

ANNUAL REPORT 2017



Pathways to impact for building thriving
and resilient communities in dry areas

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A CGIAR Research Center

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ANNUAL REPORT 2017

Pathways to impact for
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communities in dry areas



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Foreword: joint message from the Director General and the Board Chair

A bold vision for dry areas

Widespread heat waves, floods, and droughts last year were a strong reminder of the threats posed by climate change. In the non-tropical dry areas where ICARDA works we are becoming accustomed to record high temperatures and increasing water scarcity year on year – a new reality that requires innovative solutions to strengthen the resilience of rural communities.

Resilience and climate change adaptation are at the heart of ICARDA's new Strategic Plan 2017-2026 – a bold and ambitious effort to harness cutting-edge science and deliver the tools and technologies that smallholder farmers need to maintain agricultural production and protect their livelihoods.

The Strategic Plan's implementation last year saw ICARDA research activities aligned to five strategic priorities and four cross-cutting research themes (see the feature 'A new strategic direction for ICARDA' on page 2), complementing the national development priorities of the countries we work in, the wider Sustainable Development Goals (SDGs) Agenda for 2030, and the CGIAR's Strategy and Results Framework 2016-2030.

Launched in the year when ICARDA celebrated its 40th anniversary, the new Strategic Plan builds on four decades of past achievements and successful partnerships. It is also demand driven and targets critical components of sustainable dryland food production systems, including climate-resilient crop and livestock varieties; proven agronomic practices that enhance the sustainable management of natural resources; viable value chains; and improved technology transfer strategies. The result: higher and more stable production, sustainable natural resource management, increased incomes, and food and nutritional security.

Last year, the Center's activities included the development and dissemination of heat-tolerant durum wheat varieties that are now thriving in land left

fallow by rice farmers in the Senegal River Basin; new approaches to water harvesting in Jordan that combine indigenous knowledge and mechanization to enhance effectiveness; an initiative in Tunisia that is improving our knowledge of effective technology transfer strategies; and efforts to raise the productive capacity of women in post-conflict Afghanistan.

We also enhanced the safety and long-term preservation of our unique and globally important genetic resources, depositing seeds in the Svalbard Global Seed Vault, and alongside the Crop Trust and CGIAR partners, contributing to a new global genebank infrastructure that protects the food and nutritional security of future generations.

Innovation, adaptation, and resilience are critical to the long-term viability of productive agriculture in dry areas. The bold and ambitious ideas driving our new strategic direction reflect this – and help us to learn from past experiences, anticipate future challenges, and deliver the tools that farmers and rural communities need to thrive.

Aly Abousabaa, ICARDA Director General & Margret Thalwitz, ICARDA Board Chair



Aly Abousabaa



Margret Thalwitz



A new strategic direction for ICARDA

ICARDA's new Strategic Plan 2017–2026 is harnessing cutting-edge scientific research to address the challenges that smallholder farmers face across dry areas. Demand driven and building on 40 years of experience, the strategy offers practical approaches to enhance food and nutritional security, halt or reverse resource degradation, and strengthen resilience and climate change adaptation.

The new strategy emerged after an extensive consultation process with key stakeholders and partners and a careful assessment of their needs and priorities – including national agricultural research systems (NARS), CGIAR centers, and donors.

It is aligned with national and international development priorities, including the national development plans of the countries we work in, the wider Sustainable Development Goals (SDGs) Agenda for 2030, and the Strategy and Results Framework 2016-2030 of the CGIAR system. It aims to spur innovation, transform agricultural production, and create thriving and resilient communities.

Last year was the strategy's first year of operation as the Center began to align its research activities to five strategic priorities and four cross-cutting research themes.

ICARDA'S STRATEGIC PRIORITIES:



Genetic resources: mining genes and adding novel diversity to develop superior germplasm that can withstand future climate- and market-related challenges, including traits of heat, drought, cold, and salinity tolerance, disease resistance, nutritional attributes, and water efficiency.



Adapting to climate change: using conventional and molecular breeding to develop climate-smart crops and livestock for greater food and nutritional security, and stronger resistance to pests and changing climates.



Building resilience: promoting integrated crop-livestock farming systems through the optimization of economic, social, and environmental conditions in resource-poor areas, and optimizing plant biomass for restoring soil health and for livestock feed.



Promoting value chains and policies: developing sustainable value chains, viable policies, and off-farm activities to diversify incomes, create income-generating businesses, and provide employment opportunities.



Enhancing water and land productivity: supporting the sustainable use of water and land resources through rainfed, irrigated, and agro-pastoral farming, and focusing on ecosystems and landscapes that offer opportunities to reverse environmental degradation, enhance intensification, and support livelihoods.

ICARDA'S STRATEGIC PRIORITIES ARE SUPPLEMENTED BY FOUR CROSS-CUTTING RESEARCH THEMES:



Scaling up proven technologies: promoting proven technologies, investing in partnerships, and seeking more engagement with agricultural research institutes, the private sector, NGOs, development agencies, and financial institutions to put knowledge into action.



Empowering women and youth: improving women's access to land, water, seeds, financial credit, and knowledge, and encouraging disenfranchised youth to consider a future in agriculture.



Building capacity: strengthening research capacity to develop an empowered cadre of researchers and thriving institutions in the dry areas, applying research in the field and engaging closely with smallholder farmers, making scientific expertise accessible, and providing research funding opportunities.



Big Data and ICT: using geoinformatics, remote sensing, and genomics to enhance research efficiencies and policy communications.

HIGHLIGHTS OF 2017

Strategic partnerships in India

At a regional coordination meeting for ICARDA's South Asia and China Regional Program in Delhi, Radha Mohan Singh, India's Minister of Agriculture, stressed the importance of the ICARDA-India partnership and its critical investments in pulse production and climate-resilient agriculture. ICARDA works with its partners in India to address challenges faced by the country's smallholder farmers.

Initiatives last year included the release of new, less toxic, varieties of grasspea, and pulse varieties that are rich in iron and zinc – helping to strengthen the food and nutritional security of the rural poor who often suffer from nutrition and iron deficiencies that can lead to anemia and growth impairment. Speaking at the coordination meeting Minister Singh looked forward to future collaborations: “We will continue to work together towards climate resilience, mechanization in pulses cultivation and processing, and improved seed replacement rates to fill technology adoption gaps in farmer fields.”

New e-learning platform

ICARDA's Capacity Development Unit launched a new e-learning platform that offers stand-alone e-learning courses as well as additional content for face-to-face training. The platform gives ICARDA trainees a new learning experience and leverages modern technologies to enhance teaching, learning, and professional

147 PARTNERSHIP
AGREEMENTS
SIGNED OR
RENEWED



81 ISI JOURNAL
ARTICLES
PUBLISHED



750+ TRAINEES
BENEFITED FROM
TRAINING
COURSES



development. The platform also addresses the challenge of targeting diverse trainees from different regions and different time zones. Currently, some 33 courses are available online in English and French.

