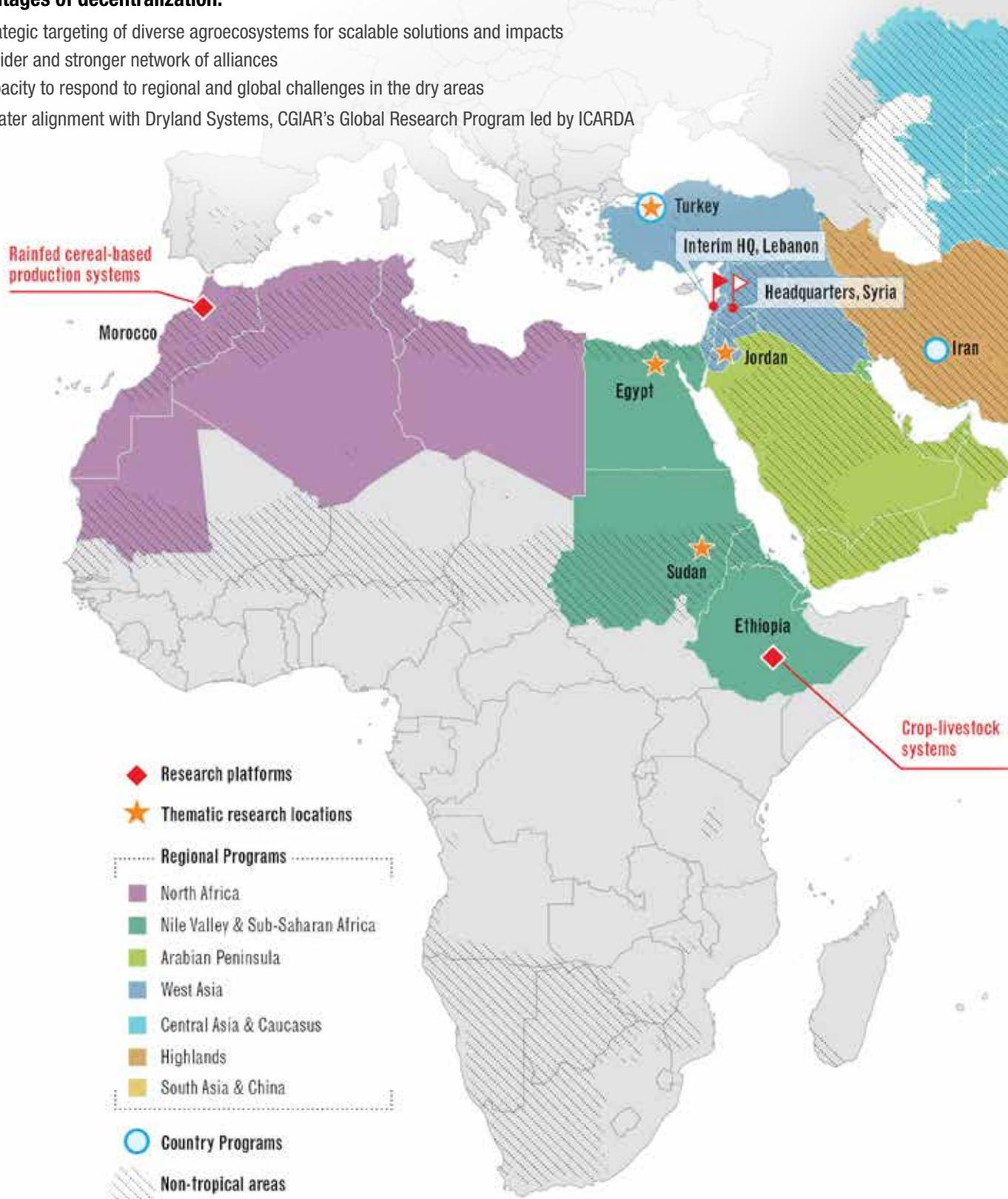
ICARDA's Decentralized Research & Capacity Development	6
Dryland Systems: Progressing to Innovation Platforms	9
Science Solutions and Impacts for Smallholder Farmers.....	11
Unleashing triple benefits of legumes for smallholders: nutrition, soil fertility, and extra incomes	12
Rebuilding agriculture and communities in post-conflict countries – from the soil up	14
Raising incomes and empowering rural women through enhanced indigenous practices.....	16
Improving wheat value chains in Africa to reduce poverty and strengthen food security.....	18
Adapting smallholder production systems to climate change in dry areas.....	20
Increasing water productivity in water-scarce areas	22
Guiding policy and practices for sustainable production systems	24
Call to Action for Policy-Makers: Strengthening Policies for Greater Water and Food Security in Dry Areas.....	26
Spotlight on Innovations for Smallholder Farming	27
Working with Countries: Building a Food-Secure Future Together	29
Highlights from regional and country partnerships	31
Capacity development.....	36
ICARDA's Research Programs	39
Audited Financial Summary.....	40
Honors and Awards in 2013	42
Board of Trustees.....	43
Donors and Investors	44
Donors by Regional & Country Programs.....	45
Appendix 1: ICARDA Genebank's Global Services and Achievements	47
Appendix 2: Scientific Publications	49
Appendix 3: Senior Staff at ICARDA.....	59
Acronyms and Abbreviations	64

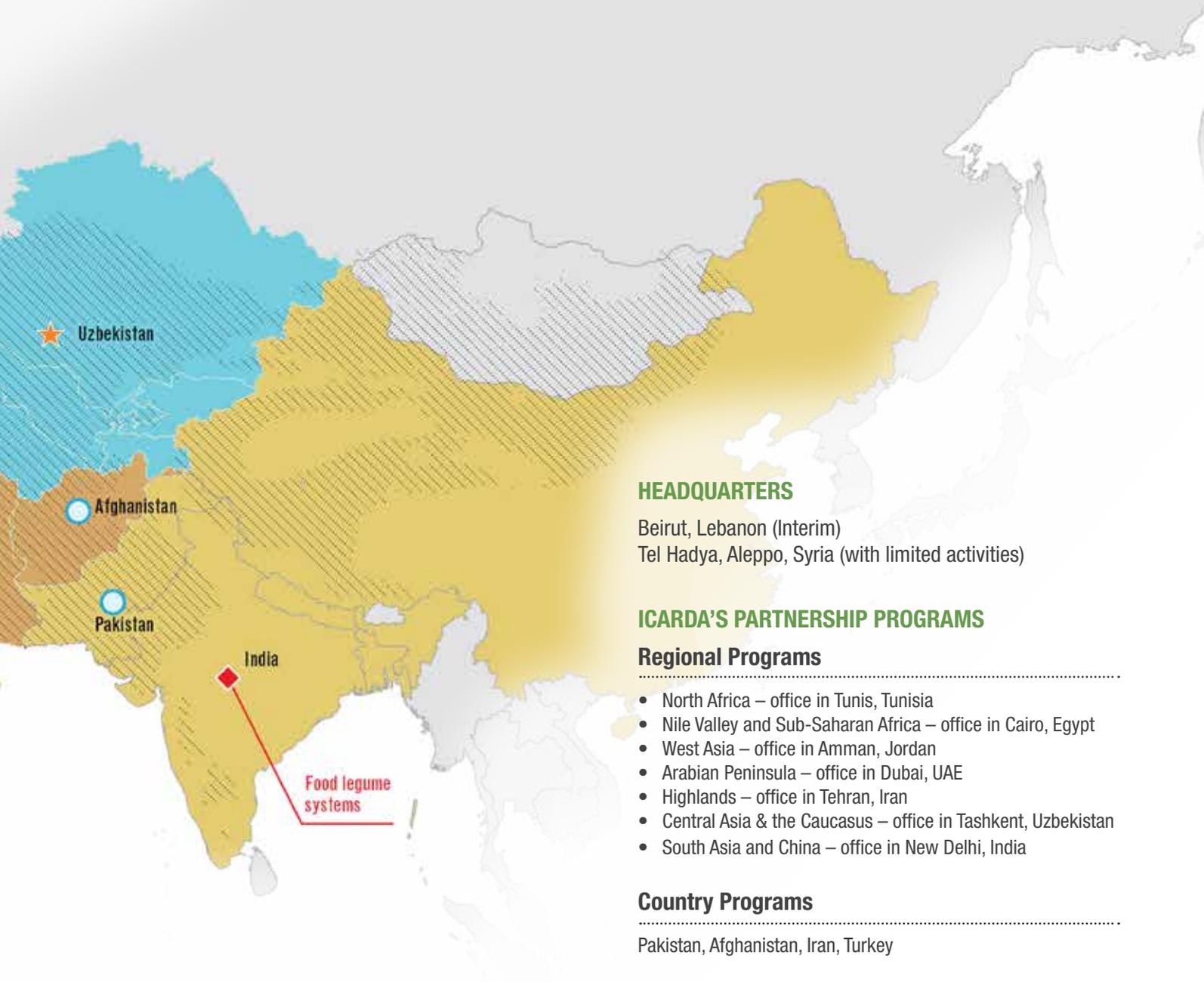
ICARDA's Decentralized Research & Capacity Development

ICARDA's decentralization has positioned the center to more aggressively and effectively advance its mission of improving the livelihoods in dry areas through science.

Advantages of decentralization:

- Strategic targeting of diverse agroecosystems for scalable solutions and impacts
- A wider and stronger network of alliances
- Capacity to respond to regional and global challenges in the dry areas
- Greater alignment with Dryland Systems, CGIAR's Global Research Program led by ICARDA





RESEARCH FOR DEVELOPMENT INITIATIVES

Integrated Research Platforms



Rainfed cereal-based production systems

Platform based in Morocco



Food legume systems

Platform based in India



Crop-livestock systems

Platform based in Ethiopia

Thematic Research Locations

- **Egypt** – High input irrigated systems
- **Turkey** – Winter wheat, winter barley, and cereal rust diseases
- **Jordan** – Building resilience in marginal lands
- **Sudan** – Heat-tolerant cereal and food legume varieties
- **Uzbekistan** – Cold agroecosystems



Dryland systems of Amhara region in Ethiopia

Dryland Systems

Progressing to Innovation Platforms



The global research partnership to improve agricultural productivity & income in the world's dry areas

Smallholder farmers, accounting for the majority of the food producers in drylands in the developing world, struggle with a daunting range of challenges – from land degradation, water scarcity and frequent droughts to weak governance, poor access to markets, and limited access to new innovations and technologies. The resulting severely low productivity is perpetuating a cycle of deep poverty in drylands, where one-third of the population depends on agriculture for their livelihoods.

The CGIAR Global Research Program on Dryland Systems is the first-ever international research program to bring a 'systems approach' to address these inter-related challenges. The Program is combining diverse research disciplines, such as crop genetic improvement, agronomic practices, natural resources management and socio-economics, to test and deliver technology packages to improve the livelihoods of family farmers in dry areas. The Program is targeting five 'flagship' regions: West African Sahel and Dry Savannas; East and Southern Africa; North Africa and West Asia; South Asia; and Central Asia and Caucasus, and has set up 'action sites' within these regions for program implementation.

In 2013, Dryland Systems made significant headway, progressing from its launch in May, after an intensive inception phase in 2012, to its implementation through successful establishment of innovation platforms across all five target regions – a singularly challenging task given the complexity of systems research and its demands on forming coalitions across different science disciplines and stakeholder communities.

Program Launch

The Program was launched at a three-day meeting in May in Amman, Jordan, that brought together some 200 participants from all five target regions. Participants included national agricultural research systems (NARS), scientists, policy-makers and development organizations (NGOs) from 40 countries. The meeting provided a stimulating forum for exchange amongst the many partners and identified themes for synergies between regional priorities and a series of global research themes and cross-cutting issues.

Program Implementation: Setting up 15 Innovation Platforms

The latter half of the year saw the establishment of a total of 15 Innovation Platforms (IP) across the five target regions using a participatory and structured process at a series of regionally organized implementation workshops. Attended by participants well-versed in the challenges of different action sites and informed by prior evidence gained through intensive assessments, analyses, and characterizations, these meetings marked the initiation of the Program's research agenda. The IPs are linked to existing research action sites and bring together a broad group of stakeholders – communities, NARS, NGOs, decision-makers, scientists, and the private sector – to form 'systems' partnerships.

Led by:



Partners:



DRYLAND SYSTEMS LAUNCHES 15 INNOVATION PLATFORMS

- Two innovation platforms in the West African Sahel and Dry Savannas, located in Mali and Ghana, with targets that include wheat and vegetable production
- Five in North Africa and West Asia, with sites in Morocco, Tunisia, Egypt, Jordan-Syria, and Iran, with a broad agenda including small ruminants, cereal and food legume production, and water-saving technologies
- Four in East and Southern Africa targeting cattle, goat, maize and groundnut production
- Three in Central Asia, where targets include better water use; improved drought, heat and salinity tolerance for crops; and salinity management
- One in South Asia, with three cluster sites in India, focusing on the promotion of effective 'scaling-up' models for improved technologies, and targeting women and youth through micro-enterprises

The Program was put on full implementation track, starting with the ground-work of a wide range of assessments, benchmarking exercises, detailed research site and agenda scoping, and planning with partners. Further, key processes and policies were put in place to guide the progress of the program, including business plans, regional research priorities, gender strategy, and communication action plan, while capacity building activities were ramped up to meet the new demands. Finally, targeted regions started testing practices and interventions for improving productivity, building systems stability, diversifying livelihoods for resilience, and enhancing value chains.

The following achievements were notable for the early stages of the Program's implementation:

- In the **West African Sahel and Dry Savannas**, training sessions targeted the strengthening of seed production capacity and enhanced knowledge on the operation of IPs; community-level dialogues were initiated to facilitate participatory research planning; and improved baseline data was developed, so national partners have the information they need to target interventions effectively.
- In **North Africa and West Asia**, conservation agriculture has been adopted by over 5000 farmers and expanded to cover almost 40,000 ha; the promotion of medicinal plants is creating economic opportunities for women in Jordan; and a community-driven approach is enabling conservation of dryland agro-biodiversity in Palestine, Tunisia, and Yemen. Further, participatory improvement of landraces and seed preparation is making possible yield gains of more than 30% over the original crop populations.
- In **East and Southern Africa**, community assessments were conducted to identify barriers to the adoption of new technologies in Mozambique and Zambia, while policy-pastoralist dialogue in East Africa facilitated constructive negotiations over the future use of rangelands. Efforts have been also made in Zimbabwe to tailor resilience options for vulnerable households in mixed crop-livestock production systems.
- In **Central Asia and the Caucasus**, several varieties of vegetable legumes were evaluated and identified, and 1350 kg of soybean and mung bean seeds were multiplied to promote farmer-to-farmer seed exchange of improved material. A project focused on women is linking rural communities with world markets for high-value wool and yarn products, increasing income for a number of households and demonstrating a replicable business model.
- In **South Asia**, a proof of concept was produced with the government of Karnataka to evaluate research impacts; integrated technologies were introduced on 7 million hectares; and over 10,000 farmers participated in activities promoting improved land management practices.

