ICARDA
Science for resilient livelihoods in dry areas

ICARDA Country Brief Series

Jordan

Photo credit: Muhi El-Dine Hilali (ICARDA), *2015, Jordan, "Forming of Jameed balls"*

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Introduction

The ICARDA country brief series provides a snapshot of the work ICARDA has done and what is on-going in the different countries in which ICARDA operates. It highlights the projects implemented, the partnerships that ICARDA

has formed for both project delivery and knowledge generation, the key research themes by ICARDA Scientists and features a summary of the impact ICARDA projects have delivered to the citizenry, especially the rural poor smallholder farmers.

About ICARDA

Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is a non-profit, CGIAR Research Center that 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 considering gender equality and the role of youth in transforming the non-tropical dry areas.

Agriculture in Jordan

Agriculture in Jordan is critical as of 2018 agriculture's contribution to the total national gross domestic product (GDP) was about 5.6%. Agriculture accounts for about 16% of the total export (US$ 1.2 billion) and 19% of total imports (US$ 4 billion), making Jordan a net importer. The livestock subsector dominates the vast agropastoral agro-ecological zone and is valued at US$ 1.38 billion. Jordan is self-sufficient in olives, olive oil, tomatoes, goat meat, fresh milk, and eggs. Additionally, it produces a significant portion of the poultry and some vegetables consumed domestically. In contrast, local diets rely heavily on imported cereal, legumes, fruits, and some vegetables. Jordan produces only about 3-4% of the wheat and barley it consumes. Nearly all barley is dedicated to livestock feed. The agricultural sector also enables jobs, rural development, food security and ways to address the country's issues and challenges such as climate change.[1] The Ministry of Agriculture in the 2020-2025 National Agricultural Development Strategy invested JD591-million, focusing on: digitization and restructuring of the sector due to constraints of the COVID-19 pandemic, generating employment and boosting productivity, fish and marine products strategy, date palm strategy, rangelands strategy and forest policies.[2]

Of the approximately 107,700 farm operations in Jordan, around 34% are less than 0.2 ha, and only 94 farms (0.09%) are larger than 200 ha.[i] Agricultural productivity in Jordan has been on the rise thanks in part to increasing labour productivity.[ii] Agriculture employs 3.7% of the population; 1.7% of Jordanian nationals and 6.9% of non-Jordanians. The livestock sub-sector employed a total of 50,300 individuals in 2017, composed primarily of household members (69%), followed by permanent employees (25%), casual employees (5.2%), and finally seasonal employees (<1%).[iii]

Three different agro-climatic zones are the basis to Jordan's agriculture: the rift valley, the highlands, and the marginal and desert areas. 52% of the total water in the country is consumed by agriculture. Water is scarce in Jordan with average rainfall at 200mm per year for 90% and 400mm of rain for 2% of the country. However, both rainfed and irrigated agriculture continue to have importance economically, socially, environmentally, and politically contributing to the stability of rural populations.[3]

The water scarcity however has not prevented biodiversity richness with over 2700 plant species[4]. The country is also considered to be the center for important crops worldwide such as barley, lentil, feed legumes and fruit trees with close to 90% of olives and some bananas, citrus, and off-season vegetables. Most of the country (90.4%) is used as rangeland and 1.5% is categorized as forest. Such flora allows 6% of the country to be adequate for agriculture.

Thanks to these benefits, Jordan is ranked as an upper middle-income country, including a market economy accompanied by development aid and remittances and a strong service sector such as tourism (62% of GDP in 2018). Despite these benefits, unemployment is of concern for Jordan as the unemployment rate reached 19.2% during the second quarter of 2019 (men 17.1%; and women 27.2% for females)[5]. Youth unemployment is reported to have reached as high as 40 %.[6] Thus, rural poverty is a major issue in Jordan, impacting agriculture, and has resulted from a mix between rapid population growth, degraded natural resources and chronic water storage.

[1] Alghad. "King's directives foresee the importance of the agricultural sector in achieving food security," 2020.
[2] Agriculture Ministry unveils 2020-2025 strategy worth JD591m to revive sector | Jordan Times
[3] Country strategy note (ifad.org)
[4] Communication Team ICARDA. (2008). Jordan and ICARDA. Aleppo, Syria: International Center for Agricultural Research in the Dry Areas (ICARDA).
[5] Department of Statistics. GoJ. 2019
[6] Turning the Corner. Jordan's Path to Growth. Jordan Five Year Growth Matrix. 2019.

These issues accelerating desertification and further reducing chances of having rainfed agriculture and livestock production and they are contributing to the lack of natural resources in Jordan. Fewer and fewer young people are willing to work in agriculture due to better opportunities in the city. The agriculture at subsistence level is mainly left to the older generation and women or even Egyptian migrant workers.

Different issues such as water availability, quality, land resource, air quality, temperature increase, extreme climate events have triggered the need for the government of Jordan to work with development partners to foster climate mitigation and adaptation measures in agriculture or prioritize conservation agriculture. Thus, Jordan has investigated the green economy in agriculture for Jordan Vision 2025[7]. Other than the environmental crisis, the COVID-19 pandemic has triggered the Ministry of Agriculture to revise and update its guiding strategy, the National Agriculture Sector Development Strategy 2016-2025[8].

ICARDA in Jordan

The presence of ICARDA in Jordan stretches back to ICARDA's establishment in 1977. On 27 October, a bilateral agreement under a Memorandum of Understanding (MoU) was signed with the Ministry of Agriculture. Through the agreement a focal institution was defined: NCARE, known as the umbrella agency for research.

This agreement triggered the development of national partnerships and regional activities. In 1989, ICARDA initiated the West Asia Regional Program Office in Amman to coordinate bilateral and regional activities. Thus, many academic and local partnerships were developed, notably with Faculties of Agriculture of the University of Jordan (UoJ), the Jordan University for Science and Technology (JUST) and the Universities of Mu'ta, Yarmouk, Hashemite, and Al Balqa'a Applied University; the Higher Council for Science and Technology (HCST), the Jordan Cooperative Corporation, the Royal Science Society (RSS), and the Agricultural Marketing Organization. Partnerships also extended to NGOs such as Jordanian Hashemite Fund for Human Development (JOHUD), the Royal Society for Conservation of Nature (RSCN), WADI for Sustainable Ecosystems Development, the Farmer Association and development institutions such as AARINENA, UNCCD, WOCAT, USDA, USFS, ACSAD, AOAD, CARDNE, FAO, IPGRI, UNDP, OFID, UNEP, USAID, USDA-ARS, IUCN and the World Bank, and others. Academic and research partnerships also were established with Dutch Universities including Utrecht University and Wageningen University as well as University of Athens (in Greece), University of Florence and University of Brescia (in Italy) University of Nevada, Reno, Texas A&M University in the USA, Oregon State University, University of Palermo in Italy. Whilst adding to the list were embassies in Jordan and Netherlands, other national institutions involved concerned Ministry of Agriculture (MoA), NARC, Ministry of Water, and Irrigation (MoWI), Ministry of Environment (MoEnv), Ministry of Planning and International Cooperation (MOPIC), Jordan Dates Association (JODA) and the Royal Botanic Garden of Jordan (RBG-Jordan).

Many institutions have contributed to ICARDA's mandate in Jordan which focuses on improving livelihoods of communities and the sustainable land management of natural resources. 30 years of collaboration have led to major contribution to ICARDA's goal in Jordan and a focus on different areas in terms of project development:

- **Conservation of genetic resources**: Crop breeding, collections of genetic resources, genetic gains, sustainable genetics, etc.
- **Germplasm improvement**: Seed health, small ruminants' reproduction and artificial insemination, improvement of food legumes and wheat, introduction of spineless cactus as a feed and food crop, etc.
- **Natural resource management**: rangelands rehabilitation, grazing management irrigation, water management and harvesting, etc.
- **Social and economic policy**: capacity development, big data, and ICT tools.
- **Development projects in diverse dryland agroecosystems**: livestock production, rehabilitation of agro-pastural land, rangeland production, dairy value chains, etc.

ICARDA's activities in Jordan have covered both technology transfer and research and capacity development (e.g., post graduate degree training). ICARDA has about 11 research activities including bilateral projects and CRPs activities with annually renewed funds.