Capacity development is a core priority of ICARDA, strengthening the capacity of individual researchers, institutions, and NARS to improve the sustainable productivity of agricultural systems through crop improvement, water and land management, integrated crop-livestock-rangeland management, and climate change adaptation. The e-learning platform can be accessed at: <http://elearning.icarda.org>

Strengthening presence in Cairo

ICARDA consolidated its presence in Egypt with the opening of a second office in Cairo, enhancing partnerships and improving the delivery of new technologies and sustainable solutions to the country's resource-poor farmers. The office combines both research and support functions. A research team will serve ICARDA's global programs and Nile Valley and Red Sea Regional Program, which strategically aligns research activities with Sudan, Eritrea, and Yemen, and a new thematic research platform for sustainable intensification in irrigated systems. Support staff, including those from finance, communications, and donor relations, will serve ICARDA's strategic priorities in Egypt and internationally.

Responding to the move, Dr. Mahmoud Medany, Director of Egypt's Agricultural Research Center (ARC), said: “We welcome ICARDA's decision to expand its operations in Egypt. ICARDA's strategic direction complements our own: prioritizing the development of

126 RESEARCH PROJECTS IMPLEMENTED IN 28 COUNTRIES

new technologies and solutions that will help Egypt's farmers prosper while strengthening their adaptation to climate change. We look forward to more collaborations and an even stronger partnership over the coming years."

Promoting solutions to reverse land degradation

ICARDA participated in discussions at the 13th session of the United Nations Convention to Combat Desertification (UNCCD), presenting practical solutions and strategies to reverse land degradation across dry areas. Held in Ordos, Inner Mongolia, China, from 6 to 16 September, the forum brought together experts and decision-makers from 196 countries to plan coordinated responses to emerging trends such as forced migration, and to agree on the actions needed to strengthen the resilience of drought-vulnerable communities.

ICARDA organized a side event with the Food and Agriculture Organization of the United Nations (FAO) on land resources planning, which introduced several new tools that countries can adopt to achieve Land Degradation Neutrality (LDN). The Center also contributed to an event organized by the African Initiative for Combating Desertification, a multi-partner initiative that is designed to reverse desertification and strengthen resilience to climate change in the Sahel and Horn of Africa.

2,490 BREEDING LINES
DISTRIBUTED TO PARTNERS IN **51 COUNTRIES**



37 ICARDA CROP VARIETIES
RELEASED BY NATIONAL PARTNERS



Safeguarding genetic resources

Last year ICARDA deposited accessions from its 2016 seed harvest into the Svalbard Global Seed Vault for long-term safekeeping – ensuring that these unique genetic materials will continue to play a critical role in the development of climate-resilient crops. The Center deposited over 31,000 seed samples of wheat, barley, faba bean, chickpea, and grasspea in the vault. The Svalbard Global Seed Vault is a secure facility located 1,300 km south of the North Pole in Norway. It currently holds more than 880,000 samples from 73 genebanks around the world, and contains seeds from almost every country in the world.

26,000+ PLANT ACCESSIONS REGENERATED



Promoting water-saving technologies for the Near East and North Africa

ICARDA announced its involvement in a new four-year project to streamline the use of affordable water-saving technologies in the Near East and North Africa (NENA). The initiative – “Implementing the 2030 Agenda for Water Efficiency/Productivity and Water Sustainability in NENA Countries” – is led by FAO and the Swedish International Development Cooperation Agency. ICARDA will contribute to the development and dissemination of new technologies to help tackle the region’s chronic water scarcity.

Speaking at the initiative’s launch in Cairo, ICARDA’s Director General, Mr. Aly Abousabaa, said: “As a world leader in assessing and improving water productivity in dry areas, ICARDA will deploy its experience in the region to promote sustainable water use technologies in target sites to enhance water productivity and reduce water loss through unproductive evaporation.”

758 PUBLICATIONS AND DATASETS



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53062837
83613740



Conserving and utilizing genetic resources

Efforts to develop and conserve our unique collection of genetic resources will help secure the food and nutritional security of millions of vulnerable people across dry areas.

ICARDA's seed collection contains over 155,400 samples of major winter cereals, food legumes, forage, and rangeland species, most drawn from regions where the earliest known crop domestication practices were recorded, including the Fertile Crescent in West Asia, the Abyssinian Highlands in Ethiopia, and the Mediterranean region. These collections include large numbers of landraces no longer found in current farming systems.

These unique genetic resources provide the essential building blocks of improved climate-resilient crops – our best chance of enhancing food and nutritional security

while coping with the adverse impacts of climate change, including drought, extreme temperatures, and the emergence of pests and disease in new locations.

In 2017, ICARDA continued to develop and expand its decentralized genebank infrastructure, including improvements to recently constructed facilities in Lebanon and Morocco. This decentralized approach has helped enhance the efficiency of ICARDA's seed distribution systems, and through open access initiatives, we have made our data on genetic resources widely available through the genebank portal Genesys.

SELECTED ACTIVITIES AND INITIATIVES

Securing the long-term conservation of ICARDA's genetic resources

Since withdrawing seed from the Svalbard Global Seed Vault in 2015, ICARDA successfully regenerated 38,000 accessions – including more than 26,000 during the 2016/17 cropping season – and deposited over 31,000 accessions back into the vault for long-term security. The launch of an online database last year improved data management, and the utilization of a bar-coding system helped to process and monitor our plant genetic resources more efficiently.

Supporting the development of resilient crops

Accurate evaluations of ICARDA accessions helped to identify superior genetic material for the development of resilient crops, providing invaluable support to crop breeders at ICARDA and partner organizations such as INRA-Morocco and NORDGEN. Efforts in 2017 included evaluating grasspea accessions for orobanche tolerance and low toxin content; evaluating lentil and wild chickpea accessions for fusarium wilt resistance; screening for high beta-glucans in wild *Hordeum spontaneum* barley; and evaluating *Hordeum bulbosum* barley introgression lines for resistance to a range of biotic and abiotic stresses.

Distributing seed samples to global partners

In 2017, more than 8,100 seed samples were distributed from ICARDA's genebank in Lebanon and Morocco to more than 47 partners in 12 countries. Identified using the Focused Identification of Germplasm Strategy (FIGS), a scientifically proven tool that helps to identify useful traits in plant genetics more accurately and efficiently, these samples are adapted to local conditions and help national partners face challenges that threaten agricultural productivity in their own environments.