Prioritizing Women and Youth

Dryland Systems escalated the focus on gender and youth by allocating them as standalone development objectives rather than cross-cutting themes in research. A gender strategy is already directing extensive capacity building and outreach across the action sites to scale out the use of gender analysis, as well as gender-responsive and gender-transformative interventions, while our youth strategy has begun to take shape for 2014, with a partnership with YPARD* as one component of it.

* YPARD: Young Professional's Platform for Agricultural Research for Development (Food and Agriculture Organization)

Science Solutions and Impacts for Smallholder Farmers



1

UNLEASHING TRIPLE BENEFITS OF LEGUMES FOR SMALLHOLDERS: NUTRITION, SOIL FERTILITY, AND EXTRA INCOMES

ICARDA continued to work with national partners to promote legumes and deliver their triple benefits particularly needed in the developing countries: nutrition, fertile soils and greater farm incomes. Multiple projects across Asia and Africa have been leveraging crop rotations, improved legume varieties, and innovative practices to meet growing food requirements in the face of climate change.

Combating malnourishment in India, Bangladesh, and Nepal

South Asia is the largest producer and consumer of lentils, a high protein food. Yet in this region, undernourishment is rife, particularly among women and children. Lentils have the potential to fight malnourishment, but progress is severely constrained by low yields and poor cultivation practices common on smallholder farms that produce most crops.

To counter dietary deficiencies, the initiative developed and promoted lentil varieties with a high content of iron and zinc. More than 1700 accessions of lentil germplasm, breeding lines, cultivars already released, and wild relatives were analyzed for their micronutrient content. The iron content was found to vary hugely from 43 to 132 parts per million (ppm) and the zinc content from 22 to 96 ppm. Select lentils with the highest levels of iron and zinc were made available to national

programs in Bangladesh, India, and Nepal, which then ‘fast-tracked’ the release of these varieties to farmers.

In Bangladesh, the government launched a massive program to disseminate three ‘Barimasur’ lentil varieties with around 86 ppm iron and 59 to 63 ppm zinc. Production of these varieties has now spread to over 72,000 hectares yielding around 93,000 tonnes per year. In Nepal, farmers in the Terai are changing to varieties with 94 to 98 ppm iron and 58 to 64 ppm zinc. In the north-east plains and central India, farmers are growing ‘Pusa Vaibhav’, a variety containing 102 ppm iron. Overall, the project reached an estimated total of 680 farmers with micronutrient-rich lentils, improving nutrition for more than 5500 people.

Funded by CGIAR Research Program on Agriculture for Nutrition and Health

Ensuring nutrition and food security in the face of climate change in West Asia and North Africa

Food security in North Africa and West Asia, a region of rapid population growth, relies mainly on cereals and food legumes produced by smallholder farmers. Yields are, however, far below their potential and face further risk as climate change affects the region.

This initiative is working to bring new high-yielding, disease-resistant, and stress-tolerant varieties for



Impacts of wheat–legume cropping systems in North Africa & West Asia in 2013

- Egypt revives its leading world-class status in improved faba bean production
- An estimated 3600 farmers and extension workers received improved technology packages
- More than 10,000 farmers and extension workers expected to benefit in 2014

both wheat and legumes to eight countries in the region. In 2013, the project encouraged the adoption of around 50 recently released food legume varieties through on-farm demonstrations and extensive capacity building activities. Farmer field schools and field days reached 3600 farmers and extension workers, while nearly 100 young scientists, engineers, and technicians – more than half of whom were



LOW-TOXIN, HIGH YIELDING GRASS PEA

Helping India's poorest farmers survive droughts

When all other crops fail, grass pea often saves farming communities from starvation. However, when consumed in significant amounts, as during a famine, grass pea can transfer toxic amounts of neurotoxins, causing permanent paralysis in adults and brain damage in children.

ICARDA and Indian plant breeders developed new strains of grass pea that are tolerant to drought and water-logging but are safe to eat.

The pilot project:

- Provided technologies with low-toxin grass pea varieties to 1982 farmers in 237 villages
- Raised yields by up to 85%
- Trained 3500 farmers in production technologies
- Ran awareness campaigns to teach 600 women how to detoxify grass pea before cooking

Participating scientists from national agricultural research institutions are carrying forward this work to firmly establish lentil as a 'rabi' crop (grown in winter and harvested in spring).

Funded by National Food Security Mission, Government of India

New lentil varieties nearly double yields and incomes in on-farm trials in India. Growing lentils in rice fallows is also making soils healthier and lowering production costs from reduced need for chemical fertilizers.

women – were trained in Lebanon, Egypt, Algeria, Jordan, Tunisia, and Turkey through short-term courses.

Innovating for maximum benefits

The initiative tested combining new varieties with sustainable practices – such as integrated pest management, supplemental irrigation, and conservation agriculture – which yielded amplified benefits. For example, in demonstrations of zero tillage, improved chickpea in Jordan yielded 24% more and improved lentil in Morocco yielded 25% more than under conventional tillage. Similarly, lentil in Morocco produced 25% more under zero tillage. And in Tunisia, supplemental irrigation increased yields by 24% for faba bean, 29% for lentil, 33% for durum wheat, 41% for chickpea, and 47% for bread wheat.

Funded by EU-IFAD

Creating extra income from rice fallows, while replenishing soils

In India, after the 'kharif', or rainy season rice crop, farmers often leave the land fallow. ICARDA partnered

with local teams to conduct participatory rural appraisals, encouraging farmers in Assam, Bihar, Uttar Pradesh, and West Bengal to intensify production by growing improved lentil in rice fallows.

Demonstrations showed farmers how to treat seed with rhizobium and fungicides, the appropriate rates for sowing seed, and how much and when to apply fertilizer, insecticides, and pesticides. The project raised awareness of the advantages of growing lentil in rice fallows through trainings, farmers' fairs, field days, and field schools. More than 7600 farmers, including more than 550 women, took part in the training, which demonstrated and encouraged the uptake of these technologies.

In tandem with the rice fallows initiative, community-based seed hubs have started to deal with the problem of scarcity in quality seed. Between 2010 and 2013, 32 hubs began producing quality seed from improved lentil. Farmers are becoming self-sufficient in seed and are able to sell any surplus to other farmers, thus spreading benefits to more households.

2

REBUILDING AGRICULTURE AND COMMUNITIES IN POST-CONFLICT COUNTRIES – FROM THE SOIL UP

Focusing on the development of agriculture sector in countries like Afghanistan, Iraq and Palestine where poverty and food insecurity are aggravated by instability can bring unique value to the region and beyond borders. Smallholder farmers in these countries suffer from poor land productivity, frequent spells of drought and outdated technologies and practices. ICARDA continued to work with the farmers and agricultural institutions to improve rural incomes, build national capacities and develop essential infrastructure.

Developing and promoting sustainable livelihoods in Afghan villages

A longstanding partnership with the Afghan Ministry of Agriculture, Irrigation and Livestock, the Agriculture Research Institute of Afghanistan, along with development partners, continued to bring a range of technologies and skills to farmers and rural women, changing lives and bringing new hope in communities.

ICARDA's country program developed two watershed management sites. One of these, in Mazar Province, serves as a learning and demonstration platform for community-based watershed management. The program also introduced solar-powered water pumps to irrigate plantations at the watershed sites – a sustainable solution for villages where electricity is often not available.

Another important addition has been diversified tree plantation to provide forage and medicinal shrubs – an approach that is not only helping the environment but also enabling a new



A new value chain of herbal remedy products is creating incomes for rural women in Afghanistan

market for herbal remedy products. A small-scale commercial unit for processing medicinal plants like mint, cumin, and fennel trains village women on adding value, and packaging and marketing of herbal oils and medicinal products. These and other activities are creating employment opportunities and generating incomes for more than 400 women.

Crop selection has been another key activity with farmers directly involved in identifying crop varieties most suitable for use in their region. In 2013, this collaborative research resulted in the release of five high-yielding wheat varieties, as well as two barley and two chickpea improved varieties. These new varieties have shown a 10 to 30% higher yield potential over existing average yields in farmers' fields. To maximize their benefits, the initiative has been promoting the varieties through field days, technical bulletins, radio programs in local languages, and more than 100 village-based seed enterprises.

Funded by the Afghanistan Ministry of Agriculture, Irrigation and Livestock; ACIAR; IFAD

Increasing rural incomes and strengthening food security in Palestine

In Palestine, access to technological know-how and agricultural inputs has been hard to come by for its 100,000 or so farmers. A three-year initiative delivered better performing rainfed crops and more efficient seed production systems, paving a path for continued sustainable development and benefits for farmers in Gaza and West Bank, even as the project approached its end in 2013.

An important milestone has been starting the country's seed conservation program in mentoring partnership with local scientists and establishing a genetic resources unit in the West Bank. Conducting 30 first-ever collection missions in the country, ICARDA guided collection, documentation, and conservation of around 1000 seed and plant samples of wild wheat, barley, chickpea, and lentil. Further, involving farmers, the research team improved 14 local landraces, increasing their wheat yields by 35%. The initiative also introduced improved germplasm from ICARDA's labs, resulting in yield gains of 29% for wheat and

26% for barley compared to farmers' cultivars. To make these improved cultivars accessible to farmers, four farmer-based seed producer groups were initiated, which managed to produce 89 tonnes of high-quality seed that attracted a premium in local markets.

In Gaza, around 80 farming households gained skills in high-performance innovations for protected agriculture. These included making compost, hydroponics (growing without soil), grafting melon plants onto disease-resistant rootstocks, and using tensiometers for water efficiency, a technique that demonstrated a 33% saving in irrigation water. Farmers also learnt new technologies for recycling wastewater to use in greenhouses. The use of treated wastewater and grey water in crop management techniques, such as drip irrigation, continued to expand, backed by safe-use protocol developed by ICARDA.

Funded by the Government of the Netherlands

Making Iraq's agriculture sector more competitive

ICARDA's Harmonized Support for Agricultural Development (HSAD), initiated in 2012, worked closely with the Iraqi Ministry of Agriculture and Kurdish Ministry of Agriculture and Water Resources to strengthen their agriculture sectors through a range of strategic interventions:

- **A pioneering tool to inform food policy-making:** In partnership with CGIAR's International Food Policy Research Institute, ICARDA scientists developed an interactive geo-spatial tool, Iraqi Spatial, a one-stop online resource for climatic, biophysi-

cal, demographic, governmental, and socioeconomic data to inform policies on food security and nutrition.

- **Modernized national seed systems and extension services:** Building capacity for the fast-track release and multiplication of improved seed varieties led to production of around 5,678 tonnes of certified commercial wheat seed from five improved wheat varieties, with another 7500 tonnes on track for 2014. The Ministry staff were trained on seed production and certification, and seed labs were upgraded. Guiding seed policy reforms is further ensuring a robust national seed program.
- **A strengthened date palm value chain:** In a bid to revive the Iraqi date palm heritage, HSAD team introduced and trained farmers on Integrated Pest Management techniques to enable organic and high quality dates. Capacity was also built in micro-propagation protocol for tissue culture as per international standards so farmers can obtain large numbers of seedlings in a short time and boost productivity.
- **Conservation agriculture:** Working in partnership with the Australian Center for International Agricultural Research and Iraqi researchers, the locally devised low-cost zero tillage seeders and extensive training is rapidly promoting the adoption of conservation agriculture. About 10% of cereal production area in Kurdistan region of Iraq is targeted for conversion by 2017 – estimated to increase farmer incomes by ~US \$8.8 million per year.

Funded by USAID; ACIAR

ICARDA'S POST-CONFLICT COUNTRY PROGRAMS

Toward greater food security and stability

The following outcomes highlight rewarding progress in the countries:

Afghanistan

- New employment opportunities and progress for more than 1900 rural women from activities such as goat keeping and selling medicinal products
- Improved national capacity for higher productivity as 1600 farmers, extension workers and researchers (1058 of them women) learned about cereal and food legume production, watershed management, solar energy, and nursery raising

Palestine

Proven innovation packages ready to sustainably increase incomes for the rural poor, such as:

- Improved wheat seed, reaping US \$750/tonne compared to US \$500/tonne from traditional varieties
- Treated grey/wastewater for irrigation, adding US \$200-600 per season to household incomes
- Protected agriculture techniques, raising farmers' incomes by US \$800-1200

Iraq

- Opening of the Conservation Agriculture Research Center at the University of Mosul in 2013, a promising development for sustainable agricultural development in the country

3

RAISING INCOMES AND EMPOWERING RURAL WOMEN THROUGH ENHANCED INDIGENOUS PRACTICES

Gender impacts were high on ICARDA's priority in 2013 through several initiatives. The initiatives highlighted here leveraged traditional practices to substantially increase the income of rural women. They also empowered women in their communities in an approach that is sustainable and replicable.

Adapting traditional felt craft in Kyrgyzstan for world markets

Women living in the harsh environment of the Naryn region in Kyrgyzstan are known for their felting tradition, producing felt rugs and carpets called 'shyrdaks.' The products enjoy relatively strong local demand but reap little income as domestic markets are limited. Instead, villagers rely mostly on the production of livestock (sheep, goats, horses, and cattle) for their livelihoods. But, with long and severe winters, Naryn suffers from high levels of poverty and unemployment.

A team of scientists and socioeconomic specialists worked with 70 women artisans from five pilot villages in the Naryn region to develop a value chain for a new range of felt products appealing for international markets, including pillows, chair mats, scarves, and slippers. The project successfully expanded regional markets, test-marketed new products in the US and established access to markets in Belgium, Germany, Hungary and the Netherlands.

Based on value-chain assessment, the project focused on improving the quality of raw materials for higher-



Sales of felt products from Kyrgyzstan at the Budapest Festival of Folk Arts, 17–20 August, 2013

	Quantity sold	Average price, US\$	Amount
Scarves	50 pieces	29.0	1466
Slippers	47 pairs	20.0	924
Chair mats	10 pieces	13.2	131
Shyrdaks	5 pieces	185.0	924
Other			255
Total			3700

value end products, mechanizing felting for efficiency, training women groups on wool processing, collaborating with professional designers on developing an assortment of new products, and creating institutional and market support for the women's ventures. These strategies provided sustainable agribusiness advantages, and positioned the project for replication beyond the pilot villages.

The total income from felt products over a four year period was just under US\$50,000; almost half of this came from newly introduced

items. Shyrdaks and stitched 'alakiyiz' slippers provided on average around 40% of the earnings from sheep wool products, while seamless felt slippers had the most marketing potential in both regional and international markets. Being labor intensive, seamless slippers provided incomes for men as well as women.

