ICARDA
Science for resilient livelihoods in dry areas

"Use of Conservation Agriculture in Crop-Livestock Systems (CLCA) in the Drylands for Enhanced Water Use Efficiency, Soil Fertility and Productivity in NEN and LAC Countries"

Overview of CLCA Main Achievements

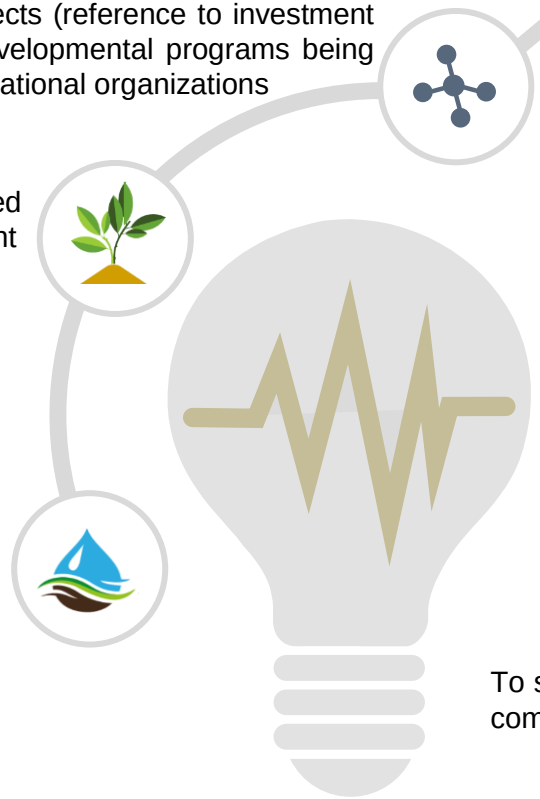
Mourad Rekik, Aymen Frija, Zied Idoudi

Crop-Livestock Systems Transformation for more Sustainable Resources Use

01 Linking with and leveraging existing or upcoming IFAD projects (reference to investment projects) within the countries of engagement as well as developmental programs being undertaken by national governments or multilateral and international organizations

02 Introduction of more productive forage crops and enhanced practices for biomass management and livestock management

03 Development of contextually-relevant soil conservation and water use efficiency practices



OBJECTIVE

To develop local adaptable soil conservation and water use efficiency technologies as well as forage crops and biomass management practices for different CLCA systems in the drylands using agro-ecological principles and participatory action research approaches

GOAL

To sustainably increase production and enhance climate resilience of small farmers' communities and their crop-livestock production systems in drylands

Geographic Scope & Thematic (GST-1/2)

Nicaragua

Maize & Red Beans – Cattle based farming system

Honduras

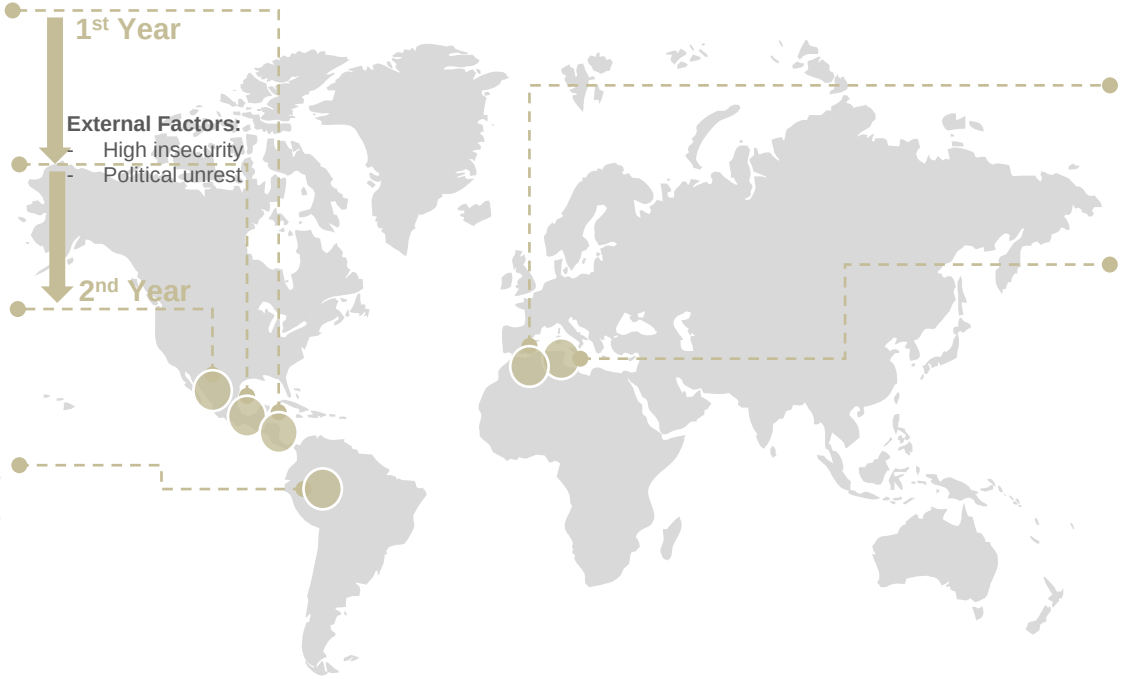
Maize & Beans & Sorghum – Cattle based farming system