[7] jor201422E.pdf (fao.org)
[8] jor201422E.pdf (fao.org)

Several awards have been received by Jordan-ICARDA partnerships. For example, NARC honored four ICARDA staff in 2006: Director General Dr Mahmoud Solh; and three scientists, Drs Ahmed Amri (plant genetic resources), Salvatore Ceccarelli (barley breeding) and Theib Oweis (water management).

ICARDA projects in Jordan

Below are summaries of all extended, active, and ongoing projects in Jordan. For a summary table with exact dates, budget, and project manager, see Table 1 at the end of this document. Below active, extended, and ongoing projects, you may find showcased completed projects that have added value and generated positive impact at country level.

Extended, ongoing and active projects:

Conservation of pollinator diversity for enhanced climate change resilience (2017-2022) | $7 824 348 million | Conservation of pollinator diversity for enhanced climate change resilience (cgiar.org)
Active in Algeria, Egypt, Jordan and Morocco, Tunisia, Turkey and State of Palestine, Conservation of pollinator diversity for enhanced climate resilience aims to conserve pollinator diversity to enhance the climate change resilience in an economically self-sustaining way. Through the Farming with Alternative Pollinators (FAP), a knowledge-based, economically self-sustaining approach to simultaneously protect wild pollinators and natural enemies and increase production and farmers' incomes. FAP includes work in agricultural sites, broad capacity building and technical assistance concerning policies, in 7 countries, and contributes to six Sustainable Development Goals (SDG 1, 2, 3, 12, 13 and 15). The project has the objective to ensure the sustainably of pollinator diversity and identifies the economic value of habitat enhancement in fields and orchards and uses incentives for farmers and policymakers to mainstream pollinator protection across sectors. By developing the first pollinator inventory for North Africa and West Asia allowing national monitoring, self-sustaining incentives for protection and capacity building for pollination protection and sustainable use of biodiversity. In Jordan, NARC implements the FAP-project with all three levels after intensive training in Rabat and in dialogue with the FAP-coordinator at ICARDA (2020-2022).

Supporting National Programs of Agricultural Research in the Arab Countries through Training | (2019-2021) | $975 000 | https://mel.cgiar.org/projects/training-agricultural-researchers-in-arab-countries
Active in Jordan, Egypt, Lebanon, Morocco, Oman and Sudan, the project aims to enhance collaboration between ICARDA and national agricultural research programs in the Arab countries, funding capacity development activities such as post-graduates and fellowships to contribute to agricultural research. In addition, the project aims to implement training courses or programs to assist Arab countries technically. Based on ICARDA Decentralization plan and the investment made to ICARDA Research Platforms through the support of AFESD, ICARDA Capacity Development Unit manage a project funded by AFESD aiming to support and advance collaboration programs between ICARDA and the National Agricultural Research Programs in the Arab countries; in addition to contributing to funding postgraduate scholarships and fellowships in the fields of agricultural research and to support ICARDA's activities in organizing a number of training programs/courses to Young Arab Professionals to fulfil the needs of Arab countries from ICARDA's research. For example, in Jordan through ICARDA Research Platform on resilience in marginal lands through integrated crop-rangeland systems and water harvesting.

Assessment of water-harvesting scaling-up potential for the NENA Region | (2021- ongoing) | $250 000 | No link available
Active in Jordan, Algeria, Bahrain, Egypt, Iraq, Kuwait, Lebanon, Lybia, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, Turkey, Yemen, Sudan, South Sudan , Palestine, and UAE (…). The project aims to quantify the water harvesting potential for scaling up across the NENA region by:

1- Collecting, generating, and streamlining the rich database and knowledge gateways required to assess the water harvesting potential at a regional scale
2- Assessing and developing a digital map of the water harvesting potential based on spatially explicit modelling and multi-criteria analysis taking into consideration site-specific factors.

It also aims at developing a GIS web-based interface to support stakeholder decision-making for target specific scaling of interventions and investment by developing a web-based dynamic interface tool that can identify SLM practices to support decision-making for site-specific interventions and implementation through a community-based participatory and transformative learning approach.

Support for Enhancement of Food Security in Arab Countries (Phase III) | (2018-2022) | $2 486 098 | FS project - EFSAC - Support for Enhancement of Food Security in Arab Countries (Phase III) (cgiar.org)
Active in Algeria, Egypt, Iraq, Jordan, Morocco, Syria, Tunisia, Yemen, Sudan, State of Palestine, the project aims to contribute to enhancing food security in Arab countries by improving the productivity of staple food crops, especially

wheat, and building the capacity of national agricultural research systems to support and sustain future growth in agricultural production. In Jordan to contribute to enhancing food security in Arab countries by improving the productivity of staple food crops, especially wheat, and building the capacity of national agricultural research systems to support and sustain future growth in agricultural production

Establishing and Operating a Regional Network for Field Measurement of Actual Crop Water Consumption (Evapotranspiration) | (2018-2021) | $716610 | Establishing and Operating a Regional Network for Field Measurement of Actual Crop Water Consumption (Evapotranspiration) | ICARDA
Active in Egypt, Lebanon, Morocco, Jordan, Tunisia, the project aims to build a common capacity of local institutions on ETa measurements, in the field and through RS, on accuracy assessments of RS ETa data of different databases and on their analysis and use for agricultural-related applications (e.g., water accounting, water productivity, water management, etc.). A comprehensive training program will be organized so that national staff will be able to collect, analyze and use the data on the ground. In Jordan, ICARDA in collaboration with FAO and five countries in the region, has established a regional ET network to establish a reliable source of ground measurement of ET with the multiple goals of calibrating and validating RS-based ETa retrievals, calibrating, and validating crop models with the ET and related datasets and for regional synthesis in the context of regional water scarcity. The NENA-ETNet will have a special focus on calibrating CORDOVA-ET system using other field ETa methods of determination to decide if CORDOVA-ET method can be used as a regional standardized validation protocol. The participating countries are Jordan, Egypt, Lebanon, Tunisia, and Morocco. The participating countries have good capacity and facilities for ET measurements using energy balance methodologies, lysimeter and gravimetric methods.

Watershed Restoration in Badia Areas of Jordan | (2019-2024) |$228988 | Watershed Restoration in Badia Areas of Jordan (cgiar.org)
Active in Jordan, the project aims to ensure security, maintenance, and continued monitoring (vegetation development and survival rate). At the new Royal Botanic Garden (RBG) site to support WADI activity, the objectives are to out-scale rehabilitation methods to agro-sylvo-pastoral areas and the assessment and analysis of site rehabilitation impacts on water dynamics.

Senior expert at the Restoring Degraded Lands Flagship for sustainable dryland agro-ecosystems | 2020 – 2022 | € 119,790 | https://www.nwo.nl/en/projects/1844
Active in Jordan, the Senior Expert will support the CRP Flagship by co-leading and executing research on drought adaptation and land degradation problems, especially in ICARDA's target areas from Sub-Saharan Africa to Central Asia. Drought adaptation will focus on adequate disaster risk management (e.g., rainwater harvesting technologies) specifically designed for arid environments, through modelling and field testing. Successful techniques will be out scaled across dryland environments. Land degradation research will target the causes and rates of wind and water erosion, as well as the design and testing of feasible strategies and techniques to reverse land degradation. Modelling was applied to test different vegetation scenarios for reducing wind erosion in the Jordanian desert and the Aral Sea basin.

Planning and piloting watershed rehabilitation for improved water productivity with water-harvesting in Jordan. | 2021-2022 | $ 206,401 | No link available
Active in Jordan, this project focuses on the marginal dryland ecosystem (uplands) and the irrigated production system around the Jordan Valley (lowlands). It addresses the ecohydrological rehabilitation of the largely degraded Jordan Valley's side Wadis that are discharging towards the Jordan Valley. In addition, it includes a community-inclusive design of rehabilitation and sustainable management options, small scale testing of rehabilitation implementation, and an ex-ante assessment of the potential for large scale impacts on the areas' ecohydrology.