KEY IMPACTS IN 2017

>8,100

seed samples were distributed to more than 47 partners in 12 countries

>26,000

accessions were regenerated in the 2016/17 cropping season

>31,000

accessions were deposited in the Svalbard Global Seed Vault

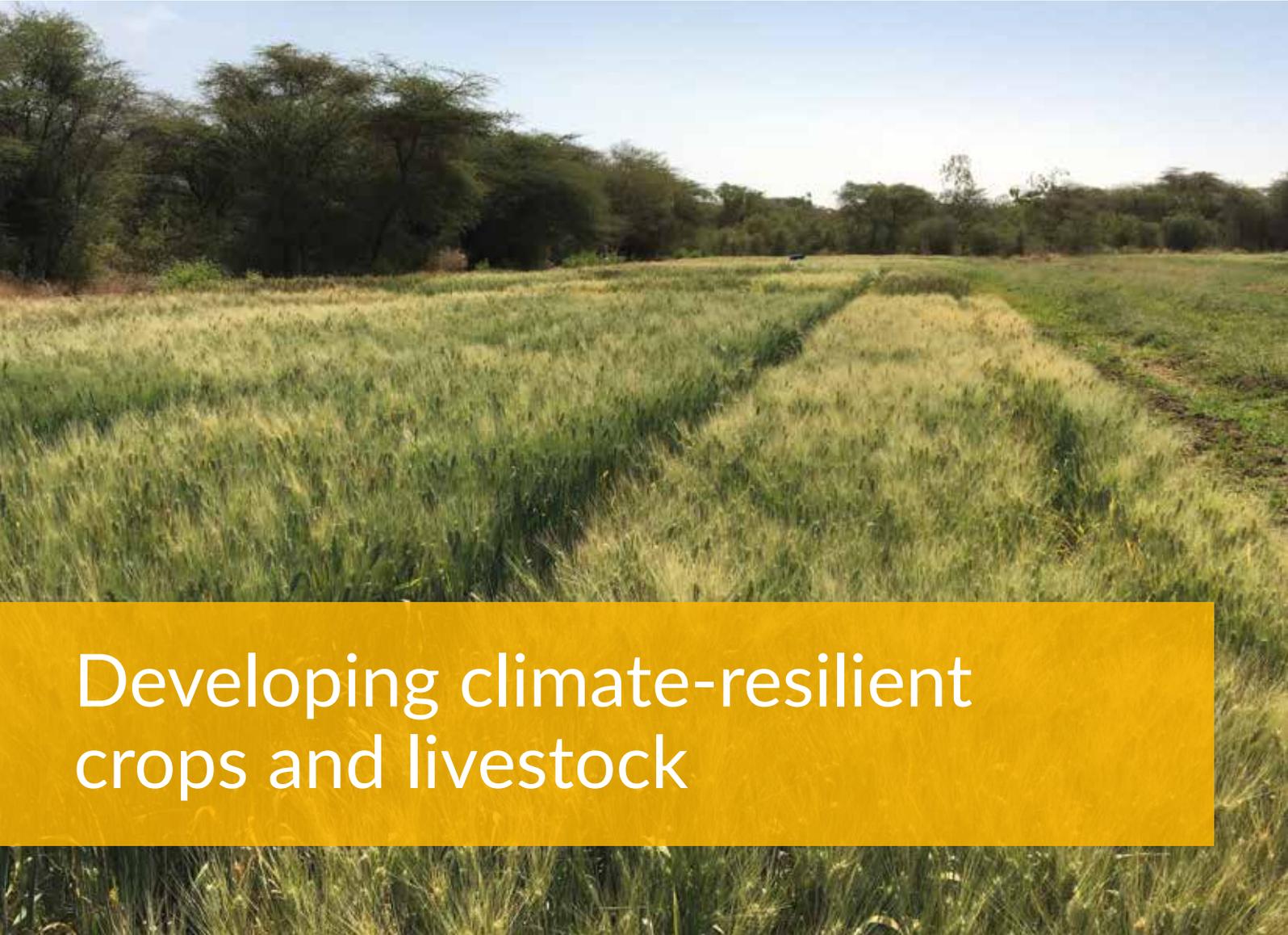
~98%

of ICARDA's genebank holdings were assigned DOIs (Digital Object Identifiers)



DONORS

- Arab Fund for Economic and Social Development
- CGIAR Genebank Platform
- Crop Trust
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH



Developing climate-resilient crops and livestock

Last year we harnessed advances in conventional and molecular breeding to develop highly adapted crops – enhancing climate change adaptation and strengthening food and nutritional security for rural communities.

Advances in crop science make dryland food production systems more efficient – and more resistant to pressures from drought, extremes of cold and heat, unpredictable rainfall, and new pests and disease. Releases of plant genetic materials from ICARDA's genebank, which hosts wild relatives of staple crops like barley, wheat, and legumes, contribute to the development of improved crops that combine high yields, resistance to a range of biotic stresses, and enhanced nutrition.

Last year, 37 improved cereal and legume varieties were released by national programs in partnership with ICARDA, and adopted by farmers worldwide. These climate-resilient crops included higher-yielding, heat- and drought-tolerant wheat varieties in sub-Saharan Africa; pest-resistant barley varieties, which support a burgeoning malt beverage sector in Ethiopia; and low-toxin grasspea varieties that provide a cheap, nutritious, and safe source of food for poor communities in India.

SELECTED ACTIVITIES AND INITIATIVES

Reducing import dependence in Nigeria

The impressive performance of improved varieties of high-yielding, heat-tolerant wheat is convincing Nigerian decision-makers that a viable solution to the country's growing dependence on wheat imports is domestic production. The varieties flourished in the prevailing hot and dry conditions of northern Nigeria, yielding up to 6 tonnes per hectare on farmer fields. Impacts recorded last year revealed a 46–105% increase in farmer incomes; an extension in the country's wheat area, from 50,000 hectares in 2012 to over 100,000 hectares in 2017; and a substantial increase in wheat production, from 70,000 tonnes in 2012 to over 250,000 tonnes last year.

Realizing the climate-smart potential of food legumes

Food legumes offer many advantages for sustainable agriculture. They add nitrogen to soils through a process known as biological nitrogen fixation; they require minimum inputs, which can reduce the costs of production; and they provide an excellent source of nutrients and proteins. In 2017, ICARDA worked with its national partners to develop 14 climate-resilient varieties of chickpea, lentil, and faba bean, and helped distribute them to farmers in Egypt, Ethiopia, India, Iran, Sudan, Tunisia and Turkey. The result: stable yields, healthier soils, and enhanced food and nutritional security.

Heat-tolerant wheat thrives in the Senegal River Basin

With the financial support of the Swedish Research Council, ICARDA scientists developed heat-tolerant durum wheat cultivars that can withstand temperatures of up to 40°C in the Senegal River Basin. The ICARDA varieties, identified after three years of multilocation testing, also grow fast, which allows farmers to produce wheat during the fallow period between rice cultivation.