Mexico

Wheat & Maize – Sheep based farming system

Bolivia

Maize & Andean Cereals (Quinoa) – Camelid base farming systems



Algeria

Cereal – Livestock belt (Barley – Wheat & Barley & Fallow – Sheep)

Tunisia

Cereal – Livestock belt (Barley – Wheat & Barley & Fallow – Sheep)

Different Production Systems

LAC Countries: Bolivia & Mexico

Maize and Andean cereals (Quinoa or Amaranth) in Bolivia; **High** pressure on the land, extension of quinoa and competition with camelid production; **Subsistence** and mixed crop-livestock type (Maize & Small ruminants); **90%** rainfed areas in Mixteca Alta/Mexico; **Extended** maize fields mosaiced with pastures and forest ecologies (average maize yield of 1.1. t/ha); **Important** degradation of natural resources; **Erosion** is a major threat to the sustainability of the systems

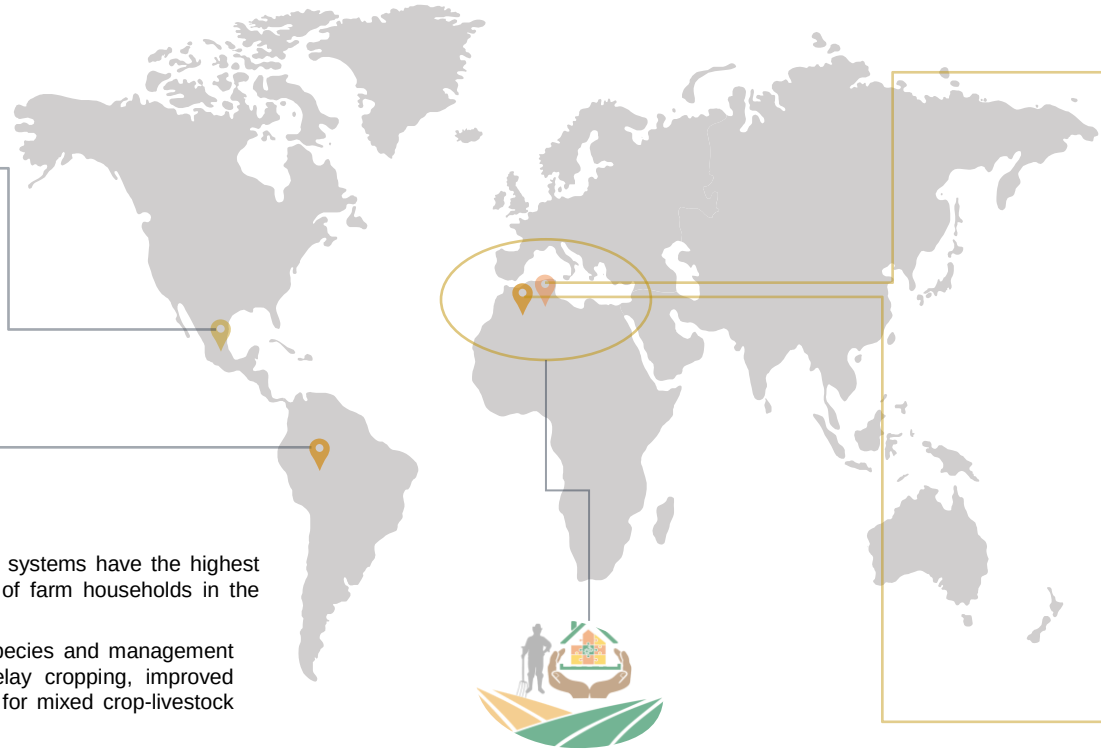
NA Countries: Algeria & Tunisia

Cereal – Livestock belt (Wheat – Barley – Fallow - Sheep); **Mixed** small to medium-scale holders; **Rainfall** 200 - 450 mm, very irregular; **Poor** soils, extremely low soil organic matter; **Very** high erosion risks; **Extended** practice of fallow; **Low** integration of forages; **Supplementary** irrigation of wheat in Algeria

(GST-2/2)

01 What technological alternatives allow to improve water use efficiency, soil fertility and productivity in specific regions of the drylands of NEN and LAC?

02 What are the best fit of CLCA alternatives to different types of mixed crop-livestock farming systems in the drylands of NEN and LAC and what are the trade-offs associated to those alternatives?