Other completed projects (but not limited to) include:

- *Water and Livelihoods Initiative | 2009 – 2018 | $ 4,846,000.00*
- *Training Materials for Agricultural Extension Agents to Integrate and Utilize RICCAR Data into a Crop Model such as APSIM and identify Context-Based Climate Adaptation Option | 2021 | $ 40,000*
- *Options for Coping with Increased Water Scarcity in Agriculture in West Asia and North Africa (CWANA Water Benchmarks Phase I) | 2003-2007 | $ 2 500 000*
- *Tracing Soil Amendment Impacts of Processed Wastewater Sludge on the Rehabilitation of Jordan's Agro-pastoral Areas | 2019-2021 | $ 100,003*
- *Support in conducting FAO/ICARDA Regional Training Workshop on Sustainable Crop Production and Conservation Agriculture | 2011 – 2012 | $ 45,000.*

- *Wastewater Reuse in the MENA Region: Addressing the Challenges | 2018-2021 | $ 150,000*
- *Climate Smart Agriculture Action Plan for Jordan | 2020 – 2021 | $ 40, 092*
- *Dairy Processing Training for Vulnerable Refugee and Host-community Women in Irbid in Jordan | 2019 | $ 28,717*

ICARDA project value in Jordan

The next graph depicts the value of ICARDA projects in Jordan from 2016-2024, based on past and current projects. We see that since 2016, there is an average annual decrease of project value with a slight stabilization from mid-2018 to mid-2021. As depicted by the projected project value, if there is no new projects or funds brought into Jordan, there would be a rapid decline in total project value starting in 2022.

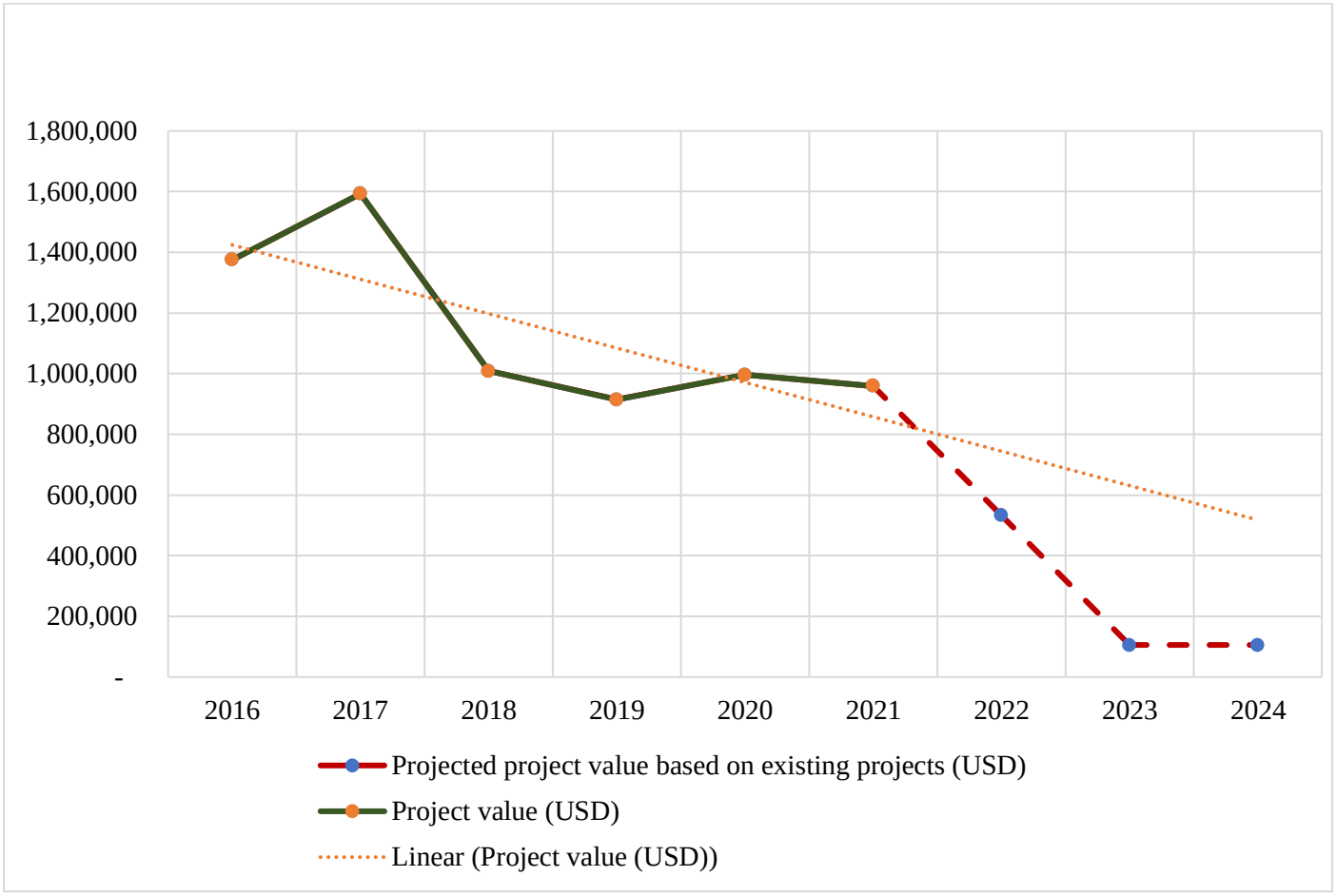

Figure 1: Trajectory of ICARDA project value in Jordan (Source: MEL, 2016 – 2021.)[9]

[9]Several assumptions were made in order to create this graph. Assumptions include: (1) All budget data in OCS at the time of data pull was up to date. (2) For multi-country projects, funds are distributed equally among countries. (3) Project spending is equally divided across all years.

Partnerships

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

Project delivery partners

Over the years, ICARDA has partnered with over 120 entities in Jordan, that can be stratified into 11 types. The broad base of academic, advances research institutions, NARS and private sector entities involved, provide solid evidence of the technical and policy related framework ICARDA operates and the sustainability of the application of ICARDA's knowledge. Future actions may involve more NGOs and Financing institutions but will not concern CGIAR Research Programs as the One CIAR will not include programs and will only include centers as of 2022.

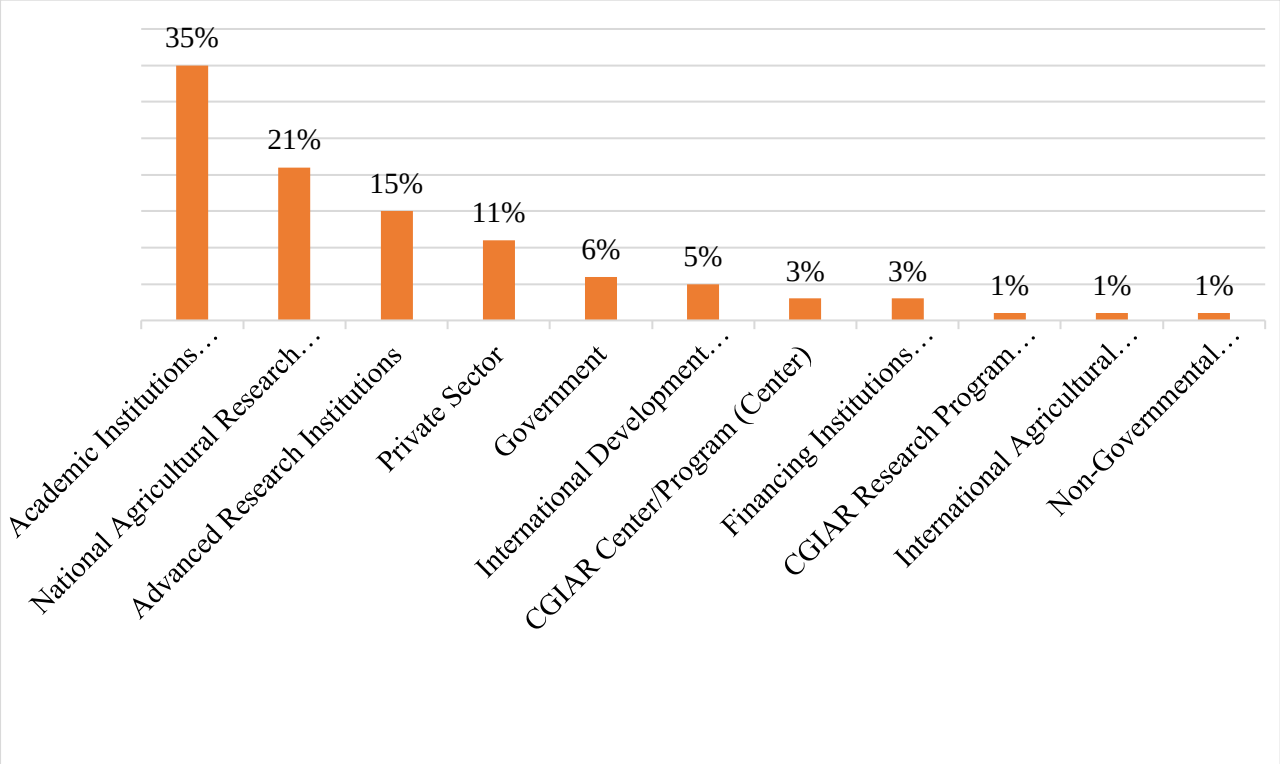

Figure 1: Percentage of project delivery partners in Jordan (Source: MEL 2021, Elaboration: MEL)

Knowledge generation partners

ICARDA partners with a wide range of partners in the generation and dissemination of scientific knowledge, in a bid to increase the uptake of research outputs and influence policymakers to create an enabling environment for the advancement and adoption of agriculture technologies at scale. A list of the partners with whom ICARDA had partnerships for knowledge generation and dissemination for the last 5 years is provided in Figure 2. It is evident that local partners are playing an important role, especially the National Agricultural Research Center (NARC) of Jordan, having dominant share in the total of 76 unique partners. The level of knowledge generation engagement with ICARDA considers a total of 276 knowledge products. The partners that have more than 5 knowledge products (=11) are

elaborated in the below graph with local partners producing the highest number of knowledge products on an individual basis (88 for NARC).