When tested, the varieties yielded over 3 tonnes per hectare in just 90 days, and if scaled up, estimates suggest they could yield up to 600,000 tonnes of new food, and an estimated €180 million in additional

KEY IMPACTS IN 2017

37

improved cereal and legume varieties were released with national partners

~858

tonnes of cereal and legume seeds were disseminated to 36,889 smallholder farmers

revenue for smallholder farmers, without affecting rice production. The initiative – “Deployment of Molecular Durum Breeding to the Senegal Basin: Capacity Building to Face Global Warming” – was awarded the 2017 Olam Prize for Innovation in Food Security.



DONORS

- African Development Bank (through IITA)
- Arab Fund for Economic and Social Development
- CGIAR Research Program on Grain Legumes and Dryland Cereals
- CGIAR Research Program on Wheat
- CGIAR member countries China, Egypt, India, Iran, Morocco, Sudan, Syria, and Turkey
- Crop Trust
- Government of India
- Grains Research Development Council (Australia)
- HarvestPlus
- United States Agency for International Development



Strengthening resilience: integrated crop-livestock systems

Our research helped farmers to optimize climate-resilient and integrated crop-livestock systems to sustainably intensify production in fragile dry areas.

ICARDA helps rural communities in climate-vulnerable regions strengthen their resilience and maintain livelihoods against a backdrop of rising temperatures and increasing water scarcity. Integrated crop-livestock systems help to cope with shifting climate scenarios, cushioning each sector from external pressure and optimizing economic, social, and environmental conditions in resource-poor regions.

Activities last year designed to optimize crop-livestock production systems included the promotion of improved agronomic practices to reduce yield gaps in rainfed systems – such as conservation agriculture, efforts to improve community-based livestock breeding, and optimized solutions that utilize plant biomass to restore soil health and provide a sustainable source of feed for livestock.

SELECTED ACTIVITIES AND INITIATIVES

Strengthening the resilience of crop-livestock farmers in Sudan

A partnership with Sudan's Agricultural Research Council (ARC) designed and implemented integrated crop-rangeland-livestock interventions in five villages in North Kordofan. The initiative combined water harvesting, supplemental irrigation, animal health, and dairy processing to strengthen the resilience of farmers against rising temperatures and drought.

Ponds constructed around cropping areas provided a critical source of water for livestock and supplemental irrigation, which brought a three- to four-fold yield increase for sesame, pearl millet, sorghum, and other dual-purpose crops such as cowpea. Harvested water was also used to irrigate multipurpose fodder trees such as gum arabic, moringa, and different types of local acacia and forage plantations. Combined with a state-wide seed collection campaign, these efforts helped farmers increase their feed stocks during the dry season.

Additional measures included the provision of veterinary services and ultrasound facilities so that farmers could check their ewes and does for uterine disorders and pregnancy, and improved dairy processing techniques and technologies to improve pasteurization, support diversification, enhance the flavor and consistency of dairy products, and improve hygiene.

Promoting conservation agriculture

Conservation agriculture combines minimum tillage, improved crop varieties, intercropping, and the retention of crop residue to help mitigate soil nutrient depletion, reverse land degradation, and increase yields. The practice brings optimal production at the minimum cost. Despite its potential, the wider application of conservation agriculture in mixed farming systems is often held back because farmers rely on crop residues to feed their livestock during the long summer feed gap.

ICARDA is working with the National Agricultural Research Institute of Tunisia (INRAT) to change this. Last year, it initiated modeling exercises to identify

suitable areas where conservation agriculture could be adopted to restore soil health. Three maps, reflecting cereal distribution, slopes, and soil organic matter, were combined.

The resulting map showed that approximately 260,000 hectares of land sown to cereals is favorable for the adoption of conservation agriculture, offering a strategic opportunity to restore soil health and protect the country's vulnerable biophysical environment. To account for the competition between livestock and residue retention, ICARDA and INRAT have been working for the last four years on fine-tuning improved integrated crop-livestock systems under conservation agriculture.



DONORS

- Australian Centre for International Agricultural Research
- Government of Sudan
- International Fund for Agricultural Development



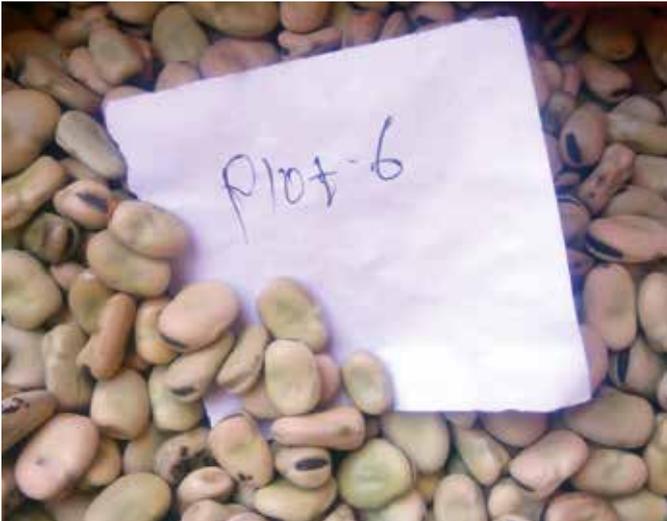
Promoting value chains and crafting new policies

In 2017, we promoted new policies and strengthened sustainable value chains for small ruminant livestock and climate-smart crops. The result: higher and more diverse incomes for smallholder farmers.

ICARDA acts as a catalyst to strengthen entire value chains, working closely with key stakeholders and allowing agriculture to generate income for poor households and promote wider economic activities. This approach looks beyond subsistence to help farmers and rural communities invest in agriculture, education, health, and small enterprises.

We recognize that agriculture can be an income-generating business for many poor rural households, and we specifically target employment opportunities for women and youth who are particularly vulnerable. ICARDA activities last year included the production of high-value cash crops, the development of policies to facilitate climate-smart investments in agriculture, and the promotion of entrepreneurial activities and private enterprise.





SELECTED ACTIVITIES AND INITIATIVES

Enhancing seed systems

An initiative funded by the United States Agency for International Development (USAID) in Ethiopia enhanced farmer access to improved varieties of malt barley, faba bean, and chickpea, helping producers overcome challenges associated with major crop diseases, drought, and the effects of climate change. ICARDA worked with NARS to multiply over 1,000 tonnes of improved seed for further multiplication by seed companies and seed producer cooperatives. The initiative also strengthened farmer-based seed production. Working with 37 farmer seed producers, seven multipurpose cooperatives, and six unions, it produced some 1,157 tonnes of seed, which were then multiplied to produce a further 21,705 tonnes of quality seed, covering 8,682 hectares and benefiting over 33,000 farmers. In addition to seed multiplication, the initiative provided capacity-strengthening opportunities for farmers, researchers, and extension agents; new technologies, including water pumps and threshers; and strategies to manage the parasitic weed orobanche, and gall disease, both major threats to faba bean production.