After nine months in 2013, the total income of women participating in the ICARDA project had already exceeded that for the whole of 2012. These women also gained considerable recognition for their new skills,

which has boosted their confidence and status. For example, one woman won the UNESCO Award of Excellence for Handicraft Products and an opportunity from the World Crafts Council to present her products at an international craft fair in Kuwait. Some others showcased products at the UNESCO boutique during the prestigious Santa Fe International Folk Art Market. More significantly, women in Naryn are now eager to invest their own money in such events; they realize that craft fairs are important for the development of their handicraft business and preserving their felting tradition.

Funded by IFAD

Enhancing the value chain for small-scale milk processing in Jordan

In Jordanian villages, small scale milk processing generates an important part of household incomes. For centuries, women have made products from processed sheep and goat milk, such as 'jameed' (traditional 'rock' cheese), yogurt, and ghee.



Innovations in dairy processing increase profitability for rural women in Jordan.

A partnership with Jordan's National Center for Agricultural Research and Extension (NCARE) helped improve the marketability and profits from jameed in the El Karak region. Jameed from Karak is highly reputed all over the country and was identified as offering the biggest income potential among dairy products through 'rapid rural assessments' of four communities.

The scientists improved the jameed value chain by enhancing processing technologies, establishing standards for quality, and identifying institutional options for direct market access. The project identified the most desirable product attributes in jameed (e.g. color, smell, and packaging) using price-quality relationships, and developed targeted interventions.

Innovations in jameed processing, such as introducing fat separators and more efficient churners, created a greater quantity of cream (byproduct) that allows for a higher quality 'ghee', saved labor, and reduced water and energy consumption. The project trained a total of 33 women and 17 NCARE staff on these modified methods and marketing strategies. The project also recommended policy options for strengthening the value chain. These included the provision of low-interest small loans, utility subsidies to favor small enterprises, and the adaptation of regional product standards to international labeling standards for greater market reach.

While the project ended in 2013, an IFAD-funded partner project continues to impart training in the value-added jameed process to a wider group of rural women in neighboring regions, thereby scaling out benefits.

Funded by OPEC Fund for International Development

DAIRY GOAT PROJECT

A lasting legacy for Afghanistan's poorest women

The immensely successful dairy goat project due to end in 2013 now extends to 2014, accruing benefits in nutrition, incomes and improved social status for more and more women in Afghan villages. The scheme motivates each woman who receives two goats from the project to give one yearling goat to a new community member.

Impacts

- Nearly 204 new women beneficiaries of the 'pass on the gift' goat scheme
- The 1578 goats distributed grown roughly four times to 7067 by 2014 (with 10% mortality)
- A six-fold increase in value of investment to present value of US \$1.11 million
- Over 1000 women trained
- Increased milk production by an estimated 15 to 30%
- Gross monetary benefits estimated to reach US \$91,250–182,500 by 2018

ICARDA is working with village elders and the Afghan government to institutionalize the 'pass the gift' practice for sustained benefits.

4

IMPROVING WHEAT VALUE CHAINS IN AFRICA TO REDUCE POVERTY AND STRENGTHEN FOOD SECURITY

Wheat is not a crop usually associated with sub-Saharan Africa (SSA). But consumption of wheat is rising rapidly in this region, faster than that of maize or rice. Countries in SSA are becoming more dependent on imports of wheat at a time when global grain prices are rising and supplies are variable because of climate change.

The Comprehensive African Agricultural Development Programme has, therefore, prioritized wheat as a strategic crop for food security in Africa. Accordingly, the project 'Support to Agricultural Research for Development of Strategic Crops (SARD-SC)' included wheat among its four target commodities, a component led by ICARDA. In 2013, the wheat initiative rolled out activities in 12 countries to improve its value chain – from seeds to markets.

Raising on-farm wheat productivity and production

Wheat production in SSA is only at 10-25% of its potential. Aiming to bridge the gap across the region, the wheat initiative is implemented through a research partnership of ICARDA with three hub countries: Nigeria, the hub for the West African Sahel; Ethiopia, for countries in the East African Highlands; and Sudan, for countries in the East African hot lowlands. In each of these three regions, scientists are testing, validating, and disseminat-



The gains in wheat productivity in Nigeria is triggering policy shift to increase wheat production and slash wheat import costs by 40-45%.

ing 'best-fit' innovations – resilient, high-yield varieties and resource-conserving cropping practices – and developing value chains from field to fork.

Recently completed baseline surveys for the three regions show that the average wheat yield is only 1 to 2 tonnes per hectare. During 2013, technologies were fast-tracked through innovation platforms in Ethiopia, Nigeria, and Sudan to thousands of farmers and value-chain stakeholders. Two improved varieties in Nigeria, five in Ethiopia, and two in Sudan, together with appropriate management packages, were promoted in 309 demonstration fields. The demonstrations showed that productivity can be

dramatically boosted to 4 to 6 tonnes per hectare or more using improved varieties with crop management practices.

West African Sahel

In Nigeria, scientists tested heat-tolerant wheat adapted to local conditions, focusing on Sahelian varieties originating from Sudan and southern Egypt. In addition, they ran experiments on agronomy and plant nutrition. Researchers set up 35 farmer-managed wheat demonstration plots – important community platforms for on-farm validation and dissemination – in six locations covering the major wheat-growing areas of the Nigerian Sahel. Breeder and foundation seed is being pro-

duced for released and pre-release varieties. Reaping the benefits of high-yielding home-grown wheat, the practice is fast catching on in the northern part of Nigeria as decision-makers look forward to ramping up production.

East African lowlands

In Sudan, scientists planted a nursery set of 150 heat-tolerant bread wheat lines, and distributed nursery sets for trials in the lowlands of Ethiopia, Nigeria, Mali, Mauritania, and Niger. Researchers also tested over 1100 advanced and elite lines for resistance to stem rust (Ug99) and leaf rust in New Halfa. Seven experiments covering agronomy, plant nutrition, and mechanization are on track across several locations in the major wheat-growing areas of Sudan, while farmer-managed demonstrations in the states of Northern Sudan, River Nile, Gezira, New Halfa, and White Nile are disseminating proven technologies.

In 2013, five field days engaged over 250 participants, including farmers, researchers, extension officers, and media representatives, on the use and benefits of improved technologies and best practices. As in Nigeria, multiplication of pre-release, breeder and basic seed is underway. In the Ethiopian lowlands, on-farm demonstrations were conducted at six sites in the Afar region and two varieties were accepted for release in May 2013. These varieties produce high yields, good grain quality, and have moderate tolerance to heat and salinity.

East African Highlands

In Ethiopian Highlands, farmers taking part in trials harvested 4 to 6 tonnes of wheat per hectare, two

to three times the national average of 2 tonnes per hectare. The farmers attributed this success to joint planning with clear responsibilities between stakeholders, new and high yielding varieties, needs-based training, frequent follow up, technical support, and timely problem solving. Farmers in the region are already looking forward to higher incomes and better livelihoods, confident of being able to produce more wheat, more competitively.

Promoting creation of wheat innovation platforms for holistic improvements

As part of SARD-SC initiative, ICARDA's team is promoting and building capacity for 'innovation platforms' (IP) as a sustainable approach to improve wheat productivity, by generating both innovations and impacts along the wheat value chain. Three training and motivational workshops, organized in partnership with the Forum for Agricultural Research in Africa, helped create better understanding of integrated agricultural research-for-development, inspiring participants from nine countries to initiate a similar IP approach in their next cropping season.

Along with mentoring, the initiative continues to provide technical backstopping for countries along the integrated approach: improved varieties and proven technologies, enabling policies and institutional frameworks, sustainable capacity building, and the strengthening of seed systems and national infrastructure.

Funded by African Development Bank



FIGHTING WHEAT STRIPE RUST DISEASE

A growing threat with climate change

Wheat stripe rust disease is becoming an increasingly frequent and severe threat, emerging in new locations as climate change expands. The disease is particularly devastating in Africa and Asia, where farmers are resource poor.

In Ethiopia, progress made in 2013 is not only safeguarding nation's crops against stripe rust, but improving yields for farmers.*

This initiative:

- Reached over 13,200 farmers across 45 districts with disease-resistant, high-yield seeds through rapid seed multiplication and distribution, informal exchange and formal sale;
- Increased farmer earnings as average yields reached 1.65 times the national annual average; and
- Set up a surveillance and early warning system to pre-empt the evolving nature of rust disease.

The fight against stripe rust has emerged as an urgent priority in addressing food security. In response, research program at ICARDA has stepped up its efforts through an integrated strategy that includes developing improved seeds, building national capacities and setting up testing and monitoring systems in vulnerable countries. The need for larger cooperation is also driving the establishment of a centralized testing and screening facility for countries at the Regional Cereals Rust Research Center in Izmir, Turkey, a joint initiative of Turkey and ICARDA.

* Funded by USAID

5

ADAPTING SMALLHOLDER PRODUCTION SYSTEMS TO CLIMATE CHANGE IN DRY AREAS

Most smallholder households in dry areas live on subsistence farming as water scarcity and often land degradation severely limit food production. Climate change is making it harder to cope, increasing their vulnerability to crop failures and poor livestock productivity. In a holistic approach, scientists are working with communities, national research systems and development partners to develop integrated solutions for production systems as a whole – land, water, crops, trees, livestock, and their dependent farmer families.

Modeling rainfed watersheds for resilience and increased productivity in the Ethiopian Highlands

The Amhara region in the Ethiopian Highlands is one of the many rainfed farming systems in dry areas with severely underdeveloped potential and high vulnerability to climate change. Farmers in this region suffer from low productivity and degraded natural resources. A multi-partner watershed management initiative, led by ICARDA, is helping to unlock the potential using the site as an innovation platform for collective learning and demonstration of a model systems approach to sustainably increasing production and rehabilitating degraded ecosystems in dry areas.

This initiative progressed into Phase II in 2013 on track to deliver a validated bio-economic systems model – a tool that will equip extension services in rainfed areas to improve



Gumara-Maksegnit Watershed, Ethiopia: 'Farmer Research Groups' monitor impacts of soil and water conservation interventions on surface runoff and soil erosion.

the productivity of their resource poor farmers and adapt them to climate change. The Phase I (2009-2012) set up the site for community watershed management, involving extension workers and 'Farmer Research Groups' to introduce interventions and monitor impacts. During 2013, the team introduced portable bamboo planting trays or 'mobile tree nurseries' that can be placed close to homes – an approach that is favoring women's involvement and helping reforest the Amhara region at the same time. The innovation has resulted in a net benefit of US \$39.5 on investment per participating farmer. High-yielding cereal and legume varieties brought further benefits, increasing farmers' productivity by 27-56% and new high value crops like cabbage, Swiss chard and carrots were introduced into the farming system to diversify incomes.

Farmers are further learning to apply technology 'packages' such as optimized fertilizer inputs combined with supplemental irrigation enjoying substantial increase in yields, e.g., trials indicated in-

creases by 50% to 175% for pepper green pods. The project also worked to improve goat farming in the region. Farmers took part in community goat breeding, learnt about improved forage species, and identified ways of controlling major goat diseases in the region. The initiative is now focusing on mainstreaming gender into the activities to ensure equitable impacts from all interventions.

Funded by Austrian Development Agency; and CGIAR Research Program on Water, Land and Ecosystems

Boosting crop–livestock production systems on marginal lands in Jordan and Iraq

West Asia and North Africa are the most vulnerable regions to climate change worldwide. In these regions, poor rural households dependent on barley–livestock systems for their livelihoods are particularly at risk as their systems perform far below average. In addition, harmful farming practices, such as deep plowing, are destroying the structure of soil and

its capacity to store water. An initiative in Jordan and Iraq is targeting rainfed barley-based systems to help build food security for livestock producers living in areas with a mere 200-350 mm of annual rainfall.

Over the last two growing seasons (2011-2013), the project demonstrated technology packages including zero tillage (ZT), planting saltbush next to barley as an alternate feed, crop rotation to increase soil fertility, water harvesting using the Vallerani ploughing system, and improved milking and healthcare of small ruminants. The use of locally manufactured ZT seeders, a home-grown innovation, showed on average 20% higher grain yield for barley compared to conventional tilling on 29 farmer fields in Jordan. In Iraq, trials on 40 farmer fields demonstrated an almost 50% yield increase in some cases.

The initiative is using farmer field days and workshops to increase awareness on the impacts of climate change and the response options

available. Strategic collaboration with ongoing development projects is adding further value to the initiative. Using baseline biophysical and socioeconomic profiling of the community at the onset of the project is helping the initiative accurately evaluate the impacts of its strategies.

Funded by IFAD

Promoting zero tillage (ZT) and other sustainable practices in Central Asia & the Caucasus

The ZT to minimum tillage approach of conservation agriculture (CA) is a boon in places like Central Asia and the Caucasus region where severe land degradation is prevalent and resource conservation an urgent need. ICARDA, working under the Regional Program for Sustainable Agricultural Development in Central Asia and Caucasus, is building the capacity and confidence of farmers, extension workers, and national decision-makers to embrace this approach by demonstrating and promoting CA in combination with

other sustainable best practices such as synergistic crop rotation and raised-bed planting.

The initiative demonstrated water-efficient irrigation and the CA approach with no-till maize, sunflowers, and winter wheat in Azerbaijan and Kazakhstan, and no-till mung bean and winter wheat in Uzbekistan, reaping higher yields, fuel savings and increased water efficiency by 21-30% in bed planting, along with 17% water savings in applied irrigation. Additionally, testing several crop rotation options demonstrated inclusion of legumes in cropping systems to increase farmers' incomes and improve soil fertility further.

Funded by FAO-Turkey Partnership Program

BRINGING CONSERVATION AGRICULTURE TO RESOURCE-POOR FARMERS IN DRY AREAS

ZT machines developed with local manufacturers is making the practice of conservation agriculture a reality for smallholder farmers in low-income countries.

In 2013, several field days and workshops were held to expand the adoption of conservation agriculture with following results:

- Reached 12,000 hectares in Iraq, since 2006 (mostly rainfed areas)
- Demonstrated the practice on wheat-legume cropping systems in Algeria, Egypt, Lebanon, Morocco, and Tunisia, reaching 12,000 ha in Tunisia
- Reached 1,800 hectares of 188 farmers in Azerbaijan; 1,100 hectares of 11 farmers in Kazakhstan; and 2,134 hectares of 24 farmers in Uzbekistan (irrigated areas)

Funded by ACIAR, EU-IFAD and FAO-Turkey



Demonstration of ZT seeding of mung bean in a cereal field in Azerbaijan. Farmers and NARS look for seed placement with ICARDA scientists after sowing with a zero-tillage seeder.

Results	Conventional	Minimum Tillage	ZT
Yield (tonnes/hectare)	1.85	1.97	2.24
Fuel saving	NA	75%	90%

6

INCREASING WATER PRODUCTIVITY IN WATER-SCARCE AREAS

Water scarcity is perhaps the biggest problem for farmers across northern Africa and the Arabian Peninsula. Rainfall is erratic in the region with annual totals generally below 250 mm, and sometimes as little as 50 mm. Meanwhile, temperatures can rise as high as 50°C. An ongoing research focus at ICARDA has been producing more with less in various production systems in our target regions – greenhouses, fields and rangelands. In 2013, a number of technology packages were optimized and validated, ready for scaling out.