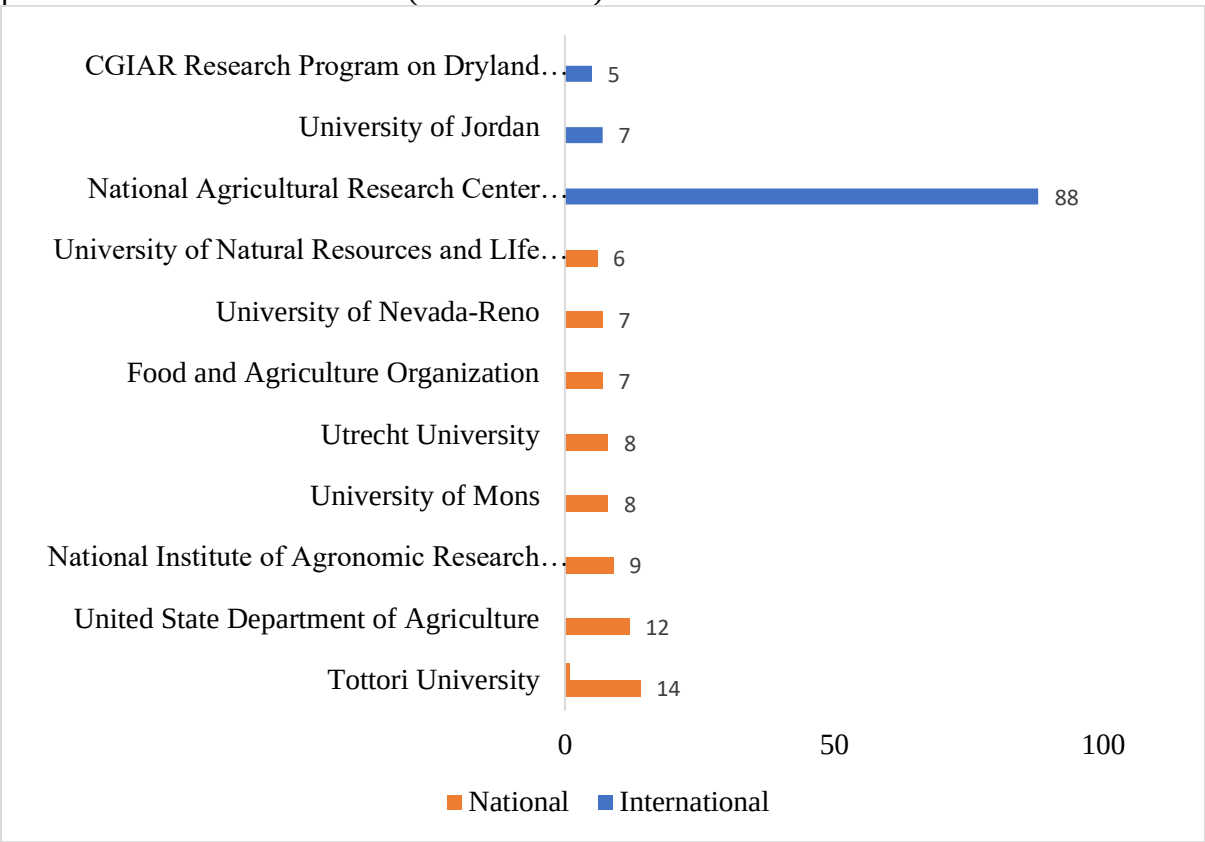

Figure 3: Distribution of knowledge product collaborations amongst institutions (Source: MEL 2021, Elaboration: MEL)

Capacity Development

Capacity development is fundamental component of ICARDA's strategy and contributes to the achievement of several goals and targets. Building the capacity of partner institutions, and beneficiaries can greatly contribute to the sustainability of ICARDA's work. In Jordan, ICARDA capacity development work has involved the training of 483 men and 260 women through short-term group trainings, and 10 individual advanced degree trainings for men and 6 for women (

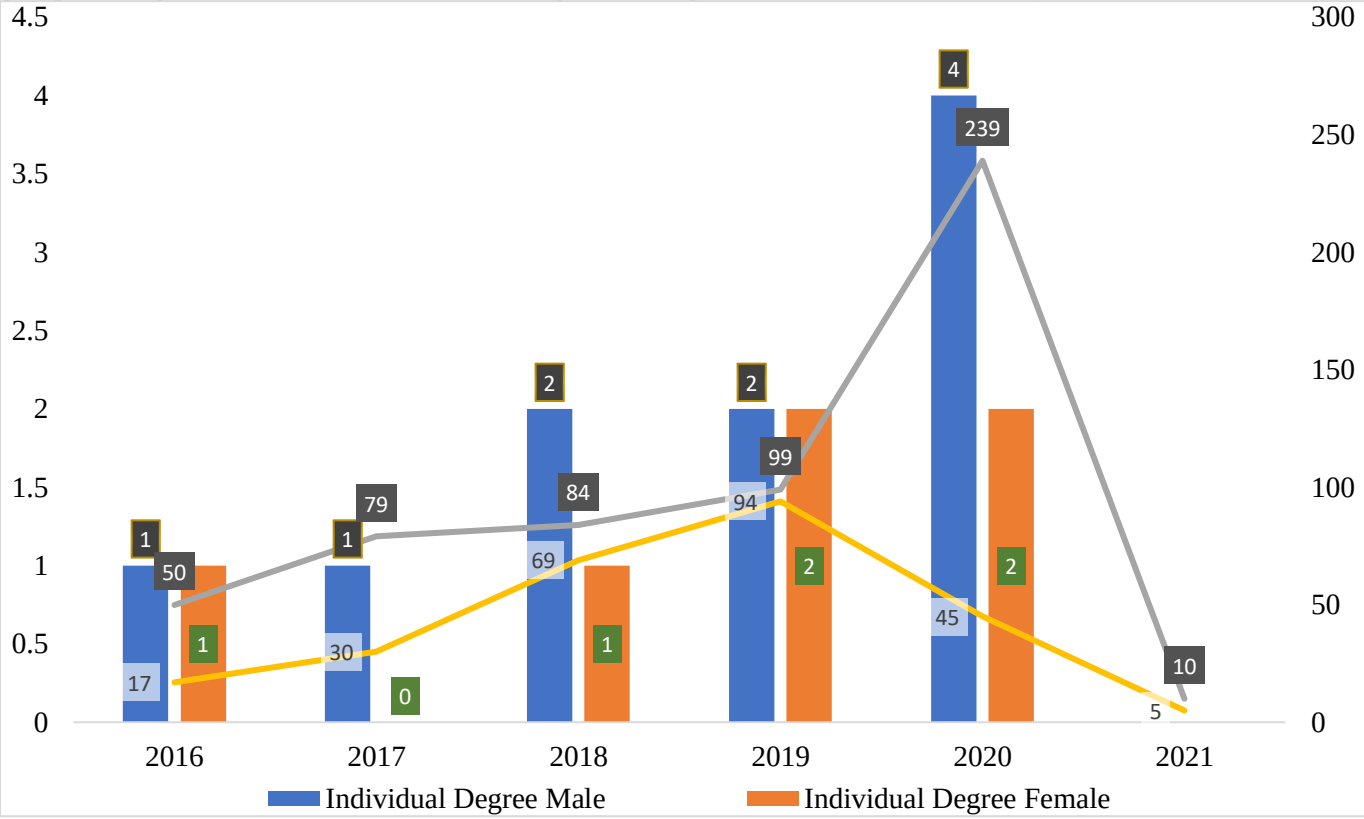

Figure). The lines in the graph, depicting group training, show upward trend until 2019 and a decreasing one from that date within the exception of group training of mails with a peak in 2020. Whilst the bar chart, depicting individual degrees, show a non-constant increasing trend for female as we have a decrease in 2017 but constant for male. Overall, twice as many males participate in individual trainings compared to women. This may be due to the need to increase incentives for women to prioritize trainings for be able to forego daily/household activities to dedicate to trainings. Thus, 2020 was the year most people trained both through group and individual training. The accuracy of this data depends on the accuracy of reported capacity development activities in MEL.