Strengthening red meat value chains in Tunisia

Selling red meat is one of the main income-generating activities in rural Tunisia. ICARDA is supporting farmers

to eliminate feed gaps and help them adapt to drought through the promotion of practical, cost-effective technologies and strategies that enhance the sustainable supply of nutritious feed and forage, including feed block manufacturing units, fast-track seed multiplication and dissemination, and improved quality forage through the production of silage. Impacts in 2017 included the multiplication of 200 tonnes of forage seed, the development of micro-enterprises to produce feed blocks, and a national strategy for forage and pasture seed production.

Cutting waste in wheat value chains

An assessment of pre- and post-harvest losses along the wheat value chain in Jordan helped identify several policies to address food waste. The study estimated that, excluding storage losses, a total of 0.31 million tonnes – approximately 34% of the total amount of wheat produced locally and imported – is being lost or wasted annually. This is equivalent to US\$109 million, and represents a loss of 344 million m³ of water and 3.65 million gigajoules of energy.

The most significant losses occurred during household consumption, in particular from the widespread practice of feeding bread to animals, with additional losses during milling, pre-harvest, and transportation. Policy recommendations include reformulating the country's bread subsidy to target only those who need it the most; using barley instead of bread as an animal feed; and initiating public awareness campaigns to educate Jordanians on the problem of food loss and waste.

DONORS

- Arab fund for Economic and Social Development
- Bill & Melinda Gates Foundation
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
- Kuwaiti Fund for Arab Economic Development
- OPEC Fund for International Development
- United States Agency for International Development



Enhancing water and land productivity

Our climate-resilient approach to rainfed, irrigated, and agro-pastoral farming enhances the sustainable use of water and land resources – helping to reverse environmental degradation, improve water productivity, and support sustainable intensification.



Against a backdrop of increasing land degradation, scarce water resources, and the impacts of climate variability and change, ICARDA's research targets agricultural production systems that deliver 'more with less' – in greenhouses, on fields, and across rangelands. We also offer advice and help national systems plan for the future and adjust to new climate scenarios.

Last year, we harnessed cutting-edge science to develop 'best-bet' technologies and practices that were optimized, validated, and disseminated to farmers and rural communities. These included an adapted machine that supports the application of raised-bed planting, helping to enhance productivity and yields; indigenous forage species that are adapted to local conditions and use limited amounts of water; and practical and cost-effective technologies like supplemental irrigation that improve water productivity and help farmers to plant and manage crops at the optimal time.

SELECTED ACTIVITIES AND INITIATIVES

Collaborative watershed restoration efforts improve barley production

In Jordan's Badia an ICARDA research team improved watershed restoration efforts launched in 2016, working with communities to place over 50 gull plugs in major erosion channels and redesigning 'marab' water harvesting areas to improve barley production. In addition, a unique soil water monitoring campaign substantially enhanced soil moisture in water harvesting micro-catchments, indicating its potential for supporting the deep percolation of stored water and eventually helping to recharge Jordan's depleted groundwater.

Harnessing traditional knowledge to preserve soil moisture

ICARDA worked with rangeland communities in Jordan to develop wadi bed water harvesting structures. Based on indigenous knowledge, and locally known as 'marab,' the structures reduce slopes (through the construction of stone walls that cross wadis) and slow runoff, allowing water to spread over larger areas and infiltrate soils to support plant growth. They also help to collect sediment, which enriches soils. In 2017, despite late sowing and low levels of rainfall, farmers achieved barley yields that were up to 6 tonnes per hectare, providing a much-needed source of fodder.

Vallerani plows help to 'green' rangelands

Vallerani plows efficiently build micro-catchments to harvest rainwater and address water scarcity in dry environments. In collaboration with the University of Jordan, ICARDA improved the technique to more effectively identify contours for the plow to follow. Auto-guiding systems also reduced construction costs substantially, resulting in the large-scale application of the plows by the government of Jordan. Results included improved vegetation cover, more animal feed, and reduced soil erosion.

DONORS

- Arab Fund for Economic and Social Development
- Bill & Melinda Gates Foundation
- Food and Agriculture Organization of the United Nations (FAO)
- International Fund for Agricultural Development (IFAD)
- Kuwaiti Fund for Arab Economic Development
- OPEC Fund for International Development
- United States Agency for International Development
- United States Forest Service





Scaling up proven technologies

We helped to improve technology adoption strategies last year – getting innovations and technologies into the hands of farmers to strengthen resilience and enhance climate change adaptation.

To ensure that our research improves livelihoods, ICARDA scales up proven technologies and invests in partnerships to generate impact. Our experience suggests smallholder farmers are unlikely to adopt new innovations without improved models of technology transfer.

Last year, ICARDA collaborated with a wide range of partners and change agents to improve the extension of new technologies and put knowledge into action,

including agricultural research institutes, the private sector, NGOs, development agencies, and financial institutions.

We also sharpened our focus on South-South cooperation to ensure that the knowledge we generate is demand driven and addresses the challenges of smallholder farmers across the dry areas of the developing world.

SELECTED ACTIVITIES AND INITIATIVES

Promoting proven wheat technologies

The ICARDA-managed initiative “Enhancing Food Security in Arab Countries” uses three innovative and participatory dissemination strategies to enhance the adoption of new wheat production innovations and technologies: a ‘mass dissemination’ approach implemented within a given site and involving the highest number of demonstration plots across a range of soil types and management systems; a ‘satellite’ approach, which selects progressive farmers to demonstrate technologies to neighboring farmers; and a ‘multi-tool’ dissemination approach using a limited number of randomly distributed demonstration plots to popularize advanced practices and technologies.

During the 2016/17 cropping season more than 17,500 people benefited from over 500 demonstrations and capacity-strengthening events. These included over 11,900 farmers, 3,500 technicians or extension agents, and 1,300 researchers. Representing an investment in future research capacity, the initiative’s Young Agricultural Scientist Program offered in-depth mentoring and training opportunities for an additional six young researchers.

Strengthening wheat value chains in sub-Saharan Africa

The ICARDA-managed wheat component of the African Development Bank-funded project “Support to Agricultural Research for Development of Strategic Crops in Africa” validated and promoted new innovations and technologies at six innovation platforms in the initiative’s three ‘hub’ countries of Ethiopia, Nigeria, and Sudan. These efforts promoted farmer-researcher interactions and targeted more efficient and effective wheat value chains to generate and diversify farmer incomes. In 2017, the initiative provided needs-based training and workshops for 3,451 farmers, 454 development agents, 54 youth and women’s groups, 33 seed producers, and 49 early career researchers from NARS. These efforts prioritized outreach to women: some 34% of farmers, 37% of development agents, 18% of seed producers, and 49% of early career NARS researchers were women.