Mexico

- What technological alternatives have the highest potential to improve the productivity and resilience of mixed maize-based systems in the Mixteca Alta of Oaxaca?
- What are the most appropriate CLCA alternatives for different types of farming systems in the Mixteca Alta of Oaxaca and what are the trade-offs associated to those alternatives?

Bolivia

- What kind of intensification strategies of llama-quinoa systems have the highest potential to, at the same time, improve the livelihood of farm households in the Bolivian highlands and preserve the natural resources?
- What technological alternatives (i.e., combination of species and management practices) are the most effective and efficient for relay cropping, improved fallows and wind barriers to improve the performance for mixed crop-livestock systems in the Bolivian highlands?
- What are the most appropriate CLCA alternatives for different types of farming systems in the Bolivian highlands and what are the trade-offs associated to those alternatives?
- Has quinoa production expanded in the last 20-30 years? At what rate? In specific land qualities such as foothills or flatlands?
- What is the average fallow length in the current quinoa production? Is there continuous cultivation? Is the cropping intensity different for specific land qualities?

Tunisia

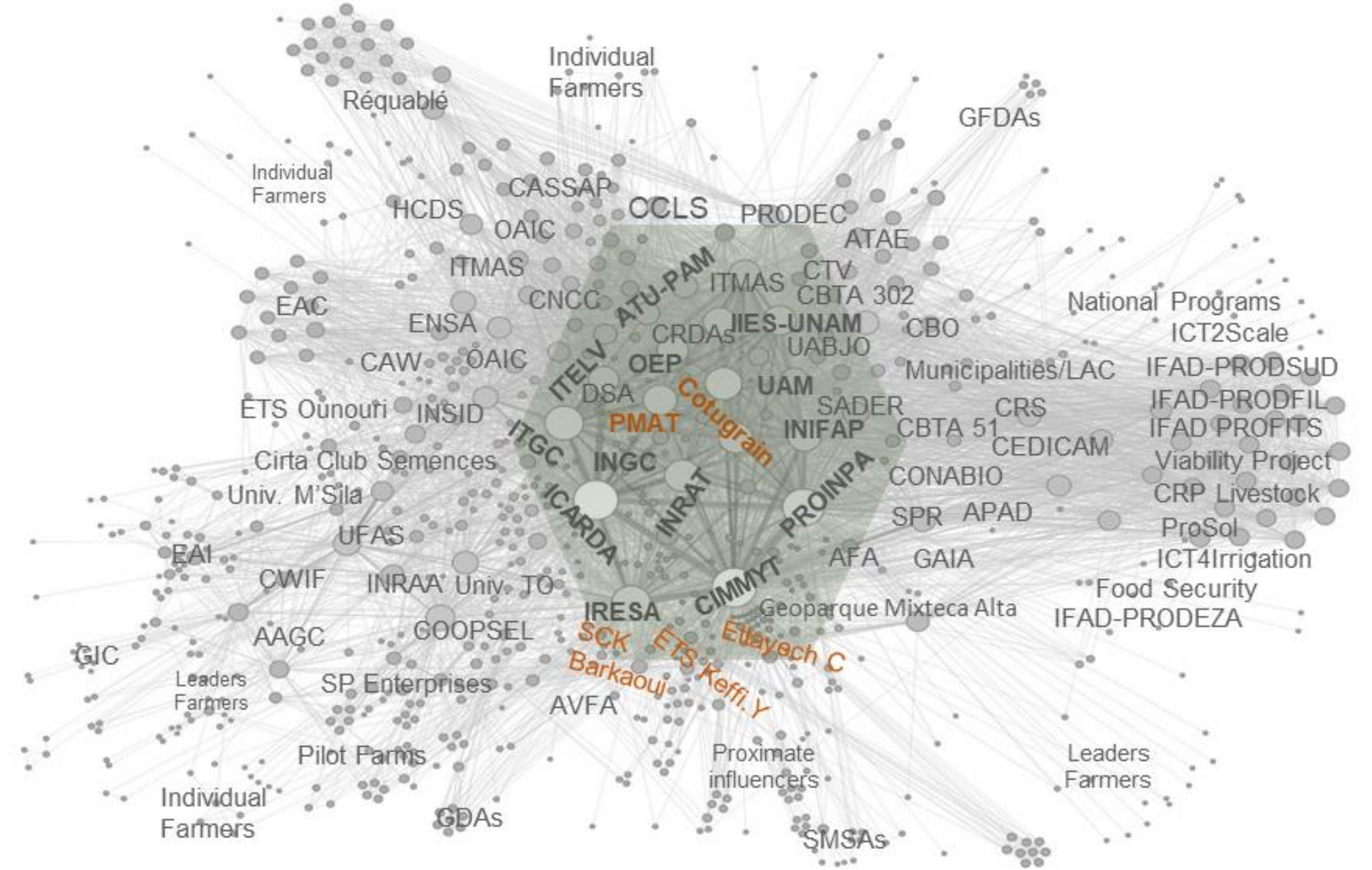
- What is the impact of enhancing barley production in mixed cereal-livestock production system on the use of crop-residues for summer grazing?
- What are the environmental and economic costs and benefits of CA practices applied for the mixed cereal-livestock production systems in Zaghouan? A focus on erosion and soil fertility valuation
- What is the impact of the adoption of CLCA options, on the different farm types identified in the region of Zaghouan, in terms of soil fertility, farm income, and feed self-sufficiency?
- What are the most suited socioecological contexts and locations where CA can be effectively promoted for long-lasting adoption?
- What is the spatial profitability distribution of CA adoption (investments), and which costs and benefits can be the most relevant and feasible to consider for such a spatial distribution?