Soilless innovations result in higher yields of cash crops with less water on the Arabian Peninsula

A partnership of scientists, extension workers and pilot farmers across seven countries in the Arabian Peninsula has delivered scalable technology packages for soilless (hydroponic) systems, enabling smallholder farmers in water scarce regions to reap high-yield, high-quality cash crops even under harsh growing conditions. The initiative tested and improved on various innovations in greenhouse design; integrated pest management practices; and soilless production systems to optimize a system that uses less water and provides higher yields.

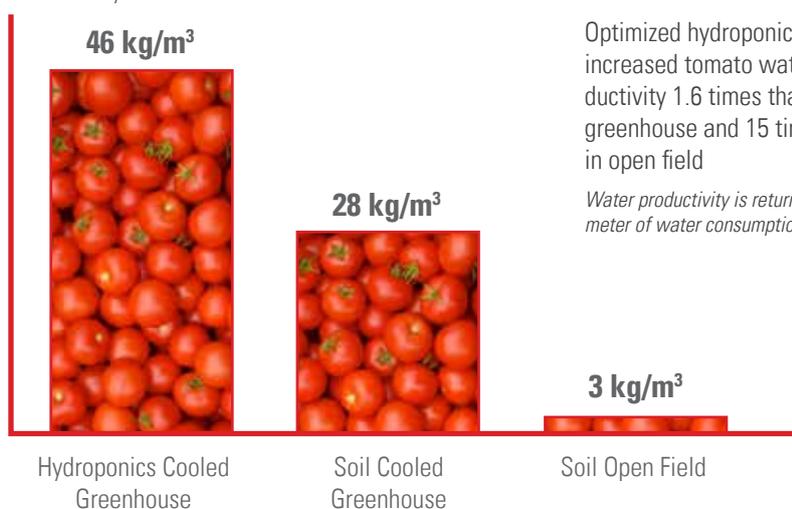
The soilless culture was optimized for greenhouses, with scientists demonstrating a 40% higher yield for cucumbers grown in greenhouses compared to those in open



I am getting a very good yield and higher quality with less running cost. Only for water, I am saving about US \$250 monthly.

Saud Al Magbali,
Grower, Oman

Tomato Water Productivity



Optimized hydroponics system increased tomato water productivity 1.6 times than in soil greenhouse and 15 times than in open field

Water productivity is returns per cubic meter of water consumption.

fields in Oman. An automated water and nutrient management system was found to further increase the production by 50% compared to manual control. In the United Arab Emirates, farmers enjoyed a seven-fold increase in water productivity growing tomatoes in a soilless culture rather than in conventional soil farming.

A cost-benefit analysis computed an average 200% increase in annual profit per m² per year from soilless

production in greenhouses. Additional benefits came from measures to control pests, such as soil solarization, which effectively controlled weeds and nematode infestations in tomato plants, increasing yields by 260% for farmers in Kuwait.

Encouraged by the income increases from the soilless farming technologies, a hydroponics demonstration and research site has been built in Yemen in 2013, while Oman, Emirates, Qatar and Bahrain have imple-



In Egypt, farmers, utilizing raisedbed machines, on average saved 24% in irrigation water and gained 34% in wheat yields in the 2012-2013 season.

mented a catalytic incentive policy to encourage farmers to convert to soilless farming and adopt the integrated technologies.

Funded by AFESD; IFAD; OFID

Raisedbed planting machines revolutionize water productivity for Egypt's smallholders

Raisedbed planting, where crops are grown in the elevated area between deep furrows, is a traditional practice in Egypt and has many conservation benefits – it reduces the amount of water applied to the land and water loss from percolation, and also ensures good aeration of the roots, efficient use of fertilizer and easier weed control. However, small-scale farmers have poor access to the technology as existing machinery is expensive and not suited to small fragmented lands.

An innovative adaptation of seed drills to formulate the beds and sow different crops at the same time with adjustable seed rates is revolutionizing water productivity and yields for smallholder farmers in Egypt's Nile Delta. These machines are easy-to-maintain, cost-effective solutions

for small- to medium-size farms, and ensure there are no skipped or double-planted areas.

In Al-Sharkia, Egypt, the land used for mechanized raised-bed cultivation of wheat increased from 1,670 hectares to a phenomenal 21,250 hectares over three years, from 2010 to 2013. As the success and simplicity of the raised-bed machine is catching on, ICARDA is working to outscale the technology by contracting a local company to manufacture machines, and sending them to countries such as Eritria, Ethiopia, Iraq, Morocco Nigeria, and Sudan. In the meantime, scientists are optimizing soil and water management practices for semi-permanent raised beds to maximize productivity and to enable greater numbers of farmers to adopt the technology.

Funded by AFESD; Kuwait Fund for Arab Economic Development; Islamic Development Bank; OFID

Laser-guided Vallerani plow harnesses rainwater to 'green' rangelands in Jordan

Jordan's rangelands occupy more than 80% of the country's area and receive less than 200 mm of rain-

fall per year, often as unpredictable storms. The region's crusting soils lose rainwater to evaporation or surface runoff. Microcatchments for harvesting rainwater can address this problem and Vallerani plows are an efficient tool to build these – a technique utilized by ICARDA as part of its ongoing project, 'Community-Based Optimization of the Water Resource Management in Agriculture in West Asia and North Africa (2004-2013)'.

ICARDA's scientists have now further improved the Vallerani technique with an auto guiding system using inexpensive lasers. This reduces the cost and time required to identify contours for the plow to follow, and has tripled the system's capacity (up to 30 ha per day), improved efficiency and precision, and substantially reduced the cost of creating microcatchments.

The technique is creating wide areas of water harvesting enabling large-scale planting, which is substantially improving water productivity, yields and incomes for farmers. Benefited farmers are enjoying more than double the yield for barley and 1.6 times for rangeland shrubs compared to those grown without water harvesting. Water harvesting has also been rehabilitating poor quality land by providing improved vegetation cover, thus mitigating degradation and erosion.

The enhanced Vallerani technology has been implemented on over 1,800 ha of rangeland so far, with adoption rates tripling since the start of the project in 2004. The technology is now being promoted in Jordan and Syria to scale out the benefits.

Funded by IFAD; AFESD; OFID

7

GUIDING POLICY AND PRACTICES FOR SUSTAINABLE PRODUCTION SYSTEMS

An enabling policy environment and a strong institutional framework are critical pieces in promoting sustainable agriculture development. In 2013, a spread of policy and socio-economic research activities helped develop insights and create knowledge to support actions of governments and institutions as they work toward greater food security, poverty alleviation and sustainable development in their nations.



Evaluating the efficacy of agricultural policies on Morocco's wheat sector

Food security and affordability is a key priority in developing nations such as Morocco, where the government has historically subsidized the wheat sector. Subsidizing bread wheat imports has kept bread prices as low as 50 cents per loaf, while subsidies on seeds and machinery, along with import tariffs, has boosted domestic wheat production to an extent that wheat has become the main crop in Morocco – the second most important in terms of production value. Yet, in spite of years of subsidies, the country has been unable to produce a self-sufficient supply in line with population growth and has become even more reliant on wheat imports – from producing 81% of wheat for domestic consumption in the 1960s to producing only 60% in 2011.

Using the example of Morocco's wheat sector, ICARDA's socio-economists have sought to understand the performance of cereals vis-à-vis

social welfare policies in developing nations. Projections made from assessing the impacts of policy change and wheat productivity improvements is shedding light for decision-makers in Morocco, which like most developing nations must juggle the interests of national economy and food security against a rapidly growing population.

The study simulated multiple scenarios to project impacts from investing in improving production methods (mechanization, irrigation, seeds, and fertilizers) and training unskilled laborers, and liberalizing markets through the unilateral elimination of import tariffs for wheat. The results indicated that wheat production would increase by 6% to over 16% from increased capital and labor productivity, but that domestic production would decrease by almost 14% if protection for import tariffs was removed.

Even though improvements in farm productivity could increase wheat production in Morocco, histori-

cal data show that such increases will not be enough to reduce wheat imports. In this case, the import tariffs are proving to be instrumental to protect the domestic wheat sector from cheaper wheat produced abroad.

One consideration in favor of being a net wheat-importing country is that Morocco suffers from water scarcity and since wheat consumes more water per kilogram produced than vegetables or fruits, importing cereals from countries with better water supplies could reserve water in Morocco for other high-demand and less water-intensive crops. Nurturing the fruit and vegetable sector would not only support Morocco's large agricultural population (almost 40% of the country's working population), but it would also increase productivity per unit water used.

Funded by CGIAR Global Research Programs on Wheat; and Dryland Systems



Climate change is diminishing survival of migratory pastoralist of Rajasthan, India

Protecting traditional migratory pastoralists of Rajasthan, India

Livestock rearing is an important means of livelihood for the resource poor in the drought prone drylands of Rajasthan, India. The 'Raika' herder community survives arid conditions, and environmental change brought on by climate change by moving their flocks and herds over migration routes to graze common pastures and fallow farmlands. This practice has evolved over the last five centuries, but is disfavoured by the sedentary population.

ICARDA's rangeland scientists studied pastoralists' migration practice in the larger contexts of the environment, the economy, and sociological systems to formulate policies and recommendations that would safeguard their livelihoods and improve productivity. The study analyzed livestock migration, using GPS collars to track the movements of a sample of cows and sheep herds. Results revealed several production constraints encountered by herders, the most challenging being the rapid deterioration of common grazing land through desert encroachment,

lack of quality fodder grasses on rangelands, and the limited veterinary care and medicines available for live-stock.

Outcomes from the study recommend interventions such as improving the conditions of common grazing lands on migratory routes, creat-

ing watering points, access to near real-time information on conditions of forage resources, and mobile veterinary services. The selling of live-stock and products at remunerative prices in nearby towns further offers an opportunity for value addition, which would require the development of market infrastructure. Steps in this direction could safeguard the migratory livelihood of pastoralists, evolved over centuries as a coping strategy against rising feed prices and climate change. The policies are due for deliberation by decision-makers at an all-stakeholder meeting early in 2014.

Funded by CGIAR Global Research Program - Climate Change, Agriculture and Food Security

Leveraging knowledge sharing to scale out natural resource conservation in Middle East and North Africa

Effective knowledge capturing and sharing across projects and beyond is crucial for making the transition from localized to system-wide interventions; without it, the scale of impacts is limited. A knowledge exchange initiative led by ICARDA is enabling transfer of technology

from successful natural resource management projects in the Middle East and North Africa region (MENA) to other parts of the region to facilitate wide-scale restoration of degraded lands.

The initiative is helping scale out strategies implemented under the Integrated Natural Resources Management in the Middle East and North Africa (MENARID) program by connecting project leaders across six countries on challenges and lessons learnt, and establishing a harmonized monitoring and evaluation system amongst them. The framework, designed conjointly with stakeholders from across the Middle East and North Africa, constitutes a facilitated online portal called the 'MENARID Gateway', live participatory knowledge-synthesizing sessions, and training workshops.

A remarkable outcome has been the transfer of Vallerani technology – a rainwater harvesting method suited for large scale land restoration – from a project in Morocco to a project in Jordan. Beginning implementation in late 2013, the project successfully treated over 147 ha of rangeland and now is looking to restore up to 600 ha of agricultural land and 1000 ha of rangelands, in cooperation with the NARS – benefiting native herders and smallholder farmers in nearby villages.

Aiming beyond the Middle East and North Africa, the online MENARID Gateway is fast becoming a growing global knowledge resource on integrated natural resource management in dryland areas

Funded by the Global Environment Facility; IFAD

CALL TO ACTION FOR POLICY-MAKERS

Strengthening Policies for Greater Water and Food Security in Dry Areas

Existing knowledge and technologies have the potential to resolve major water and land management problems faced by countries today in dry areas. The main gap between this capability and actually achieving large-scale results on the

ground is the lack of enabling policy environments in many countries – a regulatory environment that ensures technologies are effectively and equitably applied, and investments are made over a sufficient period of time to ensure impacts for millions of smallholder farmers and resilience in food production systems, in the long run.

An international conference, Policies for Water and Food Security in Dry Areas, held in Cairo, Egypt in June 2013, drove the agenda for implementing effective water policies to the forefront. Co-organized by the Egyptian Ministry of Agriculture and

Land Reclamation and its Agricultural Research Center, ICARDA, FAO, IFAD and IDRC, the event engaged some 200 policy makers, donors, experts, development organizations, research-for-development organizations and scientists from 28 countries on the efficacy of current regulatory frameworks, water and food policy options and effective strategies and steps needed to enhance land and water productivity in dryland countries.

Countries with senior-level participation at the event included: Afghanistan, Belgium, China, Egypt, Ethiopia, India, Iran, Iraq, Jordan, Lebanon, Morocco, Sudan, Syria, Tajikistan, Tunisia, Turkey, Uzbekistan, and Yemen.



The outcomes from the event are framed in a set of recommendations that guide the long-term investments and policy action needed by governments to strengthen national food and water security in the world's dry areas.

Available under Publications at www.icarda.org/water-and-food-security-conference/resources

NEXT STEPS

The conference led to a consensus amongst the delegates on the following next steps:

1

Establishing a strategic partnership to better coordinate national, regional and international efforts and promote existing knowledge and technologies for greater water and food security in dry areas

2

Creating a cooperative program to develop, analyse and promote agricultural policies and institutional options to enhance water and food security, play the advocacy role for policy implementation, and help countries develop and implement water and food security policies

Spotlight on Innovations for Smallholder Farming



ZT seeder developed with Rama company in Jordan

Affordable zero-till seeders for conservation in developing countries

Conservation agriculture – the practice of minimizing soil disturbance, maintaining soil cover, and rotating crops – is a proven technique that improves soil fertility, along with saving time and costs associated with plowing. Particularly beneficial where natural resources are scarce, the practice has the potential to unleash productivity in dry areas.

However, the practice's adoption in low-income countries has been extremely low. A major obstacle has been the high cost of available zero till (ZT) seeders, which are often imported. These cost between US \$20,000-\$60,000, and are also too complex to use on small farms and require specialized maintenance.

Along with national partners, ICARDA worked with local small-scale manufacturers in Syria, Iraq, and Jordan to adapt conventional seeders in the market to ZT mechanism, planting seed directly into untilled soil with crop residues. These machines, costing a fraction at \$5,000-10,000, are catalyzing wider adoption of conservation agriculture in dryland developing countries. They are also contributing to rural businesses, spawning local maintenance workshops.

The approach innovated in Syria and Iraq, under ICARDA-Australian Centre for International Agricultural Research partnership, is now being adapted with rural communities in Jordan, Morocco and Tunisia.