DONORS

- Arab Fund for Economic and Social Development
- African Development Bank (through IITA)
- Bill & Melinda Gates Foundation
- International Institute for Tropical Agriculture
- Kuwait Fund for Arab Economic Development
- OPEC Fund for International Development



Addressing the needs of rural women

As the role of women in agriculture increases across dry areas ICARDA works with our partners to close gender gaps. Our efforts last year helped to better understand women's access to land, water, seeds, financial credit, and knowledge.

Across dry areas rural women face a triple work burden: agricultural production, the rearing of children, and household duties such as food preparation and the collection of fuel and water. Women also tend to be over-represented in unpaid, seasonal, and part-time work, and are often paid less than men for the same work.

ICARDA promotes the needs, and raises the aspirations, of women, working alongside them to address inequality. We help to foster informed policy dialogue, and through training and technical assistance provide tools and

expertise so that rural women can lead more fulfilling and productive lives.

Last year, ICARDA encouraged women in rural areas of Egypt, Tunisia, Sudan, India, Uzbekistan, Afghanistan, Morocco, and Nigeria to adopt entrepreneurial activities for high-value commodities. We also developed enabling policies for gender equity in agricultural development, and improved women's exposure to innovations and new practices. In addition, our activities enhanced access to extension, veterinary, and other agricultural service delivery systems.

SELECTED ACTIVITIES AND INITIATIVES

Assessing the situation of women workers in rural Egypt

An empirical study conducted jointly by ICARDA and FAO on the work of women and empowerment in rural Egypt generated evidence on gender disparities in rural employment. The study found that women had limited access to productive resources and services, faced challenges in rural labor markets, and were often excluded from decision-making within their communities. Subsequent recommendations included the need for corrective measures in the wage sector – addressing late payments, reduced payments, and the gender wage gap – and improving access to decent employment opportunities to generate gains in food security, poverty reduction, and economic growth. A policy dialogue was initiated with over 40 policymakers to discuss the lack of decent work opportunities for different categories of women and men workers in rural areas.

Targeting wage gaps and adverse working conditions in Morocco

A study last year documented wages and working conditions for landless female and male agricultural laborers in Morocco, analyzing workers from a range of locations, age groups, and working arrangements (part time, full time, small farms, and large farms). The study found that higher-paid, equipment-intensive activities were predominantly assigned to men, whereas women often performed lower-paid, time-intensive work. Women were also systematically paid less than men even when they performed the same tasks.

Additional findings revealed that young men were more likely than young women to leave school and work in the wage sector, and deeply entrenched gender ideologies in Morocco and elsewhere require men to provide for their families. The study highlighted the importance of paying research and policy attention to issues of gendered vulnerability for both women and men, and the need to enforce existing legislation in Morocco to ensure equal pay for women.

KEY IMPACTS IN 2017

40

Egyptian policymakers discussed the provision of decent work for rural women

415

women and men in Saiss, Morocco, were assessed for gender wage gaps and working conditions

~174

women farmers received training on entrepreneurship, barley production, and the development of feed blocks

Supporting entrepreneurial and innovation skills

An initiative focused on the improvement of rural extension services for smallholder livestock producers in Tunisia – “Mind the Gap” – offered business training for rural women to enhance their entrepreneurial skills. Some 174 women benefited in 2017, receiving training tailored to their specific needs. The initiative contrasts and compares the effectiveness and outcomes of different extension methods, and researchers are now analyzing the impacts of the women-focused business training on empowerment, food security, and nutrition outcomes. Findings will feed into new pastoral policy reforms in Tunisia, highlighting the important role that women play in the country’s livestock sector.

DONORS

- African Development Bank
- Food and Agriculture Organization of the United Nations
- CGIAR Research Program on Policies, Institutions and Markets
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
- CGIAR Research Program on Wheat



Building capacity: an investment to improve the quality of agricultural research

Capacity strengthening is core to ICARDA's mission, helping to deliver quality research and development impact, and ensuring that agricultural investments are country-led and sustainable over the long term.

Capacity strengthening initiates a process of change, providing farmers, researchers, and extension officers with the strategic skills and knowledge to transform agricultural production systems. In recent years, ICARDA has seen an increase in the number of female participants in its capacity-building initiatives. In ICARDA-supported PhD programs, for instance, there are now equal numbers of female and male scientists.

In 2017, more than 750 professional staff members from national programs were involved in ICARDA-facilitated capacity-development activities. These training events were in the form of regional courses and workshops, and individual degree, non-degree, and internship programs.

We continued to build on our extensive network of partnerships to apply research in the field, and engaged closely with smallholder farmers through the practice of extension. We also enhanced access to scientific expertise and opportunities in applied research.

ICARDA provided individually tailored learning opportunities for 21 researchers from partner organizations. To secure long-lasting impacts, we also focused on the needs of young scientists, providing training opportunities, work experience, and joint supervision for 13 interns and 38 newly enrolled PhD and MSc students in collaboration with universities.

SELECTED ACTIVITIES AND INITIATIVES

Launching an e-learning platform

ICARDA's Capacity Development Unit launched an e-learning platform (www.icarda.org/capacity-development/e-learning-platform) offering stand-alone e-learning courses as well as additional content for face-to-face training. The platform gives ICARDA trainees a new learning experience and leverages modern technologies to enhance teaching, learning, and professional development. The platform addresses the challenge of targeting diverse trainees from different regions and different time zones.

Training the researchers of the future

A Young Agricultural Scientist Program (YASP), part of the "Enhancing Food Security in Arab Countries" initiative, provided training for seven young scientists from Egypt, Jordan, Tunisia, Morocco, Palestine, Sudan and Syria. The program strengthened the scientists' knowledge and expertise across various areas related to wheat production systems, including the breeding of field crops, biotechnology, plant protection, and water and soil management. ICARDA's Morocco Platform, focused on the intensification and diversification of rainfed cereal-based production systems, also offered training opportunities and supervised the research of 130 ongoing MSc and PhD research projects.

Supporting post-conflict transition

ICARDA continued to support the capacity development of farmers and researchers in Afghanistan and Iraq, supporting the post-conflict transition of both countries. With funding from a range of donors, the Center provided capacity-strengthening opportunities for over 1,300 people on a range of topics, including biotechnology application, water management, rainfed agriculture, salinity management, and cereal and legume crop improvement.