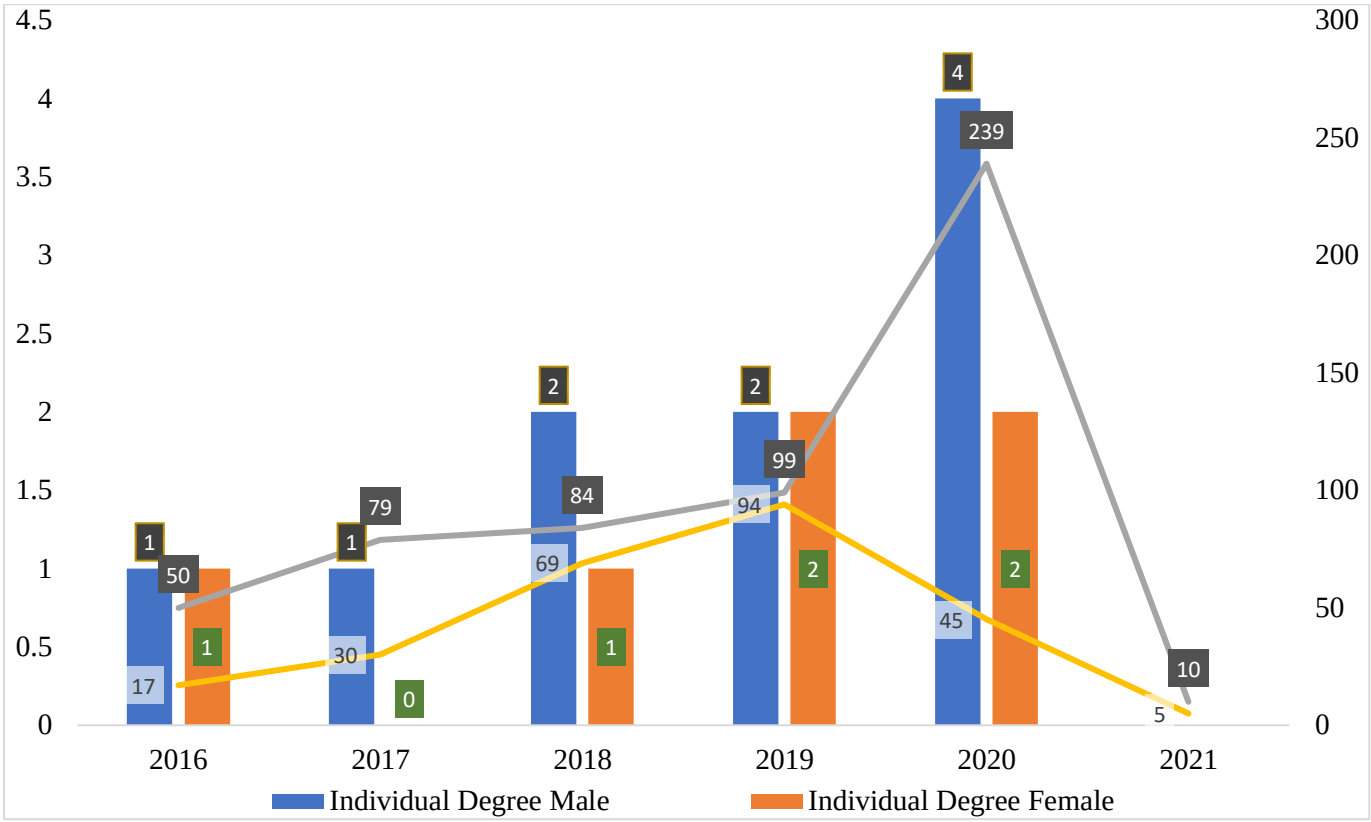

Figure 4: Capacity Development in Jordan (Source: MEL 2021, Elaboration: MEL)

Research themes

The research themes ICARDA scientists have worked on with respect to Jordan are key insights, on where the largest share of ICARDA work (priority) in the country lies and can be a useful precursor to where the most impact will be created. Figure 5 is a demonstration of the top 20 ICARDA research themes on Jordan. These account for 372 out of the 2,194 thematic area mentions. The top key areas are related to capacity development, SDG 15, water harvesting, cactus pears, agriculture, climate change and livestock.

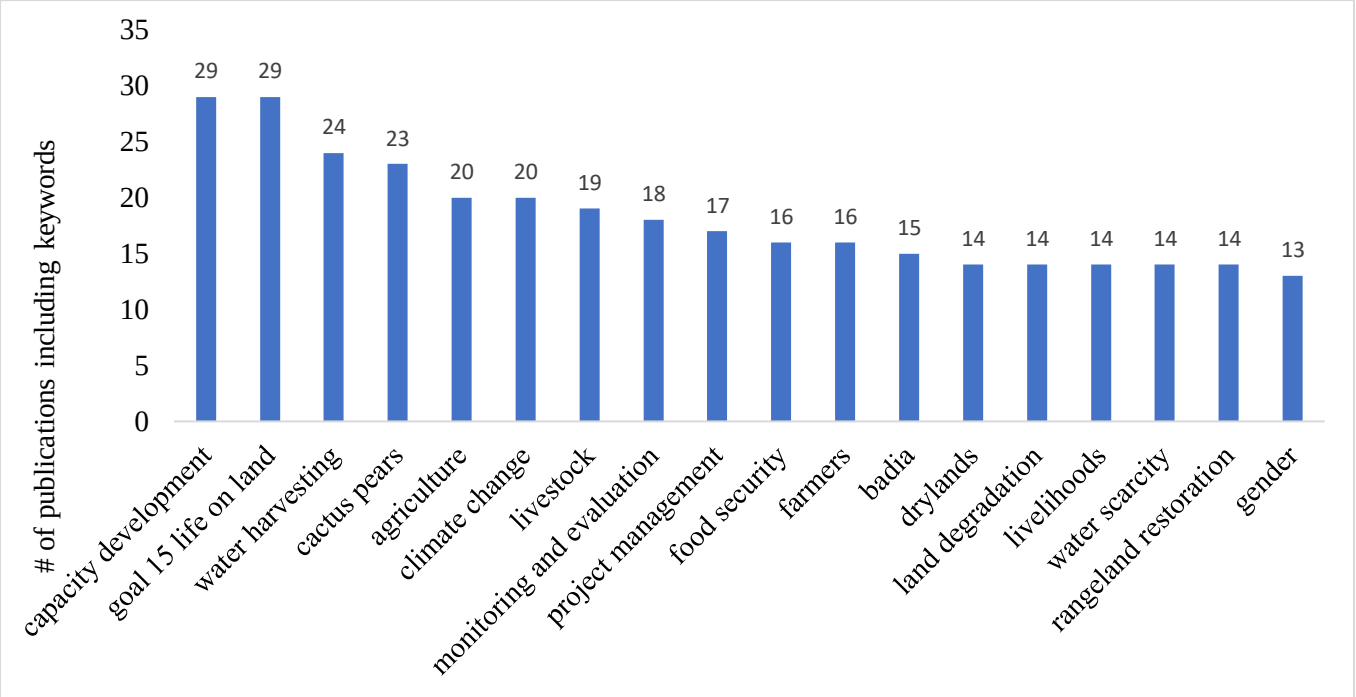

Figure 5: Frequency of research themes within ICARDA publications on Jordan (Source: DSPACE 2021, Elaboration: MEL)

Technologies development, testing and scaling

Through strong partnerships with its national and international partners, ICARDA excels at developing innovations and generating knowledge aimed at building of resilient and profitable farming systems in the global dry areas. Details on the identification, development and deployment of the resultant technological packages such as sustainable land management technologies, and crop varieties are presented in this section.