Small-scale mechanized raisedbed systems for water savings

Raised bed planting – making furrows in fields and planting seeds at the top of these furrows – is a well-established practice in Egypt. Farmers recognize the practice's ability to substantially save water and raise overall yields, and use machines to efficiently prepare raised beds before planting crops. However, for smallholder farming, the challenge has been mechanizing raised bed planting – the machines must be suitable for small lands, cost-friendly and light enough for the Nile soils to avoid soil compaction.



Mechanized raisedbed machine prototype

Key Benefits

- Saves water **by 20%**
- Reduces seed rate **by 50%**
- Decreases farming cost **by 25%**
- Reduces planting time **by 88%**
- Increases crops yields **by 15-25%**



Working with farmers in the Sharkia province in Egypt along with national partners, ICARDA's scientists developed a multi-crop raised-bed planting machine which formulates beds in the same path as seeding with adjustable seeding rates.

Fast track seed multiplication in Ethiopia helped reach 400,000 hectares in the first two years of the program.



The design ensures all plots are planted with no skips or double planting. The machine can be used flexibly, both for intensive crops (such as wheat, berseem and rice) and interspaced crops (such as corn, sugarbeet and faba bean).

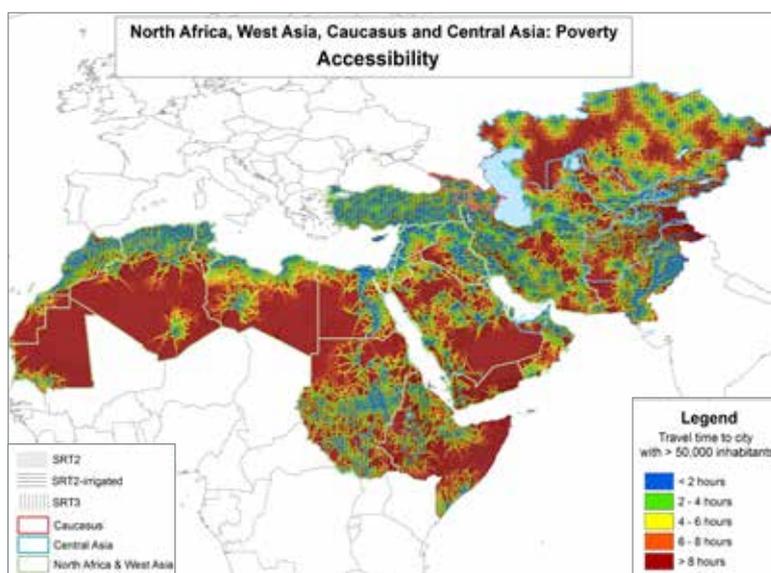
The results are promising rapid uptake of the technology – the application is spreading to other provinces in Egypt and being introduced outside to Sudan, Ethiopia, Eritrea, Nigeria, Iraq and Morocco.

Fast-track seed distribution for safeguarding crops from outbreaks

Smallholder farmers in developing countries are often vulnerable to disease outbreaks with poor and untimely access to quality seeds and improved technologies. A novel participatory on-farm seed multiplication strategy is proving to significantly cut the time-lag between the development and distribution of quality seeds to smallholder farmers.

The strategy was developed by a partnership of the Ethiopian Institute for Agricultural Research and ICARDA in an urgent response to a major wheat stripe rust epidemic in Ethiopia in 2010, which had wiped out crops and left thousands of farmers devastated. The initiative, funded by USAID, has since then successfully distributed roughly 20,000 tons of improved seed with rust resistance to over 13,200 farmers, preventing another outbreak.

The strategy is now part of an innovative framework to combat rapidly evolving diseases like stripe rust. To stay ahead of diseases, the on-farm participatory seed multiplication of improved varieties must be quickly followed by release of multiplied seeds to neighboring farmers. Combining this approach with farmer field days, demonstrating the benefits, will further ensure all farmers are equipped with disease-resistant varieties.



Mitigating risk and improving research productivity

Access to markets, with remote sensing data available down to localized region, is informing research strategies for strengthening value chains in target regions.

geoagro.icarda.org

Geoinformatic innovation to power up systems approach for drylands

An innovative application of Geoinformatics, utilizing cutting edge expertise, access to advanced sensor technologies and powerful data processors, is powering up the systems research for Dryland Systems, CGIAR's global research program charged with developing integrated solutions for dryland communities.

Using systems approach requires accounting in a wide range of factors – from climate and soils to markets and tradition – to develop integrated solutions for crops, livestock, resource management and policy that can together ensure sustainable livelihoods in the long run. The Geoinformatics application, led and implemented by ICARDA, is using spatial information to map various indicators, assess challenges, and identify solutions for different agroecosystems.

Working with Countries: Building a Food-Secure Future Together



Climate-proofing villages in dryland countries

Villagers from Kadok at the foothills of Uzbekistan gather with ICARDA scientists to collectively assess the effects of climate change and develop adaptation strategies.

Partnering with countries through national research and extension systems (NARS) has been a cornerstone of ICARDA's research-for-development initiatives. The approach has been allowing us to shape agendas that are responsive to countries' needs and deliver impacts where needed the most – both at farm and at national levels.

ICARDA's regional and country programs combine research with extensive capacity development to ensure development continuum. They work through a core partnership of international scientists, NARS, local research institutions and universities, with inputs from national policy- and other decision-makers.

Our partnership programs – six at a regional level and four at country level – cover over 40 dryland countries across Africa and Asia. Additionally, a new Highlands research partnership is in the works – with strategic sites in Iran, Morocco and Turkey – to address the unique production constraints of mountainous dry agroecosystems.

ICARDA's Agricultural Research-for-Development Partnerships

Regional Programs

- Nile Valley & Sub-Saharan Africa
- North Africa
- West Asia
- Arabian Peninsula
- Central Asia & Caucasus
- South Asia & China
- Highlands (emerging initiative)

Country Programs

Turkey, Iran, Afghanistan & Pakistan



HIGHLIGHTS FROM REGIONAL AND COUNTRY PARTNERSHIPS

In 2013, decentralization brought ICARDA closer to its partner countries, enhancing its support and reach to all its stakeholders. The achievements of the regional and country partnerships included scaling out successes, technology improvements and new initiatives.

* Denotes program office location. For list of donors, see [page 45](#).

Nile Valley & Sub-Saharan Africa Regional Program

Activities in: Egypt (Cairo*), Eritrea, Ethiopia and Sudan

The program is addressing the region's challenges through innovations in irrigation technologies, improved wheat varieties, stronger wheat-legume cropping systems and more robust seed systems.

- The use of multi-crop raisedbed machines adapted for small-scale farming, developed by ICARDA scientists, dramatically expanded from about 4,000 acres in 2010-11 to 55,000 acres in 2012-13 cropping season in Egypt, saving smallholder farmers irrigation water by 24% over traditional methods and increasing wheat yields by 34% on average ([more on page 23](#)).
- The wheat cultivars developed under ICARDA-Egypt Wheat Improvement Program made headway as they reached over 12 African countries through SARD-SC, the newly launched African initiative ([more on page 18](#)). The program is attracting scientists from the region and beyond.
- The wheat-legume cropping project successfully developed and demonstrated higher yield packages for faba and chickpeas for smallholders in the region. The substantial increase in faba bean yield is proving to be a promising development in Egypt with the ministry deciding on a national campaign to promote the technology for wider uptake ([more on page 12](#)).
- ICARDA's seed systems initiative to bring certified seeds to more farmers noticeably increased the number of beneficiaries in Egypt by 117% from 2010/2011 season. In Sudan and in the Northern State, the spread of newly introduced high-performance wheat, Imam, and its recommended package increased dramatically as well, reaching 45-50% coverage in Gezira. Further, a new heat-tolerant and high-yield variety, Goumria 3, developed from ICARDA's germplasm, was registered and nationally released to farmers.

A new agreement between ICARDA and Egypt's Agricultural Genetic Engineering Research Institute is expanding their collaboration on crop improvement, to greater advantage of both Egypt and the larger region.



Water-saving raisedbed farming in Sharkia province in Egypt

North Africa Regional Program

Activities in: Algeria, Libya, Mauritania, Morocco (Rabat*) and Tunisia

The program focuses its efforts along expanding conservation agriculture to address the severely constrained production systems in the region and promoting food legumes for its multiple benefits.

- An initiative, aiming for rapid adoption of conservation agriculture by smallholder farmers, developed and tested affordable zero-till seeding machinery in Morocco, Algeria and Tunisia, engaging local manufacturers and farmers in the process. It also conducted many trials with farmers on weed management, crop residue management and livestock feeding options (forage crops, alley-cropping and byproducts) to optimize the benefits from conservation agriculture.



Bountiful harvest of lentils in Morocco

- The joint Morocco-India food legume initiative, launched in 2012, organized and started its activities in five regions in Morocco and seven states in India, working with smallholder farmers on testing and demonstrating improved varieties, creating village-based seed production systems, and evaluating options for adding value to food legume chain. With extensive participation of research institutions and universities in both countries, along with two CGIAR Centers – ICARDA and ICRISAT – this five-year initiative is aiming for holistic and mutual benefits for the two countries through the collaboration.

2013 also brought a further boost to the North Africa program as ICARDA signed an MoU establishing a research platform in Morocco, building on its longstanding partnership with Institut National de la Recherche Agronomique. The platform will leverage the region's diverse soil and climate conditions to strengthen rainfed cereal-based agricultural systems for scaling out.

West Asia Regional Program

Activities in: Iraq, Jordan (Amman*), Lebanon, Palestine, Syria, and lowland Turkey

The program implements a range of activities in the region tailored to the needs of the target countries and national priorities.

- In Palestine, a push for gene conservation and crop improvement added 59 new wild relatives of wheat and barley to the nation's collection through 10 joint gene collection missions; increased grain yields by 35% by improving populations through community selection process; and distributed 4.2 tons of newly introduced improved varieties and improved landraces to farmer community enterprises for seed multiplication ([more on page 14](#)).
- In Iraq, ICARDA vigorously implemented many activities through the HSAD initiative ([more on page 15](#)), such as introducing integrated pest management and international standards for tissue culture for date palm; enhancing capacities of staff, facilities and institutions in the production of certified wheat seed; and disseminating conservation agriculture practices and ZT seeders to rural communities in the Kurdish region.
- For marginal lands in Iraq and Jordan, improving productivity of integrated barley-livestock systems was a priority to help adapt smallholder communities to climate change. The initiative produced several characterization maps as part of a 'climate change atlas.' Further, the use of locally manufactured ZT seeders grew as a Jordanian company, part of ICARDA's innovation partnership, manufactured and sold five machines. Artificial insemination for sheep was introduced in the target area and improved rams distributed to flock owners, promising large gains in productivity.



Inauguration of ICARDA's office in Amman by HE Dr. Akef Al-Zoubi, the Jordanian Minister of Agriculture (September 2013)

The opening marked the relocation of ICARDA's more than 35 scientists to Amman and the start of an experimental station in Mushaqar, 35 km from Amman, following an MoU with Jordan's National Center of Agricultural Research and Extension.

The ICARDA-Jordan's collaboration took new shape as an agreement was signed with Jordan's Higher Council of Science and Technology for research on rangeland management, a critical need for the country where more than 80% of the land is covered by marginal rangelands.

Arabian Peninsula Regional Program

Activities in: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates (Dubai*), Yemen

The program's research and testing activities with farmers is directed toward maximizing land and water productivity – the two critical performance criteria in the region.

- An integrated soilless technology package, tested and validated by ICARDA's scientists, is providing greater amount of "crop per drop," substantially increasing incomes for pilot farmers. The results are encouraging Oman, Emirates, Qatar and Bahrain to offer financial incentives to nationally increase the uptake of these innovations ([more on page 22](#)).
- An indigenous forage crop, Buffel grass, was screened for 35% higher water productivity than the commonly grown Rhodes grass in the region. The program promoted replacing traditional grass with the more water-efficient Buffel grass, helping a growing number of farmers in Emirates to enjoy 51% savings in irrigation water.
- Further, activities continue to seek increases in productivity through optimizing fertilizer inputs, growing mixtures for soilless farming and adding new strategies like spineless cactus.

The program is now on track to scale out the technologies and measure impacts of the research through socio-economic analyses.



Buffel grass, an indigenous forage, is saving irrigation water and bringing high quality fodder for farmers in Arabian Peninsula.

Central Asia & Caucasus Regional Program

Activities in: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan (Tashkent*)

The program works to improve rural livelihoods while promoting sustainable management of natural resources, important for the region's fragile agroecosystems affected by soil and water salinity.

- Germplasm enhancement and crop improvement formed a major part of ICARDA's activities in the region, some with exceptional results. Several new winter wheat varieties like Chumon, Ormon and Gozgon emerged virtually unscathed after a yellow rust outbreak in Tajikistan and Uzbekistan in the spring of 2013, while many leading commercial cultivars were seriously hit. Seed multiplication is now in progress under the joint initiative of ICARDA and CIMMYT.
- Two winter wheat varieties resistant to salinity and frost were identified in Turkmenistan after years of joint research with ICARDA. Further efforts are on in Uzbekistan to introduce non-conventional salt-tolerant crops such as pearl millet and sorghum into crop-livestock systems for better productivity, through a partnership of ICARDA with ICBA and ICRISAT.
- Conservation agriculture projects demonstrated practices and imparted training to farmers in Kazakhstan, Tajikistan, Uzbekistan and Azerbaijan to combat land degradation, a major goal of ICARDA's work in the region.
- A women-centric initiative of ICARDA, integrating livestock productivity enhancement with value-added yarn products for export, concluded in Tajikistan and Kyrgyzstan in 2013 with significant outcomes – higher incomes for rural women and small livestock breeders, sustained impacts and a scalable value chain for the region ([more on page 16](#)).



The improved wheat variety, Gozgon, stayed unscathed in stripe rust outbreak in Uzbekistan in spring of 2013.

South Asia & China Regional Program

Activities in: Bangladesh, Bhutan, China, India (New Delhi*) and Nepal

The rapidly expanding program has been innovating with existing farming practices for quick and high-value returns to increase nutrition and incomes for the millions of subsistence farmers in the region.

- The program's introduction of intercropping of lentils in rice fallows is revolutionizing farm productivity in India, bringing nutrition, soil fertility and an additional US \$450 on average per year into the pockets of small-holder farmers ([more on page 13](#)).
- Another initiative disseminated improved varieties of lentil and grasspea, zero-tillage and relay cropping, and other production technologies to almost 5,000 farmers across some 367 villages through field days and trainings, boosting their incomes and food security.
- To combat malnutrition prevalent in rural Bangladesh, India and Nepal, the program introduced micronutrient-rich lentil through screening and breeding to select lentil cultivars with high levels of iron and zinc. The initiative received extension and is on track to promote the technology through fast-track seed multiplication and distribution ([more on page 12](#)).