KEY IMPACTS IN 2017

>45

countries benefited from people joining ICARDA capacity-development activities

>678

trainees participated in ICARDA center-level group courses

>70

interns, non-degree trainees, and newly enrolled MSc and PhD students benefited from training opportunities

>1,300

participants and trainees in Afghanistan and Iraq attended farmer field days and in-country training courses

DONORS

- Arab Fund for Economic and Social Development
- Australian Centre for International Agricultural Research
- Bill & Melinda Gates Foundation
- CEVA Sante Animale
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
- European Union
- Food and Agriculture Organization of the United Nations
- German Federal Ministry for Environment, Nature Protection and Nuclear Safety
- Japan International Cooperation Agency
- Kuwait Fund for Arab Economic Development
- OPEC Fund for International Development
- United States Agency for International Development
- United States Department of Agriculture



Harnessing Big Data and ICT

Big Data and ICT are revolutionizing research. Last year, ICARDA harnessed geoinformatics, remote sensing, and the outpouring of data from molecular research in multiple ways – from real-time maps of crop productivity and water consumption to the more accurate targeting of genetic improvements in breeding programs.

ICARDA uses Big Data and ICT to enhance the efficiency of its research and guide effective policymaking. We also realize that the impacts of Big Data and ICT can be more valuable if they are shared with others – reflected in ICARDA's commitment to open access initiatives and extensive cooperation with partners.

In 2017, ICARDA continued to invest in its geoinformatics, ICT, and Big Data Platform, which offers

spatial solutions for integrated agro-ecosystems and contributes to the recently launched CGIAR Big Data Platform.

We also used geoinformatics technology to conduct in-depth analyses of land degradation, opportunities for intensification, and crop yield estimates – from field level to regional scale – to enhance agricultural planning.

SELECTED ACTIVITIES AND INITIATIVES

Analyzing rangeland degradation and restoration

The Rangeland Hydrology and Erosion Modeling (RHEM) tool is web-built and designed to model and predict runoff and erosion rates in rangeland areas. This advanced tool, which takes into account land characteristics and produces scenarios, risk analyses, and case studies, was made widely available to national partners through ICARDA's Capacity Development Unit.

In Tunisia, ICARDA scientists also utilized Geoinformatics Options and Context (GeOC) – an online geographic information system (GIS) that continuously monitors impacts in target areas through the application of remote sensing. Based on an 'option by context' approach the tool offers support to private and public stakeholders, answering common questions on sustainable land use and its management at different scales.

Assessing gaps through satellite earth observations

In Central Asia, ICARDA scientists developed a methodology that uses sophisticated satellite earth observations to map cropping system dynamics and estimate crop yields at the field level, helping to better understand the response of agricultural productivity to crop rotation, irrigation and drainage infrastructure, and environmental factors. Results showed that cropping patterns – the presence or absence of multi-annual crop rotations and the spatial diversity of crops – had the most persistent effects on crop yields, suggesting the need for diversified cropping systems. Remotely sensed estimates of crop production in combination with geospatial technologies provided a unique perspective that, when combined with field surveys, helped planners to identify management priorities and reduce adverse environmental impacts.

Development of decadal dynamics of land use in Jordan

The availability of national land cover databases plays a fundamental role in understanding environmental and

KEY IMPACTS IN 2017

Regional scale mapping and monitoring of cropping intensities, productivity, and degradation patterns prompted alternative land uses

Quantification of agricultural productivity for bridging yield gaps and targeting interventions more effectively

Online data visualization system based on geoinformatics technology developed to help analyze agricultural landscapes

A new decadal database on land use and land cover dynamics developed in Jordan

socioecological issues under changing demographics and climatic conditions. In 2017, ICARDA used time series satellite data over three decades from 1980 to 2015 to map decadal dynamics of land use and land cover changes in Jordan at a 30 m spatial resolution. The resulting database – the Jordan National Land Cover Database (JNLCD) – encompasses four wall-to-wall land cover maps. It demonstrates remarkable land use changes across rainfed agricultural land, urban environments, and open rangelands, and indicates progressive land degradation, decreases in productivity, and the loss of pristine and ecologically important landscapes. The JNLCD will inform the development of more effective monitoring and management regimes, and offer a baseline for the advancement of landscape-based agricultural research for development in Jordan and the wider region.

DONORS

- Indian Council of Agricultural Research, Government of India
- International Fund for Agricultural Development
- Government of Russia (through IFPRI)

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Financial information

Statement of Activity (US\$ x 1,000)

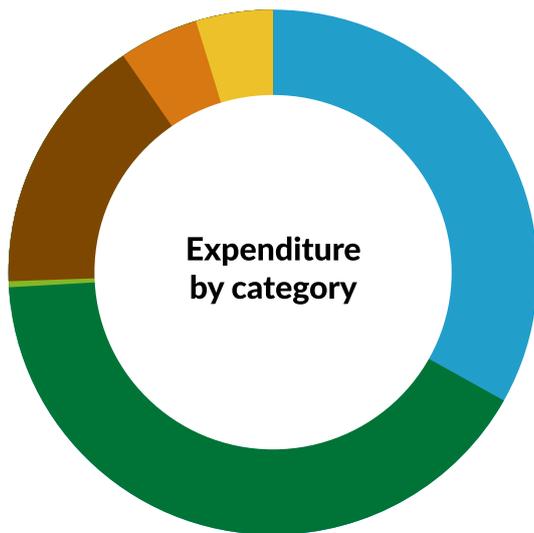
REVENUES	2017	2016
Grants (core and restricted)	35,225	40,149
Other revenues and gains	258	865
Total revenues and gains	35,483	41,014
EXPENSES AND LOSSES		
Program related expenses	34,993	39,635
Management and general expenses	4,675	4,746
Other losses and expenses	-	-
Total expenses and losses	39,668	44,381
Indirect costs recovery	(3,366)	(3,420)
Net expenses and losses	36,302	40,961
Net surplus/(Deficit)	(819)	53

Statement of Financial Position (US\$ x 1,000)

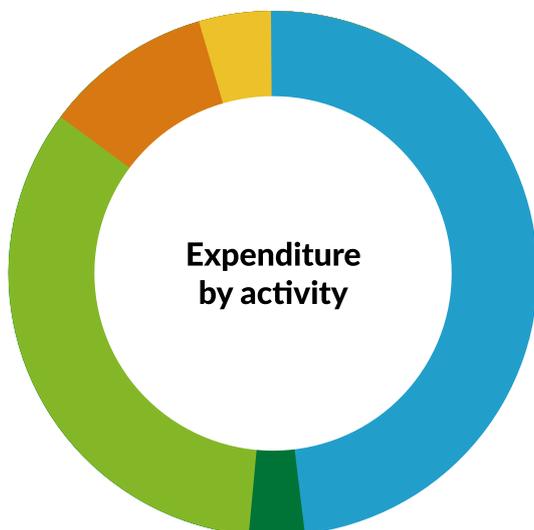
ASSETS	2017	2016
Current assets	23,644	26,660
Property and equipment	1,739	2,231
Other assets	-	-
Total assets	25,383	28,891
LIABILITIES AND ASSETS		
Current liabilities	17,618	20,307
Long term liabilities	-	-
Total liabilities	17,618	20,307
Net assets = Reserves	7,765	8,584
Total liabilities and net assets	25,383	28,891