Variety development

As part of the varietal nursery development process ICARDA conducts several multi-location trials to ensure that the varieties developed as well adapted and suitable for different agro-ecological zones within its areas of operation. Jordan has participated and benefitted from this process with a total of 116 of trial lines of chickpea, lentil, faba bean, durum wheat, grass pea, spring barley, barley and spring bread wheat have been provided to since 2016 (Figure 6). Overall, the top distributed variety is chickpea over the period, on the contrary, Spring Bread Wheat is inexistant. For Spring Barley and Grass pea we can observe a constant increase over the period whereas for Durum Wheat, Faba bean, Lentil the increase is irregular with decreases in 2018-2019 for Durum Wheat and Lentil and a sudden increase from 2019 to 2020 and stabilization from 2020 to 2021 for Faba bean. Barley stands out compared to other varieties due to a stagnation from 2017 onwards.

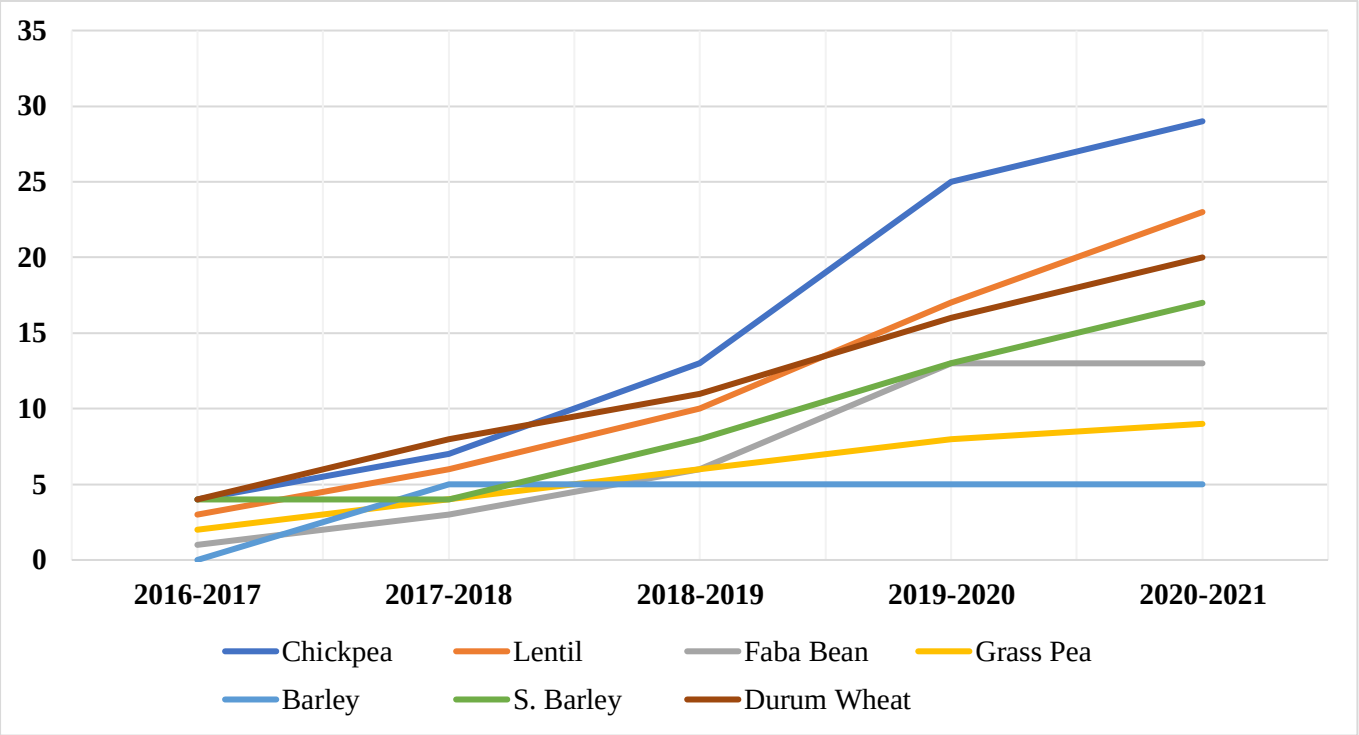

Figure 6: Cumulative ICARDA variety trials lines distributed to Jordan (Source: INDMS 2021, Elaboration: MEL 2021)

Variety release

Variety release is a key pre-requisite for taking crop technologies to scale through wide distribution networks. ICARDA has contributed to the release of 26 varieties of 6 crops by the Jordan Government. The crops include barley, chickpea, durum, faba beans, lentil, forages, and spring bread wheat (Figure). The release of ICARDA-germplasm varieties by the Jordan government has been consistent since 1980 (Figure). There has been an irregular annual trend of releasing varieties over the period. Effectively, we can observe a strong peak in 1988 and a fairly strong peak in 1990. As for the other years, there is stabilization between 1 to 3 releases. The ICARDA-supported varieties released by the Jordan government were bred for disease tolerance and resistance, farmer-preferred seed sizes, increased yield, water-deficit environments, among others.

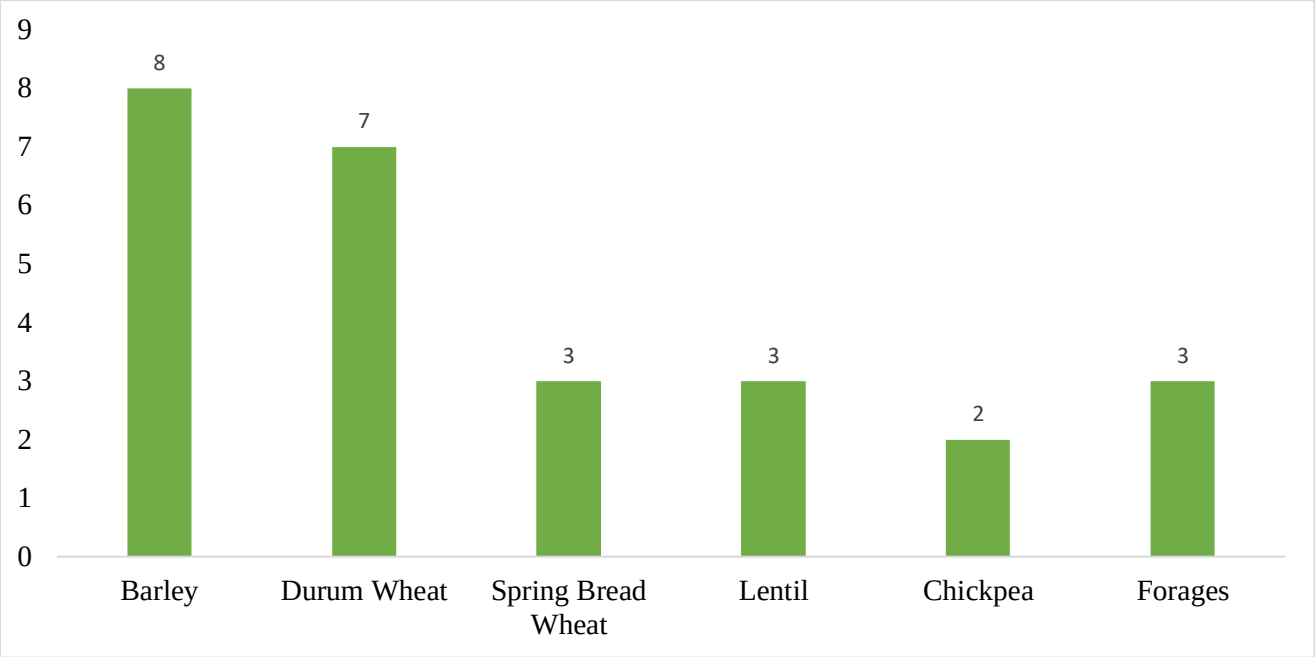

Figure 7: Varietal Releases from ICARDA germplasm by the Jordan government 1983-2021 (Source: INDMS 2021, Elaboration: MEL)