Extra crop, extra profits: growing lentil in a rice fallow in Assam, India

A new agreement signed between India and ICARDA in December 2013 rolled out an extensive workplan, laying out a total of 14 research projects on crop improvement and natural resource management over the next three years. Further, the partnership with China received new impetus with the establishment of Center of Excellence for Dryland Agriculture – a research collaboration of Chinese Academy of Agricultural Sciences, ICARDA and ICRISAT – for improving productivity of drylands in China.

Turkey Country Program

The program's historical focus on developing winter wheat germplasm for Central and West Asia, and North Africa region continued to deliver on crop improvement for cold agroecosystems and gained further ground with new initiatives.

- The program released three chickpea and four lentil high-yielding, disease resistant varieties in 2013. The new cultivars were promoted to farmers and extension staff through demonstrations and on-farm trials in three provinces, along with seed dissemination.
- As part of ICARDA's international nursery distribution activities from Turkey, 652 sets of nurseries from four different crops and cereal pathology were disseminated to more than 50 countries around the world.
- The International Winter Wheat Improvement Program – a joint initiative of the Government of Turkey, ICARDA and CIMMYT – provided for active scientist exchange, as well as training of young scientists, in 2013. The ongoing initiative since 1986 has resulted in more than 40 improved wheat cultivars, which are now covering more than 2 million hectares in 12 countries.



Agreement expands Turkey-ICARDA partnership at ICARDA's 53rd Board Meeting in Baku, Azerbaijan, December 2013

A new agreement signed between Turkey and ICARDA is expanding the partnership to global reach. A Regional Cereal Rust Research Center will be launched in Izmir in 2014 to combat rusts diseases in the Central and West Asia and North Africa regions, where the disease is emerging as a serious threat to food security in a changing climate. Further, ICARDA's winter barley breeding program was also relocated to Turkey and activities started in 2013.

Iran Country Program

The program is targeting research solutions to overcome arid conditions while leveraging the diverse agroecosystems of the country for greater productivity.

- In 2013, two improved forage crop varieties, selected from ICARDA's vetch materials and developed in partnership with the Dryland Agricultural Research Institute of Iran, doubled their coverage area from 2012 when they were introduced. Improved food legume crops also expanded from 25 hectares in 2012 to about 50 hectares in 2013.
- Two new sustainable varieties of chickpea for autumn planting in cold rainfed conditions and winter wheat for supplementary irrigation in cold regions were released by ICARDA-Iran collaboration to increase productivity in the dry and cold terrain.
- The initiative for value-added processing and export of cashmere started implementation with a baseline characterization of production systems. Three cooperatives were set up for training women on producing handmade crafts, and progress was made along improving breeding and animal husbandry practices.



A group of women from Baft and Zarab cooperatives making cashmere hats in Iran

Afghanistan Country Program

The program is bringing community-driven agriculture development, engaging villagers, rural women, local officials and universities in a diverse range of activities from crop improvement to water management and animal husbandry ([more on page 14](#)).

- Five high-yielding wheat varieties, two barley and two chickpea improved varieties were released through ongoing collaboration.
- A Herbal Remedies Producers' Association is opening new opportunities for rural households, particularly women, to increase their incomes.
- Farmers across the country are benefiting from distribution of technical bulletins informing on soil and watershed management and Atriplex production, a new forage introduced by ICARDA, backed by the Afghan Minister of Agriculture.
- The dairy goat project continued to increase its beneficiaries and added 295 new women recipients of 568 native Gujri breed goats in 2013 ([more on page 17](#)).

Encouraged by the success, two new research projects are due for launch in the first quarter of 2014, both focusing on improving livestock productivity .



Installation of solar powered water pumps in Mazar province in Afghanistan

Pakistan Country Program

The program is fostering natural resource management in degraded areas and providing support to country's research activities toward improving local cotton production and quality for greater farmer incomes.

- The program established and organized 40 watershed demonstration sites throughout Pakistan to build capacity of farmers in water management techniques, alternate irrigation systems and other inexpensive water conservation measures. The activities are encouraging community interest in watershed rehabilitation, for example, a farmer developed 8000 microcatchments for growing fruit plants.

The program is providing management support and germplasm improvement expertise to the country's initiative, funded by USDA, to develop disease-resistant cotton crops and strengthen the cotton value chain.



A gully once abandoned converted into productive land at a demonstration site in Pakistan

CAPACITY DEVELOPMENT

In 2013, ICARDA both increased its number of beneficiaries and widened its scope, extending its support to the CGIAR Consortium's global research programs, including Dryland Systems that ICARDA leads. It imparted capacity development to agricultural extension workers, farmers, research scientists, and students through a range of forums – these included farmer schools, guided tours, and field trials; thematic workshops; and degree and non-degree research awards. Relative to previous years, the number of beneficiaries significantly increased in the targeted countries of Tajikistan, Ethiopia, Kenya, Afghanistan, India, Iran, Palestine, and Yemen.

ICARDA is also collaborating with the CGIAR and other member centers in building a 'community of practice' in capacity development, and contributed to outlining a unified strategy for the global research programs to ensure result-driven capacity development.



MSc student working on faba bean crop improvement at the ICARDA-Agricultural Genetic Engineering Research Institute laboratory in Cairo, Egypt

Diverse training for scientists, extension workers and farmers

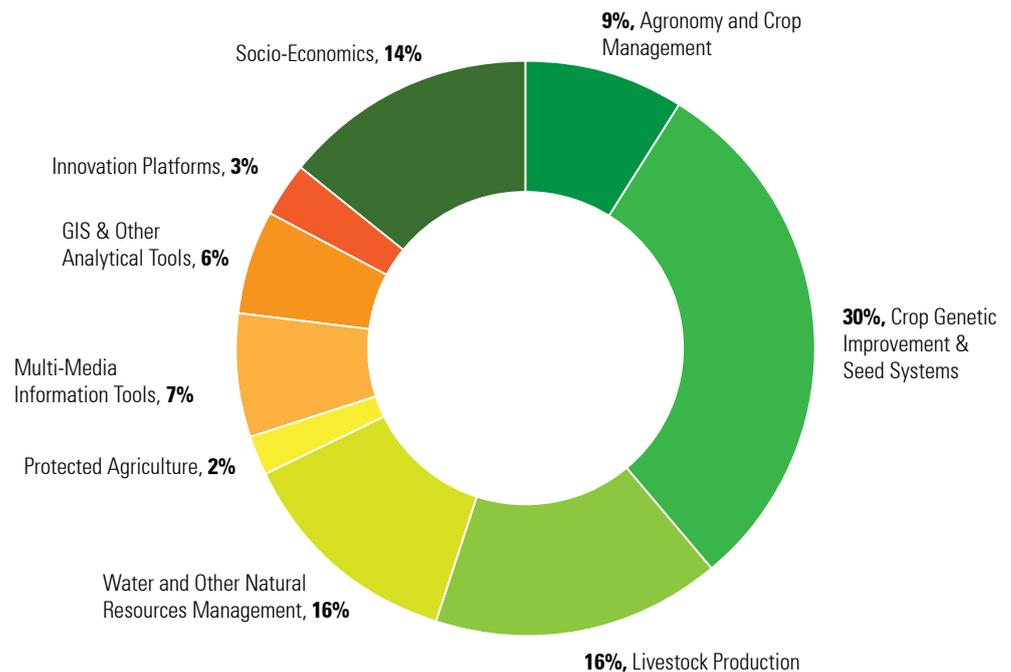
During 2013, ICARDA conducted a total of 79 group courses for roughly 1330 research scientists and supported an additional 11 trainees through individual non-degree programs or internships. These activities encouraged participation from women, who accounted for roughly 25 percent of all trainees.

The training courses covered a wide range of themes, with several new topics introduced in response to farming and research needs in partner countries, e.g., Water Planning and Geographic Information Systems (GIS); Mapping Climatic Variables for Climate Change; Managing Rangeland Productivity; Zero-tillage Seeder Technologies; and Hydroponics or Soil-less Production Systems. Another addition, 'Innovation Platform' for food systems is supporting implementation of the newly launched Dryland Systems program, with the first workshop held in Morocco in October 2013.

To maximize the uptake of the technologies, ICARDA tailored its methods to the context of the requirements. For example, in the Arabian Peninsula, farmer-to-farmer transfer of technology was used to successfully expand the uptake of soilless farming practices in horticulture, while a series of field days in Central Asia and the Caucasus made significant headway in demonstrating and encouraging farmers and local authorities to adopt sustainable practices such as no-till planting, crop residue retention and crop rotation. In Ethiopia, ICARDA used field days for progressive farmers to share their experiences with risk-averse farmers on new improved wheat varieties, which eventually led to wide uptake of rust-resistant, high yielding varieties by thousands of farmers.

ICARDA's capacity development activities by theme, January – December 2013

(Includes group courses and individual non-degree courses)



SOME HIGHLIGHTS FROM 2013:

- The number of scientists trained almost doubled from 2012
- Close to 400 women scientists received training
- Six new courses added to portfolio

Decentralization enhances ties and outreach to countries

The decentralization of ICARDA is adding value to its capacity development as it shifts from center-based activities to multiple locations across the targeted dry areas, aligning them with its newly consolidated setup of research platforms, thematic research locations, country programs and regional programs. The new locations now include Jordan, Egypt, Lebanon, Morocco, Tunisia, Algeria, Ethiopia and Turkey, along with India and Uzbekistan.

ICARDA's decentralized capacity development program is bringing hands-on learning opportunities for the beneficiaries while enabling greater integration between the center and the national agricultural research systems (NARS) in partner countries.

Preparing a new generation of scientists

ICARDA awarded 35 students with scholarships for MSc and PhD programs during 2013 – an initiative that is helping nurture a new generation of agricultural scientists. With mainly young scientists in the early stages of their career and 51 percent of them as women, this initiative is not only building national capacity but also fostering the importance of investment in agriculture sector, while addressing the gender gap.

The awarded students conducted part of their research at an ICARDA research site with joint supervision from one of the many universities and agricultural research institutions ICARDA partnered with for the purpose of the degree training program. These institutions included: Cairo University, Egypt; the University of Damascus, Syria; the University of



Extension members and local researchers in Iraq learn about conservation agriculture, as part of HSAD-Iraq initiative

agricultural research institutions ICARDA partnered with for the purpose of the degree training program. These institutions included: Cairo University, Egypt; the University of Damascus, Syria; the University of



Farmer field day in the Amhara region in Ethiopia, promoting uptake of rust-resistant wheat seed varieties.

Khartoum, Sudan; the University of Jordan; Qatar University; Kuwait University; Sana'a University, Yemen; the Mediterranean Agronomic Institute of Chania, Greece; the Federal Rural University of Pernambuco, Brazil; and the University of Nottingham, United Kingdom.

Funded by the Arab Fund for Economic and Social Development, the aim of scholarships has been to provide young scientists with a strong grounding in conducting agricultural research that involves farmers and newest technologies to improve rural livelihoods in dryland countries. To this end, students worked on a range of topics, gaining hands-on learning from ICARDA's projects on ground. These topics included:

genetic studies of cereal and legume crops; water and soil management; smallholder goat farming and marketing; genetic studies of date palm; improved cropping systems and technologies; pest control for lentils; wastewater utilization; irrigation and fertilizers; and adaptation of citrus farming to climate change.

DONORS FOR CAPACITY DEVELOPMENT

- African Development Bank
- Arab Fund for Economic and Social Development
- Australian Centre for International Agricultural Research
- European Union
- Gulf Cooperation Council
- International Fund for Agricultural Development
- Islamic Development Bank
- Japan International Cooperation Agency
- Kuwait Fund for Arab Economic Development
- OPEC Fund for International Development
- US Agency for International Development

Capacity development is also funded as a cross-cutting activity under:

- CGIAR's Dryland Systems Research Program
- Other CGIAR's Global Research Programs



ICARDA's Research Programs

An integrated approach to better livelihoods

ICARDA uses an integrated agroecosystems approach, working closely with the NARS, other partner organizations and local communities, to advance sustainable agriculture development in dry areas.

Our research for development is put into action through four disciplines that together provide an integrated approach to improving smallholder crop and livestock production systems: Biodiversity and Integrated Gene Management, Integrated Water and Land Management, Diversification and Sustainable Intensification of Production Systems, and Social, Economic and Policy Research. Capacity development is implemented across all research activities to simultaneously foster skills and expertise of extension workers, farmers, local scientists, and students. This model ensures sustainable benefits for both for the communities and the fragile natural resources in drylands.

Crop Improvement: Biodiversity and Integrated Gene Management (BIGM)

The crop improvement program works to conserve agricultural biodiversity in dry areas and to use these resources to improve food security, nutrition, and livelihoods through breeding. It covers durum and bread wheat, barley, chickpea, lentil, faba bean, grasspea, and forage and pasture crops.

BIGM scientists work on biodiversity conservation as well as crop improvement. The research applies both conventional and biotechnological approaches, and includes the following to enhance adoption of new varieties: integrated disease and pest management, and seed production and delivery systems.

Integrated Water and Land Management (IWLM)

The water and land management program aims to improve the management of scarce water resources, and to combat desertification and land degradation.

IWLM scientists develop technical, institutional, and policy options for improving water productivity in both rainfed and irrigated production systems; for sustainable, equitable, and economic use of all water sources; and for improved land management and drought mitigation. Research focuses on appropriate, effective technologies, such as supplemental irrigation and rainwater harvesting.

Production Systems: Diversification and Sustainable Intensification of Production Systems (DSIPS)

The production systems program focuses on improving livelihoods and reducing risk by intensifying and diversifying traditional production systems.

DISPS scientists work with agronomy, integrated crop-livestock-rangeland systems, market linkages, diversification into higher value crops, and value addition to crop and livestock products to create new income opportunities. Activities also include improving forages and other feed technologies, conservation agriculture, community-based livestock breeding programs, and protected (greenhouse) agriculture.

Social, Economic and Policy Research (SEPR)

This program aims to provide insights on rural poverty, livelihood strategies, and gender and youth issues to more effectively target research and development investments and accelerate technology adoption.

SEPR scientists provide poverty mapping, value-chain and market analysis, and policy and institutional options in agriculture. Adoption and impact studies help identify barriers to the adoption of new technologies, informs the design of research and development programs, and provides quantitative evidence of the returns to research investments.

CONTRIBUTING TO CGIAR GLOBAL RESEARCH PROGRAMS

ICARDA's research-for-development activities are intimately linked to CGIAR global research programs. The Center contributes to a total of 10 research programs, leading the one on Dryland Systems and providing outputs and outcomes toward 9 other research programs.