Statement of Grant Revenues (US\$ x 1,000)

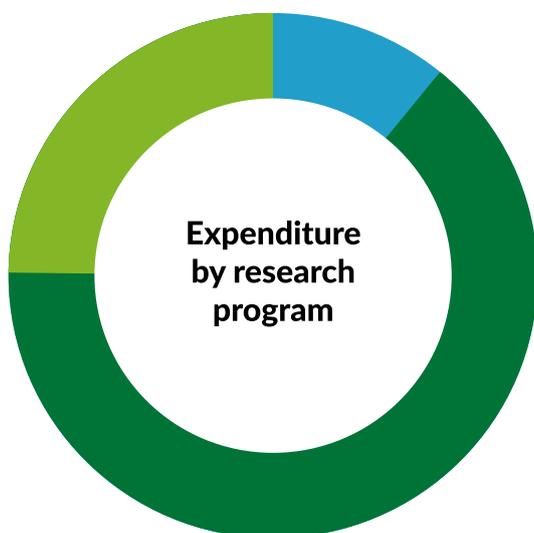
DONORS	2017
Afghanistan Ministry of Agriculture, Irrigation, and Livestock (MAIL)	1,245
Arab Fund for Economic and Social Development (AFESD)	5,331
Australian Centre for International Agricultural Research (ACIAR)	1,581
Bill & Melinda Gates Foundation	614
China	214
Cornell University	236
Crop Trust	3,438
European Commission	1,086
Food and Agriculture Organization (FAO)	373
Germany	1,586
Grains Development and Research Center (GRDC)	472
Gulf Cooperation Council (GCC)	1,215
India	1,144
International Crop Research Institute for Semi-Arid Tropics (ICRISAT)	283
International Food Policy Research Institute (IFPRI)	309
International Fund for Agricultural Development (IFAD)	1,533
International Institute of Tropical Agriculture (IITA)	942
International Livestock Research Institute (ILRI)	1,163
International Maize and Wheat Improvement Center (CIMMYT)	2,392
Iran	1,147
Japan	374
Kuwait Fund for Arab Economic Development (Kuwait Fund)	638
Libya – Agricultural Research Center	339
OCP Foundation	277
Sudan	474
Syria	302
Turkey	212
United States Agency for International Development (USAID)	2,279
United States Department of Agriculture (USDA)	1,632
World Agroforestry Centre (ICRAF)	207
Miscellaneous	2,187
TOTAL	35,225



- Personnel Cost
33.16%
- Supplies and Services
40.91%
- Collaborators - CGIAR Centers
0.43%
- Collaborators - Partners
15.83%
- Travel
4.85%
- Depreciation
4.82%



- Research Programs
48.32%
- Research Support
3.28%
- International Cooperation and Communication
33.82%
- Corporate Services
10.11%
- Management
4.47%



- Integrated Water and Land Management Program (IWLMP)
11.05%
- Biodiversity and Integrated Gene Management Program (BIGMP)
64.11%
- Sustainable Intensification and Resilient Production System (SIRPS)
24.84%

Donors and investors

Afghanistan Ministry of Agriculture, Irrigation and Livestock (MAIL)

African Development Bank (through IITA)

Agricultural Research Center – Egypt

Arab Fund for Economic and Social Development (AFESD)

Australian Centre for International Agricultural Research (ACIAR)

Austrian Development Agency (ADA)

Borlaug Global Rust Initiative

Bill & Melinda Gates Foundation

Bioversity International

Caritas Switzerland

Ceva Sante Animale S.A.

CGIAR Fund

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) led by CIAT

CGIAR Research Program on Policies, Institutions and Markets (PIM) led by IFPRI

CGIAR Research Program on Water, Land and Ecosystems (WLE) led by IWMI

CGIAR Research Program on Wheat led by CIMMYT

CGIAR Research Program on Livestock led by ILRI

CGIAR Research Platform on Genebanks led by the Crop Trust

CGIAR Platform for Big Data in Agriculture led by CIAT

Charles Sturt University

Cooperative for Assistance and Relief Everywhere (CARE)

Cornell University

Crop Trust

Curtin University of Technology – Australia

Deutsche Gesellschaft für Internationale Zusammenarbeit, GmbH

Durham University – United Kingdom

Empresa Brasileira de Pesquisa Agropecuária (Brazilian Enterprise for Agricultural Research)

European Commission

Federal Ministry of Agriculture and Rural Development – Nigeria

Food and Agriculture Organization of the United Nations

German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Government of China

Government of Iran

Government of Libya

Government of Morocco

Government of Sudan

Government of Syria

Government of Turkey

Grain Research and Development Corporation (GRDC) – Australia

Gulf Cooperation Council (GCC)

HarvestPlus

Indian Council for Agricultural Research (ICAR)

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

International Fund for Agricultural Development (IFAD)

International Livestock Research Institute (ILRI)

International Maize and Wheat Improvement Center (CIMMYT)

Italian Development Corporation

Japan International Cooperation Agency (JICA)

King Abdullah University of Science and Technology

Kuwait Fund for Arab Economic Development

Massachusetts Institute of Technology (MIT)

Michigan State University

New South Wales Department of Primary Industries –
Australia

OCP Foundation – Morocco

OPEC Fund for International Development

State Government of Madhya Pradesh – India

State Government of Odisha – India

State Government of West Bengal – India

Swedish International Development Cooperation Agency
(through ICBA)

Swedish University of Agricultural Science

Tottori University – Japan

United States Agency for International Development

United States Department of Agriculture

University of Saskatchewan

World Agroforestry Centre

World Food Programme



Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is a non-profit, CGIAR Research Center that focusses on delivering innovative solutions for sustainable agricultural development in the non-tropical dry areas of the developing world. We provide innovative, science-based solutions to improve the livelihoods and resilience of resource-poor smallholder farmers. We do this through strategic partnerships, linking research to development, and capacity development, and by taking into account gender equality and the role of youth in transforming the non-tropical dry areas.
www.icarda.org



CGIAR is a global research partnership for a food-secure future. CGIAR science is dedicated to reducing poverty, enhancing food and nutrition security, and improving natural resources and ecosystem services. Its research is carried out by 15 CGIAR centers in close collaboration with hundreds of partners, including national and regional research institutes, civil society organizations, academia, development organizations and the private sector.
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