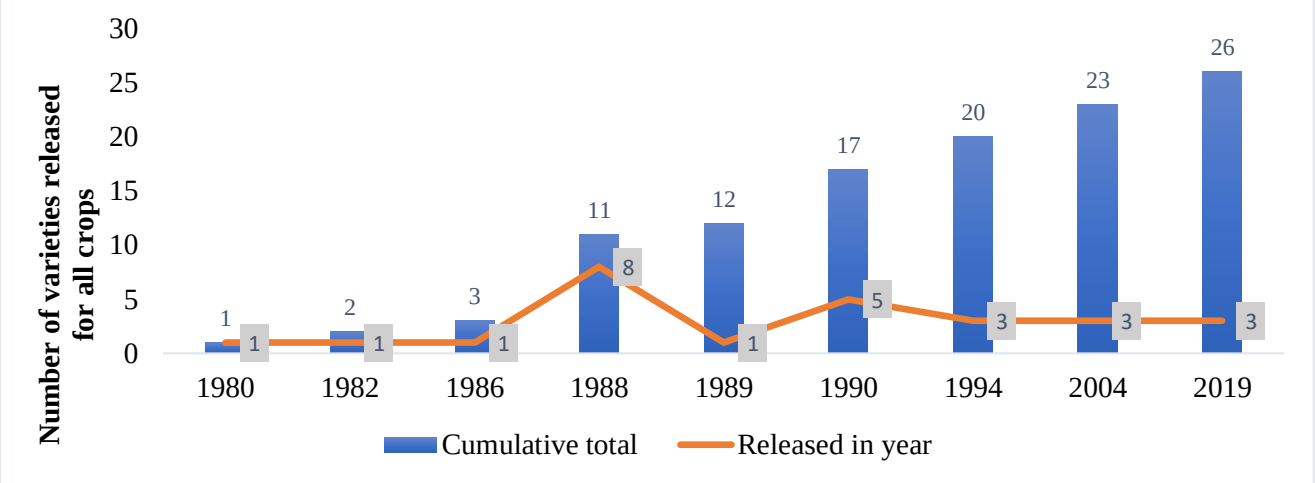

Figure 8: Trend of ICARDA germplasm release by the Jordan government (Source: INDMS 2021, Elaboration: MEL)

Impact assessment of some technologies promoted by ICARDA in Jordan

Below are summaries of research conducted on the impact of ICARDA-promoted technologies and practices in Jordan. The technologies range from irrigation technologies' effect on yield, production cost and soil salinity, adoption of soil and water conservation technologies and irrigation technologies, business/process and crop development technologies and their associated economic returns.

Rehabilitation of dry agro-pastures through community-based mechanized micro water harvesting and flood-irrigation agriculture to benefit to 1,000 ha/ year in Jordan

Intervention: The empowered community-based approach rehabilitates degraded dry agro-pastoral watersheds through water harvesting, plantation of native vegetation, and enhanced downstream flood-water agriculture allowing a better adaptation to drought conditions and improvement in carbon storage in the uplands and reducing the need for agricultural inputs in the lowlands.
Impact: Mechanized micro-water harvesting packages developed by ICARDA and the Jordanian National Agricultural Research Center (NARC) are being scaled out in collaboration with local communities, targeting at least 1,000 hectares per year and 20,000 km^2 in the long term.
Study title & source:
https://marlo.cgiar.org/projects/WLE/studySummary.do?studyID=4081&cycle=Reporting&year=2020

Cactus accessions across different agro-ecological to enhance establishment of cactus orchards.
Intervention: The performance of 68 accessions that were planted in Al-Karama Agricultural station (National Center for Agricultural Research (NARC) Station) located in south of the Jordan Valley.
Impact: Significant differences were found between cactus pear accessions under Jordan valley environmental conditions. These differences are a good basis for providing resources that can be grown well under different environmental conditions.
Study title & source: Mounir Louhaichi, Sawsan Hassan, Yousef Alghawanmeh, Lotfi Lababidi. (2020). Evaluate cactus accessions across different agro-ecological to enhance establishment of cactus orchards. https://hdl.handle.net/20.500.11766/12328

Impact of rangeland rehabilitation strategies on drought resilience in Jordan
Intervention: Micro-water harvesting, controlled grazing and protection rehabilitation techniques to improve vegetation cover are often the strategies of intervention but the assessment of their impact is scare. Therefore, this study analyses 12 strategies from 2004 to 2018 to know whether they are effective and drought resistant.
Impact: Over fifteen years, based on the use of strategies, only seven sites had a positive vegetation cover trend, three of which were controlled grazing sites.
Study title & source: Sarah Barnahrt. (2019). Impact of rangeland rehabilitation strategies on drought resilience in Jordan. https://hdl.handle.net/20.500.11766/10131

Innovations

Production systems and management practices:

Improved Jameed processing technology targeting small scale women entrepreneurs
Innovation: ICARDA, developed an improved processing method for Jameed increase quality and yield. The improved technology helps increase production of Jameed which is a hard-dry skimmed yogurt mainly made from sheep milk, in the form of balls. The improved jammed permits accessing additional consumers and therefore market demand. It helps reduce inputs costs and produces complementary products such as milk fat used in the niche market for processing sweets.

Stage of innovation: Stage 3: available/ ready for uptake. The improved process has been disseminated and adopted mainly in Jordan by organizations and is in need for additional capacity development and skills transfer to be able to be adapted and scaled elsewhere.
Source: https://mel.cgiar.org/innovation/addinnovation/id/447

Sustainable Land Management technologies:

Supplemental Irrigation
Innovation: Supplemental irrigation has been introduced in the WANA region by ICARDA over a 20-year period. The breakthrough includes fine-tuning of when and how much to irrigate, where to source water from, what associated agronomic practices to follow, diversification of cropping systems – all aimed at maximizing water productivity as well as nutritional water security under a changing and variable climate.

Stage of the innovation: Stage 3 – ready for uptake. This has led to a change in behavior and policy in favor of supplemental irrigation practice which is now supported by national governments. Through a series of JICA- and AFESD-funded training courses and project level dissemination events, ICARDA has trained hundreds of national researchers, postgraduate students, and farmers on the supplemental irrigation practice.
Source: Murat Sartas, Theib Oweis, Vinay Nangia, Enrico Bonaiuti. (2020). Scaling Readiness Innovation Profile of "Supplementary Irrigation" Water Management System in Iran, Jordan, Syria and Turkey for Improving Water Availability and Efficiency in Rainfed Farming. https://hdl.handle.net/20.500.11766/12734

Cactus Fruit Plantation in Arid Dry Lands

Innovation: This technology is based on the natural advantages and the multi-purpose usage of spineless cactus pear (Opuntia fiscus-indica), to cultivate marginal lands in Jordan, generating environmental and socio-economic benefits.

Stage of innovation: Stage 3: available/ ready for uptake. In Jordan, elite accessions for fruit production have been identified. In parallel, intense program has been taking place to enlighten decision makers, government officials and farmers about the importance of cactus pear. The demand has been created but we do not have enough plant material to go for out scaling.
Sources: https://qcat.wocat.net/en/summary/5882/?as=html
https://www.cgiar.org/innovations/cactus-pear-natures-green-gold-for-better-farmer-livelihoods/
https://ruralsolutionsportal.org/en/-/39585602-8
https://hdl.handle.net/10568/114695

Gully plug

Innovation: Gully plugs aim at rehabilitating active gullies in dryland watersheds, which are prone to erosion through concentrated surface runoff. Multiple gullies plugged in succession dissipate runoff energy, foster local water retention and infiltration, encourage sedimentation, assist in the stabilization of gully bed and side banks, and stimulate revegetation of flow paths; the channel measures must be combined with proper SLM in the catchments upstream.
Stage of innovation: Stage 3 – ready for uptake. For this watershed intervention, which started in 2016 in collaboration with Jordan's National Agricultural Research Center and local agropastoralists, ICARDA devised three Sustainable Land Management technologies: Mechanized micro water harvesting, Gully plugs and Marab technology with the ministry announcing to adopt the technologies on state owned land.
Source: https://qcat.wocat.net/en/summary/5862/?as=html

Marab - Water Harvesting Based Floodplain Agriculture

Innovation: The Marab is a local downstream water harvesting measure in an integrated watershed context, where up/midstream users and applied land management practices affect the Marab. The technology diverts and spreads excess runoff over deep-soil flood plains. The technology comprises local gully-filling, grading/leveling of seed bed, and construction of a bund-and-spillway system creating several compartments for flood-irrigated agriculture.
Stage of innovation: Stage 3 – ready for uptake. A policy brief has been published for the government to take up recommendations and include them in their policy plan. Suitable areas for Marabs in Jordan can be identified using geospatial information and incorporating the knowledge of biophysical parameters/variables, and the improved ecosystem services obtained from the site in Al Majeddyeh.
Source: https://qcat.wocat.net/en/summary/5770/?as=html

Mechanized micro water harvesting through 'Vallerani' tractor plough for central Jordanian Badia

Innovation: Mechanized micro water harvesting breaks up crusted and compacted soils, and fosters the capture and retention and the deep-infiltration of surface runoff generated during heavy rainfall events. The micro water harvesting pits store water and provide soil moisture to the out-planted shrub seedlings and the emerging seeds - and thus boosts the development of resilient vegetation patches towards the eventual rehabilitation of degraded rangelands.