ICARDA is lead center for:

- Dryland Systems

ICARDA is a partner in:

- Policies, Institutions and Markets
- Grain Legumes
- Dryland Cereals
- Livestock and Fish
- Agriculture for Nutrition and Health

CIMMYT & ICARDA work together on:

- Wheat
- Water, Land and Ecosystems
- Climate Change, Agriculture and Food Security
- Managing and Sustaining Crop Collections

Audited Financial Summary

Statement of Activity (US\$x1000)

	2013	2012
REVENUES		
Grants (Core and Restricted)	61,045	43,509
Other revenues and gains	1,939	1,457
Total revenues and gains	62,984	44,966
EXPENSES AND LOSSES		
Program related expenses	61,887	42,943
Management and general expenses	6,417	4,968
Other losses and expenses	-	-
Total expenses and losses	68,304	47,911
Indirect costs recovery	(6,574)	(3,961)
Net Expenses and Losses	61,730	43,950

Net Surplus from Ordinary Activities	1,254	1,016
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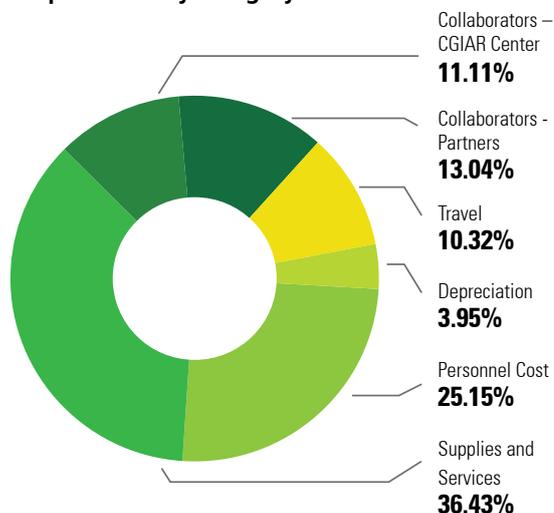
Extra-Ordinary Expenses	(6,732)
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Overall Surplus (Deficit)	1,254	(5,716)
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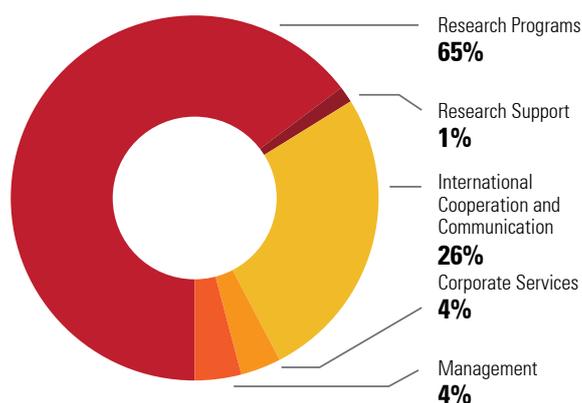
Statement of Financial Position (US\$x1000)

	2013	2012
ASSETS		
Current assets	44,210	36,440
Property & equipment	2,499	1,780
Other Assets	-	-
Total assets	46,709	38,220
LIABILITIES AND ASSETS		
Current liabilities	35,691	25,901
Long term liabilities	65	2,620
Total liabilities	35,756	28,521
Net Assets = Reserves	10,953	9,699
Total liabilities & net assets	46,709	38,220

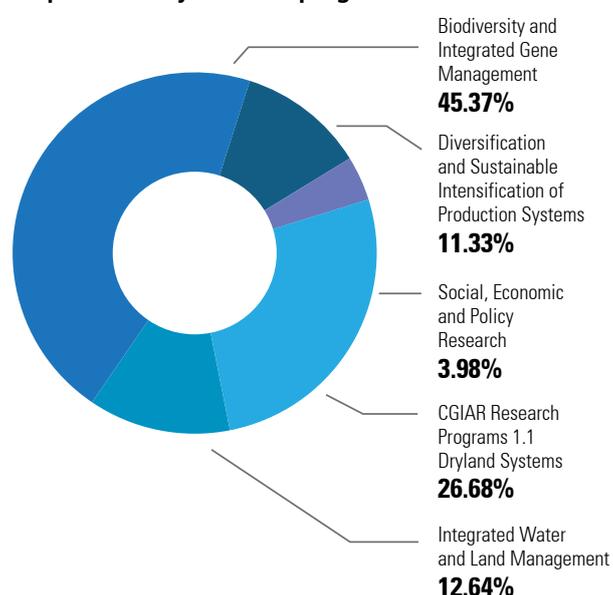
Expenditure by category



Expenditure by programs and activities



Expenditure by research programs



Statement of Grant Revenues, 2013 (US\$x1000)	
DONORS	Amount
Arab Fund for Economic and Social Development (AFESD)	1,697
Australia	4,913
Cornell University	318
European Commission	1,477
Germany	781
Global Crop Diversity Trust (GCDT)	1,470
Grains Development and Research Center (GRDC)	750
Gulf Cooperation Council (GCC)	539
India	936
International Center for Tropical Agriculture (CIAT)	1,007
International Crop Research Institute for Semi-Arid Tropics (ICRISAT)	5,607
International Development Research Center (IDRC)	344
International Food Policy Research Institute (IFPRI)	420
International Fund for Agricultural Development (IFAD)	3,375
International Institute of Tropical Agriculture (IITA)	1,979
International Livestock Research Institute (ILRI)	750
International Maize and Wheat Improvement Center (CIMMYT)	2,565
International Water Management Institute (IWMI)	888
Italy	429
Japan	550
Kuwait Fund for Arab Economic Development (Kuwait Fund)	354
Libya - Agricultural Research Center	3,152
Syria*	423
The Consortium of International Agricultural Research Centers (CIARC)	11,785
The Netherlands	379
The OPEC Fund for International Development	336
United States Agency for International Development (USAID)	8,666
United States Department of Agriculture (USDA)	1,762
Miscellaneous	3,393
TOTAL	61,045

* Donor that provided core funds

Honors and Awards in 2013



Mahmoud Solh,
Director General
*Life Time Achievement
Award by the International
Commission of Dryland
Development*



Bill Payne, Director, CGIAR Global Research Program on Dryland Systems

- 2013 Fellow of the Crop Science Society of America, USA
- One of three global experts appointed to the UNCCD panel on combatting desertification



Chandrashekhara Biradar,
Head, Geoinformatics Unit
*Outstanding Young Scientist
Award, Association of Agri-
cultural Scientists of Indian
Origin (AASIO), USA*



Mounir Louhaichi, Rangeland Management, Diversification and Sustainable Intensification of Production Systems
Nominated as Deputy General Coordinator for the FAO-ICARDA International Cooperation Network on Cactus Pear (CACTUSNET)



Theib Oweis, Director, Integrated Water & Land Management
"Outstanding Research Contribution for the Development of Drylands" by the International Commission of Dryland Development



Jozef Turok, Regional Coordinator, Central Asia and Caucasus Regional Program
OIV Prize 2013 from the International Organisation of Vine and Wine for the book, "Caucasus and Northern Black Sea Ampelography" by Maghradze, D., Rustioni, L., Turok, J., Scienza, A. and Failla, O. 2012



(From left to right) **Dhehibi Boubaker, Roberto Telleria and Aden Aw-Hassan**, Social, Economic and Policy Research Program

Paper on "Impacts of Public, Private, and R&D Investments on Total Factor Productivity Growth in Tunisian Agriculture" awarded second best paper among 300 entries at the 4th International Conference of the African Association of Agricultural Economists

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Dr. S. Ayyappan

Director General of the Indian Council of Agricultural Research

Ministry of Agriculture of India

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Senior Partner, F & N Consultancy, Kuwait

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President and Director General

Lebanese Agricultural Research Institute

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Dr. Mohammed Badraoui

Director

Institut National de la Recherche

Agronomique, Morocco

Expertise: Agronomy

Sweden

Dr. Carl-Gustaf Thornström

Associate Professor, Department of Plant

Biology and Forest Genetics

Swedish University of Agricultural

Sciences

Expertise: Genetic Resources, Intellectual Property Rights

Switzerland

Dr. Paul Steffen

Director, Agroscope Reckenholz-Tanikon

Research Station

Zurich, Switzerland

Expertise: Agronomy, Research Management and Policy

Syria

Mr. Nader Sheikh Ali

Director General, International Cooperation Division

State Planning Commission, Syria

Expertise: Economics and Planning

Dr. Hussein Alzubi

Director General, General Commission for Scientific

Agricultural Research

Ministry of Agriculture and Agrarian Reform, Syria

Expertise: Agriculture, Plant Breeding

Turkey

Dr. Masum Burak

Director General of Agricultural Research

Ministry of Agriculture and Rural Affairs,

Turkey

Expertise: Horticulture

USA

Dr. Susan Schram

Vice President, Outreach and Cooperative Programs

Agricultural Coop. Development

International/Volunteers in Overseas

Cooperative Assistance (ACDI/VOCA), USA

Expertise: International Agriculture, Rural Development

Donors and Investors

MAJOR DONORS IN 2013

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Australia (incl. ACIAR, AusAid, GRDC)
USA (incl. USAID, USDA)
World Bank
International Fund for Agricultural Development (IFAD)
The Netherlands
Arab Fund for Economic & Social Development (AFESD)
India
Kuwait Fund for Arab Economic Development
African Development Bank (AfDB)
European Union (EU)
Germany (incl. GIZ)
Gulf Cooperation Council (GCC)
Libya
Austria
Egypt
Syria
Japan (incl. JICA, JIRCAS)
Food and Agriculture Organization (FAO)
Morocco
Mexico
China
Italy
Cornell University
Global Crop Diversity Trust (GCDDT)
Islamic Development Bank
Turkey
Iran
OPEC Fund for International Development (OFID)
Canada (incl. IDRC)
OCP Foundation
Common Fund for Commodities (CFC)

MAJOR DONORS, CUMULATIVE 1977 TO 2013

USA (incl. USAID, USDA)
World Bank
Germany
United Kingdom
IFAD
Netherlands
Arab Fund for Economic & Social Development (AFESD)
Kuwait Fund for Arab Economic Development
African Development Bank (AfDB)
European Union (EU)
Italy
Australia (incl. ACIAR, AusAid, GRDC)
Canada (incl. IDRC)
CGIAR (incl. Consortium and Challenge Programs)
Sweden
Norway
Desertification Trust Fund
Iran
Libya ARC
Japan (incl. JICA, JIRCAS)
UNDP
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OPEC Fund for International Development (OFID)
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Belgium
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Food and Agriculture Organization (FAO)
Asian Development Bank
Gulf Cooperation Council (GCC)
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Turkey
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UNEP
UNCCD
Islamic Development Bank
Ethiopia
Finland
South Africa
Mexico
Peru

Donors by Regional & Country Programs

Nile Valley and Sub-Saharan Africa

- United States Agency for International Development (USAID)
- International Fund for Agricultural Development (IFAD)
- Australian Centre for International Agricultural Research (ACIAR)
- African Development Bank (AfDB)
- Islamic Development Bank (IsDB)
- Arab Fund for Economic and Social Development (AFESD)
- Kuwait Fund for Arab Economic Development (KFAED)
- International Development Research Center (IDRC), Canada
- Austria Development Agency
- Government of Egypt

North Africa

- Ministry of Agriculture, Libya
- African Development Bank (AfDB)
- International Fund for Agricultural Development (IFAD)
- Australian Agency for International Development (AusAID)
- Ministry of Agriculture, Morocco
- OCP Foundation Morocco
- Arab Fund for Economic and Social Development (AFESD)
- Food and Agriculture Organization of the United Nations (FAO)
- European Union (EU)

West Asia

- International Fund for Agricultural Development (IFAD)
- Arab Fund for Economic and Social Development (AFESD)
- Netherlands Government
- United Nations Development Programme (UNDP)
- United States Agency for International Development (USAID)
- Japan International Cooperation Agency (JICA)
- Australian Agency for International Development (AusAID)
- Australian Centre for International Agricultural Research (ACIAR)
- European Union (EU)

Arabian Peninsula

- Arab Fund for Economic and Social Development (AFESD)
- International Fund for Agricultural Development (IFAD)
- OPEC Fund for International Development (OFID)
- Gulf Cooperation Council Secretariat

Central Asia and the Caucasus

- International Fund for Agricultural Development (IFAD)
- Food and Agriculture Organization of the United Nations (FAO)
- Asian Development Bank
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany
- Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Germany
- Osrodek Studiów Wschodnich, Russia

South Asia and China

- National Food Security Mission, India
- Ministry of Agriculture, India
- Indian Council of Agricultural Research
- Indian Ministry of Agriculture
- CGIAR Research Program-Grain Legumes
- CGIAR HarvestPlus Challenge Program
- OPEC Fund for International Development (OFID)
- OCP Foundation, Morocco

Turkey

- Government of Turkey
- International Center for Agricultural Research in the Dry Areas (ICARDA)
- International Maize and Wheat Improvement Center (CIMMYT)

Iran

- Agricultural Research, Education and Extension Organization, Islamic Republic of Iran

Afghanistan

- Ministry of Agriculture, Irrigation and Livestock, Afghanistan
- International Fund for Agricultural Development (IFAD)
- Australian Centre for International Agricultural Research (ACIAR)
- Australian Agency for International Development (AusAID)
- Netherlands Government
- Government of India

Pakistan

- United States Department of Agriculture (USDA)
- Australian Centre for International Agricultural Research (ACIAR)

ICARDA is distributing nurseries of its mandated crops – wheat, barley, faba bean, lentil, chickpea and grass pea – to countries worldwide from its new research facility in Terbol, Lebanon, established in partnership with the Lebanese Agricultural Research Institute and American University of Beirut. The Center’s headquarters for nurseries and trials in Tel Hadya, Syria, continues to operate in a limited role.



Appendix 1: ICARDA Genebank's Global Services and Achievements

Crop	Variety	Country	Adaptation and key traits
Bread wheat			
	Shisham Bagh 013	Afghanistan	Irrigated; Ug99 & yellow rust resistant
	Dehdadi 013	Afghanistan	Irrigated; Ug99 & yellow rust resistant
	Guhar	Afghanistan	Rainfed
	Koohdasht	Afghanistan	Rainfed
	Zagras	Afghanistan	Rainfed
	Adel 6	Ethiopia	Irrigated; high yield potential, heat tolerance, and moderate tolerance to salinity
	Nejmah14*	Ethiopia	Irrigated; high yield; heat tolerance, moderate tolerance to salinity
	Goumria	Sudan	
Durum wheat			
	Azeghar-2 (Lahn 3)	Lebanon	High yield; yellow rust resistant
	Mikki 3 (Berdawni)	Lebanon	Drought tolerant
	ICRASHA1 (Ghzayyel)	Lebanon	High yield
Winter wheat			
	Tak-Ab	Iran	High Yield YR resistant
Barley			
	Balkh 013	Afghanistan	High yield; drought tolerant
	Shamal 013	Afghanistan	High yield; drought tolerant
	Gudratli 48	Azerbaijan	Winter barley; drought & frost tolerant; brown rust tolerant
	Garabakh33	Azerbaijan	Moderately resistant to cold; frost resistant, loose smut resistant
	Yundamai1	China	High yield
	Yundamai2	China	High yield
	Yundamai4	China	High yield
	Yundamai5	China	High yield
	Yundamai6	China	High yield
	Kendal	Turkey	Spring barley (six row) ; high yielding
Faba bean			
	Gora	Ethiopia	Large seeded; high yield; chocolate spot resistance
	Shendi	Sudan	Large seeded; high yield; terminal heat tolerance
	Marawi	Sudan	Large seeded; high yield; terminal heat tolerance
Chickpea			
	Rabat 013	Afghanistan	Winter type; high yield; short duration
	Baghlan 013	Afghanistan	Spring type; high yield; short duration
	Sultan	Azerbaijan	Winter type; Ascochyta tolerant; drought tolerant
	FLIP97-7C	Lebanon	High yield; drought tolerant

FLIP97-706C	Lebanon	High yield; drought tolerant
Ghab5	Lebanon	High yield; drought tolerant
Hasanbey	Turkey	Winter type; Ascohyta blight tolerant (submitted for registration in 2013)
Seckin	Turkey	Winter type; Ascohyta blight tolerant (submitted for registration in 2013)
Arda	Turkey	Winter type; Aschoyta blight tolerant
Lentil		
Binamasur-7	Bangladesh	SB & rust tolerant
Dembi	Ethiopia	Rust resistance
IPL316	India	Large seeded; Rust & fusarium wilt resistance
VL Masoor 516	India	Fusarium wilt & rust resistance
Boulifa	Tunisia	Red cotyledon; high yield; medium seed size; wilt resistance
Bozok	Turkey	Spring type; yellow cotyledon
Gümrah	Turkey	Spring type; yellow cotyledon
Karagül	Turkey	Spring type, yellow cotyledon
Tigris	Turkey	Winter type; red cotyledon

**CIMMYT/ICARDA origin*

Summary of Nurseries Distributed for 2013-14 Cropping Season

Crop	Countries	Collaborators	No of sets available	Number of sets distributed
Bread wheat	26	39	5	204
Durum wheat	21	31	2	106
			7	310
Barley	32	54	9	339
Faba bean	25	31	8	143
Chickpea	27	43	13	340
Lentil	26	36	13	254
Grass pea	19	24	4	68
			38	805
Total	45	106	54	1454

Appendix 2: Scientific Publications

Papers in ISI Journals

- Abbeddou, S., J. Diekmann, B. Rischkowsky, M. Kreuzer, and A. Oberson. 2013. Unconventional feeds for small ruminants in dry areas have a minor effect on manure nitrogen flow in the soil-plant system. *Nutrient Cycling in Agroecosystems* 95(1):87-101.
- Abdelali, M., B. Dhehibi, and A. Aw-Hassan. 2013. Determinants of small scale dairy sheep producers' decisions to use middlemen for accessing markets and getting loans in dry marginal areas in Syria. *Experimental Agriculture* 50(3):438-457.
- Abdolvahab, A., R. Mohammadi, J. Rizvi, M. Singh and R. Haghparast. 2013. Weed suppressing ability of different bread wheat genotypes in drylands of western Iran. *Indian Journal of Agricultural Research* 47(6):510-516.
- Ahmed, S., M.M. Abang, and F. Maalouf. 2013. Integrated management of Ascochyta blight (*Didymella fabae*) on faba bean in northern Syria. *Phytopathologia Mediterranea* 52(1):233.
- Ahmed, S., and M. Imtiaz. 2013. Effects of temperature on virulence of *Didymella rabiei* pathotypes affecting chickpea. *Phytopathologia Mediterranea* 52(1):224.
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- Ansari-Renani, H.R., J.P. Mueller, B. Rischkowsky, S.M. Seyed Momen, M. Ehsani, and S. Moradi. 2013. Observations on the efficiency of using different cashmere combs. *Small Ruminant Research* 114(2-3):220-224.
- Asaad, S., S. Koudsieh, and D. Najjar. 2013. Improved method for detecting *Ustilago nuda* in barley seed. *Archives of Phytopathology and Plant Protection*. 47(2):194-156.
- Ates, S., D. Feindel, A. El Moneim, and J. Ryan. 2013. Annual forage legumes in dryland agricultural systems of the West Asia and North Africa regions: research achievements and future perspective. *Grass and Forage* 69:17-31.
- Ates, S., S. Isik, G. Keles, A.H. Aktas, M. Louhaichi, and V. Nangia. 2013. An evaluation of deficit irrigation for efficient sheep production from permanent sown pastures in a dry continental climate. *Agricultural Water Management* 119:135-143.
- Atik, O., S. Ahmed, M. Abang, M. Imtiaz, A. Hamwieh, M. Baum, A. El-Ahmed, S. Murad, and M. Yabrak Mohammad. 2013. Pathogenic and genetic diversity of *Didymella rabiei* affecting chickpea in Syria. *Crop Protection* 46:70-79.
- Bakyawa, J., D. Serwadda, M. Devlin, and C. IJsselmuiden. 2013. Implementing a health research communication program in a low resource country: Experience from Uganda's Makerere University School of Public Health. *Scholarly and Research Communication* 4(2):1-20.

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- Belete, E., A. Ayalew, and S. Ahmed. 2013. Associations of biophysical factors with faba bean root rot (*Fusarium solani*) epidemics in the northeastern highlands of Ethiopia. *Crop Protection* 52:39-46.
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[Authors, book, chapter. publisher. page no.]

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Appendix 3: Senior Staff at ICARDA

Note: List is as of December 31, 2013

Italic: Staff departed during 2013



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Dr. Mahmoud Solh, Director General
 Dr. Elizabeth Bailey, Executive Assistant to the Director General and Board Secretary
 Mr. Raymond Melbourne Davies, Consultant - Internal Auditor
 Dr. William Albert Payne, Director - CGIAR Research Program on Dryland Systems
 Ms. Houda Nourallah, Administrative Officer - DG
 Mr. Wael Tabbarah, Consultant – Legal

OFFICE OF THE DEPUTY DIRECTOR GENERAL - RESEARCH

Dr. Maarten van Ginkel, Deputy Director General - Research
 Mrs. Ourouba Zein el-Deen, Executive Secretary
 Dr. Murari Singh, Senior Biometrician
 Mr. Khaled Al-Sham'aa, Specialist - Experimental Research Informatics

GOVERNMENT LIAISON

Dr. Majd Jamal, Assistant Director General - Government Liaison

Mr. Mohamad Nabil Traboulsi, Assistant National Research Coordinator
 Ms. Zukaa Musattat, Executive Secretary

CORPORATE SERVICES

Mr. Koen Geerts, Assistant Director General - Corporate Services
 Ms. Hanaa Sharif Swar, Manager of Damascus Office
Mr. Waheed S. Quader, Head - Physical Plant Unit

FINANCE

Mr. Erwin Navarro Lopez, Director of Finance
 Mrs. Imelda Silang, Financial and Management Reporting Manager
 Mrs. Noujoud Nouheily, Assistant Manager - Treasury and Fixed Assets
 Mr. Mohamed Samman, Treasury Supervisor
 Mrs. Nathalie Saouma Issa, Senior Project Accountant
 Mr. Ghiath Nahas, Senior Accounting Supervisor
 Miss Nora Boyajian, Senior Project Accountant
 Miss Ralda Gareg, Budget Officer
 Mr. Munzer Kastaly, Accounting Supervisor
 Mrs. Maha Oulad Benchiba, Finance Officer

HUMAN RESOURCES (HR)

Miss Khar Hoay Tan, Consultant - Acting Director of Human Resources

Mr. S.S. Sharat Kumar, Director of Human Resources

Ms. Lina Yazbek, Administrator - HR Services

Ms. Mary Malki, Specialist - Compensation & Benefits

Ms. Mouna Rustom, Administrator - Program Assistant/ Outreach

PURCHASING & SUPPLIES

Ms. Dalida Nalbandian, PSD Manager

Miss Lobna Al-Fahili, Administrator - Procurement

Ms. Nahla Assal, Supervisor - Procurement

INTERNATIONAL SCHOOL OF ALEPPO

Mrs Shirley Ann Davis-Phillips, School Head

Miss Raghad Rahwan, Executive Secretary

STATION OPERATIONS

Mr. Antoine Shomar, Assistant Farm Manager

Dr. Hassan Machlab, Lebanon Country Manager

VISITORS SERVICES

Ms. Hiba Eimesh, Travel Coordinator

RESEARCH PROGRAMS

Biodiversity and Integrated Gene Management (BIGM)

Dr. Michael Baum, Director, Biodiversity and Integrated Gene Management Program

Dr. Ahmed Amri, Head of GRS/Deputy Director of BIGM

Dr. Adnan Al-Yassin, Barley Breeder

Dr. Seid-Ahmed Kemal, Pulse Pathologist

Dr. Wuletaw Tadesse Degu, Senior Scientist - Spring Bread Wheat Breeding

Dr. Mohamed Kharrat, Coordinator for Wheat-Legume Systems project in WANA

Dr. Zewdie Bishaw, Head - Seed Unit

Dr. Masanori Inagaki, JIRCAS Scientific Representative

Dr. Quahir Sohail, PDF - Spring Wheat Breeding

Dr. Shiv Kumar Agrawal, Lentil Breeder

Dr. Kumarse Nazari, Cereal Pathologist

Dr. Fouad Maalouf, Faba Bean Breeder

Dr. Sajid Rehman, PDF - Cereal Pathology

Dr. Safaa Kumari, Plant Virologist

Dr. Abdoul Aziz Niane, Scientist

Dr. Andrea Visioni, PDF - Barley Breeding

Dr. Siham Asaad, Head of ICARDA Seed Health Laboratory

Dr. Mariana Yazbek, PDF - Genetics Resources

Dr. Osman Abdalla El Nour, Consultant - Bread Wheat Breeder

Dr. Aladdin Hamwieh, Associate Scientist - Chickpea Breeding

Dr. Miguel Sanchez Garcia, PDF - Spring Wheat Breeding

Dr. Miloudi Nachit, Durum Wheat Breeder

Dr. Mustapha El-Bouhssini, Entomologist

Dr. Sripada M. Udupa, Senior Scientist, Biotechnology

Dr. Filippo Maria Bassi, Associate Scientist - Durum Breeder

Dr. Abdullah Bari, Genetic Resources Scientist

Dr. Sanjaya Gyawali, Barley Breeder

Dr. Michel Edmond Ghanem, Associate Scientist - Wheat Breeding and Biotechnology

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Dr. Ramesh Pal Singh Verma, Barley Breeder - High Input Environments

Dr. Karthika Rajendran, PDF - Lentil Breeding

Dr. Ayed Al Abdallat, Senior Biotechnologist

Mr. Mohammed El Hadi Maatougui, Consultant - PPB Eriteria-Italy

Mr. Mohamed Fawzy Nawar, Documentation Specialist

Dr. Ali Shehadeh, Associate Scientist - Curator of Range Forage Species

Ms. Fida Alo, Research Associate

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Mr. Samer Murad, Research Associate - Spring Bread Wheat Breeding

Mr. Tawffiq Istanbuli, Research Associate

Mr. Fawzi Sweid, Research Associate

Mr. Mohammed Amer Jnedan, Research Associate - Spring Barley Breeding

Mr. Fouad Jabi El-haramein, Research Associate

Mr. Hasan Al-Hasan, Research Associate

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Mr. Ali Abdullah Ismail, Research Associate
Mr. Samer Murad, Research Associate
Mr. Samer Lababidi, Geneticist
Mr. Samir Hajjar, Training Coordinator
Mr. Munzer Alnaimi, Research Associate
Mr. Adonis Kourieh, Research Associate

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 Dr. Akmal Akramkhanov, Project Manager - Knowledge Management in CACILM II
 Dr. Yaser Mhawish, Project Watershed/Water Scientist
 Dr. Mohammed Karrou, Water and Drought Management Specialist
 Dr. Debra Turner, Senior Soil Fertility Specialist
 Dr. Richard Willem Otto Soppe, Senior Water and Salinity Management Specialist
 Dr. Vinay Nangia, Agricultural Hydrologist
 Dr. Atef Swelam, Project Coordinator - Nile Delta Project
 Dr. Feras Ziadat, Soil Conservation/Land Management Specialist
 Mr. Kristofer Dodge, Coordinator - Water and Livelihoods Initiative
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Dr. Caroline King, Manager Middle East Water & Livelihood Initiative

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Acronyms and Abbreviations

AARINENA	Association of Agricultural Research Institutions in the Near East and North Africa
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AfDB	African Development Bank
AFESD	Arab Fund for Economic and Social Development
APRP	Arabian Peninsula Regional Program
AREEO	Agricultural Research, Education and Extension Organization, Iran
AusAID	Australian Agency for International Development
BMU	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Germany
CAC	Central Asia and Caucasus
CIMMYT	International Maize and Wheat Improvement Center
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement (France)
CRP	CGIAR Research Program
CWANA	Central and West Asia and North Africa
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit, Germany
ICAR	Indian Council of Agricultural Research
ICARDA	International Center for Agricultural Research in the Dry Areas
ICBA	International Center for Biosaline Agriculture
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre (Canada)
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IPCC	Intergovernmental Panel on Climate Change
IsDB	Islamic Development Bank
JICA	Japan International Cooperation Agency
KFAED	Kuwait Fund for Arab Economic Development
MoU	Memorandum of Understanding
NARS	National agricultural research systems
NCARE	National Center for Agricultural Research and Extension (Jordan)
OFID	OPEC Fund for International Development
OPEC	Organization of the Petroleum Exporting Countries
OSW	Osrodek Studiów Wschodnich, Russia
SWAT	Soil and Water Assessment Tool
UAE	United Arab Emirates
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
USDA	United States Department of Agriculture, USA
WANA	West Asia and North Africa

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p. 12.....	Mohamed Kharrat
p. 13.....	Aqeel Hasan Rizvi
p. 14.....	Javed Rizvi and Naeem Azimi
p. 16.....	Svetlana Balalaeva for ICARDA
p. 17.....	Muhi Hilali
p. 18.....	Communications Team
p. 20.....	Ethiopia rainfed project
p. 21.....	David Feindel
p. 22.....	Arash Nejatian
p. 23.....	Theib Oweis
p. 24.....	Communications Team
p. 25.....	Mounir Louhaichi
p. 27.....	Stephen Loss (top), Atef Swelam (bottom)
p. 28.....	Communications Team
p. 29.....	Stefanie Christmann
p. 31.....	Theib Oweis (top), Shiv Agrawal (bottom)
p. 33.....	Ram Sharma (bottom)
p. 34.....	I. A. Sheikh for ICARDA (top), Rajita Majumdar (bottom)
p. 35.....	Hamidreza Ansari Renani for ICARDA (top), Afghanistan Team (middle), Pakistan Team (bottom)
p. 36.....	Aladdin Hamwiah
p. 37.....	HSAD Team
p. 38.....	Communications Team
p. 46.....	Michael Devlin



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