Stage of innovation: Stage 4: taken up by next users. Jordan's Ministry of Agriculture took up the mechanized MWH system (Vallerani tractor plow system for rangeland rehabilitation) - used for various initiatives such as the 'Badia Restoration Program', with the aim to rehabilitate 15k hectares degraded rangelands per year.
Source: https://qcat.wocat.net/en/summary/5860/?as=html

Policy Contributions

The ministry of Environment has been taking solid action to support Jordan's green growth transformation.

Explanation of policy/involved stakeholders: Economic growth that is sustainable and socially inclusive is the basis for Jordan's green growth vision that is willing to maintain the importance of building resilience in the main green economic sectors such as agriculture so that the economy to absorb external shocks such as the negative consequences of COVID-19 and regenerate itself. Based on the continuous efforts and ambition to support environmental and climate action in Jordan, different stakeholders were involved including the Ministry of Environment, Global Green Growth Institute, Ministry of Planning and International Cooperation, Ministry of Agriculture, and many other ministries, and local partners such as Higher Council for Science and Technology, Royal Scientific Society, Department of Statistics, National Agriculture Research Center, Water Authority, the Jordan Valley Authority, and development partners such as ICARDA, GIZ, UNDP, NDC Partnership, EBRD, EU, AFD, FAO and World Bank.

ICARDA's contributes to the following action areas based on Jordan's green growth transformation:

- **Action areas**: Mainstream green growth into the provision of agriculture extension services and explore options to improve their long-term sustainability.
- **Action areas**: Develop a flexible crop planning and variety selection methodology and decision-making process based on crop-per-drop and economic competitiveness.

Source:
http://www.moenv.gov.jo/ebv4.0/root_storage/ar/eb_list_page/20022_jordan_agriculture_v06_rc_web-0.pdf

Enhancing a Traditional Water Harvesting Technique in Jordan's Agro-pastoral Farming System

The contribution draws on lessons learnt from research conducted in development and monitoring of a scientific-driven WHT called "Marab1"in a participatory approach with the local community by ICARDA and the NARC in Jordan. Not only does the research contribute to policy recommendations but also highlights the principles of an effective adaptation and coping strategy to re-establish the productive functioning of Jordanian Badia environments. The research also emphasizes on how investing in Marab at the community level could improve the livelihoods of rural households and communities in the Badia, where water scarcity, land degradation, and food insecurity are widespread. Within the research conclusions such as using an appropriate WHT for agriculture, such as Marab, can contribute to both poverty alleviation and climate change adaptation in agro-pastoral farming systems, can be found.

Source: https://hdl.handle.net/20.500.11766/11506

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

Based on its expertise and strong experience in the country, ICARDA has identified the following concrete actions through which it can contribute to the achievement of SDG 1, 2 and 15: Zero Hunger, improved livelihoods, and better life on land for better resilience of farming communities as well as water management in Jordan. Several opportunities and recommendations based on impact assessment studies, trending innovations, and policies, can be seized in this section to either reinforce policy discourse, upscale innovations or encourage well targeted investments and decision making.

General themes:

1. **Innovations:**
    - Development of low-cost solar energy systems which can be used by small-holder farmers for irrigation, conservation of milk, drying of fruit and vegetables etc.
    - Establish an agricultural insurance company and develop agricultural risk mitigation strategy in line with climate risks
2. **Policy:**
    - Map and optimize research to impact pathways to improve relevance of innovation efforts in the agriculture sector
    - Undertake sector reforms in line with the green growth strategy and improve access to climate finance for small farmers
3. **Capacity development:**
    - Capacity building and technology packages to put in place new water harvesting and water saving farming practices.
    - Design and implement capacity building program for green growth planning and implementation in the agriculture and forestry sector
    - Capacity building in milk management and dairy processing for women empowerment and youth.
    - Increase the quantity and quality of Jordan's agricultural extension services and explore the options for expanding access to extension services

Main thematic:

4. **Water and Land:**
    - Rapid diagnostic and assessment of the impact of the conflict on water, land and value chains, and ex ante impact assessments of recovery measures on land and water use and productivity through a combination of digital technologies and a network of agricultural experts and data on the ground.
    - Generating evidence on the benefits of using location-based irrigation optimization and rainwater harvesting techniques in implementing Supplementary Irrigation in uncontrolled/real conditions without support from ICARDA and other R4D organizations
5. **Livestock:**
    - Providing high yielding and more nutritious crops and feed for livestock to smallholder farmers.
    - Improving small ruminant nutrition with local feeds (cactus), productivity, management at household level and value chains at regional level.
6. **Genebanks:**

- Rapid introduction of seed supply and multiplication, building national and community-based seed distribution and certification networks.

7. **Rural employment:**
   - Support rural green growth and employment through ecosystems restoration

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Table 1: Summary of ongoing projects in Jordan (Source: OCS & MEL2021, Elaboration: MEL)

Project Title	Total funds	Countries	Main Donor	ICARDA Strategy	Date from	Date to	Project Leader
Conservation of pollinator diversity for enhanced climate change resilience	7 824 348	Jordan, Algeria, Egypt, Morocco, Turkey, State of Palestine Tunisia	BMUB	Adapting to climate change	2017-06-01	2022-05-31	Stefanie Christmann
Supporting National Programs of Agricultural Research in the Arab Countries through Training	975 000	Jordan Egypt Lebanon Morocco Oman Sudan	AFESD	Building capacity	2019-01-01	2021-12-31	Charles Kleinermann

Project Title	Total funds	Countries	Main Donor	ICARDA Strategy	Date from	Date to	Project Leader
Assessment of water-harvesting scaling-up potential for the NENA Region	228988	Jordan Algeria Bahrain Egypt Iraq Kuwait Lebanon Lybia Morocco Oman Qatar Saudi Arabia Syria Tunisia Turkey Yemen Sudan South Sudan Palestine UAE	FAO	Scaling up proven technologies	2021-06-02	2022-05-30	Govind, Ajit
Support for Enhancement of Food Security in Arab Countries (Phase III)	2486098	Egypt, Iraq, Jordan, Morocco, Syria, Tunisia, Yemen, Sudan, State of Palestine Algeria	AFESD; OFID	Adapting to climate change	20-09-2018	31-12-2022	Habib Halila

Project Title	Total funds	Countries	Main Donor	ICARDA Strategy	Date from	Date to	Project Leader
Establishing and Operating a Regional Network for Field Measurement of Actual Crop Water Consumption (Evapotranspiration)	716610	Egypt, Lebanon, Morocco, Jordan, Tunisia	FAO	Enhancing water and land productivity	2018-12-23	2021-11-30	Vinay Nangia
Watershed Restoration in Badia Areas of Jordan	228988	Jordan	USDA-USFS	Enhancing water and land productivity	18-09-2019	30-12-2024	Stefan Strohmeier
Planning and Piloting Watershed Rehabilitation for Improved Water Productivity with Water harvesting in Jordan	206,401	Jordan	FAO	Enhancing water and land productivity	07-10-2021	31-05-2022	Stefan Strohmeier
Senior expert at the Restoring Degraded Lands Flagship for sustainable dryland agro-ecosystems	119,790	Jordan	NOW, WOTRO SCIENCE FOR GLOBAL DEVELOPMENT	Enhancing water and land productivity	2020-04-1	2022-09-30	Dr. ir. G. Sterk

[i] Jordanian Department of Statistics, "Table 1.2 Number and Area of Agricultural Holdings by Type of Holding and Total Area Size Class of the Holding.Pdf," in *Agricultural Census*, 2017, 56–68, http://www.dos.gov.jo/dos_home_e/main/agriculture/census/tables1/tab1_2.pdf.
[ii] World Bank Group, "The Role of Food and Agriculture for Job Creation and Poverty Reduction in Jordan and Lebanon."
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