Algeria

- What technological alternatives have the highest potential to improve the productivity and resilience of mixed cereal-sheep systems in Algeria CLCA target sites?
- What are the enabling factors allowing for higher productivity of crops cultivated under CLCA systems?

- To assess and track the evolution of the established knowledge hub in Algeria and Tunisia in terms of social dynamics and learning
- To track changes and dynamics within the production system which are due to the enhanced knowledge management and to the already established demonstrations implemented in 2020/2021. Changes of farmers behavior and decision making will be part of the changes the project aims to track in both NA countries

Engage Effective Partnership & Deliver at Scale



Engage Effective Partnership & Deliver at Scale

1,200

Gender Based-Interventions for Innovative Solutions in NA reaching out 1200 women farmers

5,600

Dissemination of the Integrated Improved Crop-Livestock Management Packages to 5,600 Mixed, Smallholder Farmers in NA and LAC Countries

20,000

Farmers are indirectly reached through broader CLCA initiatives

6,000

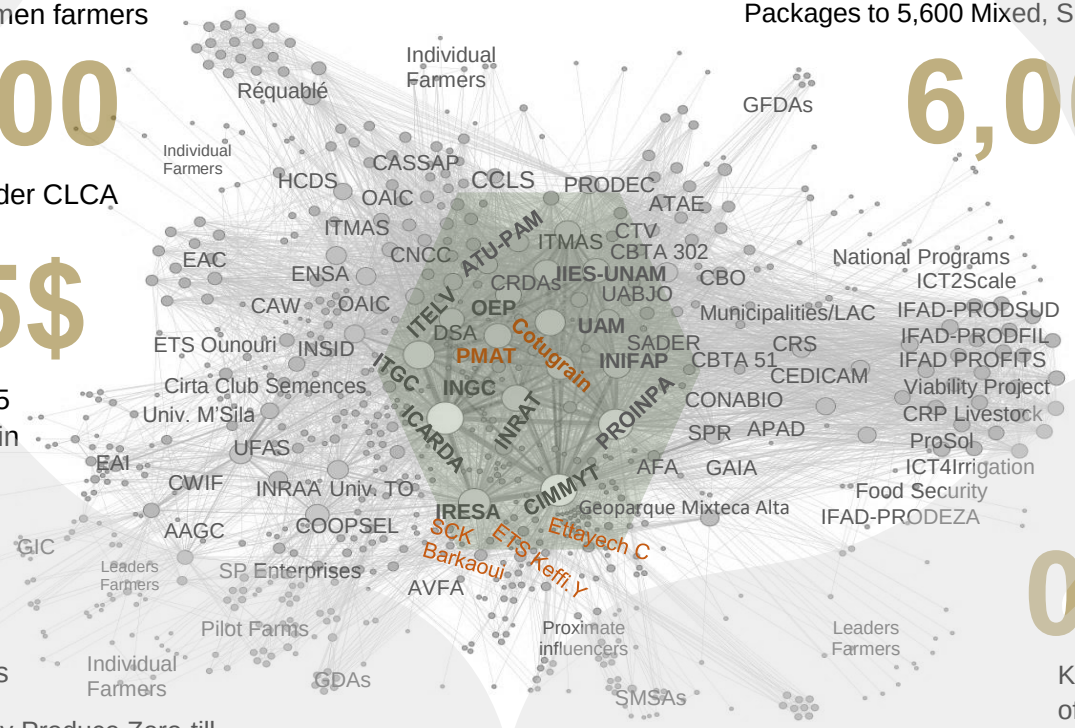
Hectares were Implemented under CLCA Farming Systems in NA and LAC Countries

125$

A cost per beneficiary ratio of US$125 compared to the average of US$246 in IFAD's 2016-2018 portfolio.

5,000

knowledge Provision & Capacity Lifting to more than 5,000 Farmers, National and Local Extension Agents, Students, Young Scientists, and Policy Makers – in NA and LAC Countries



02

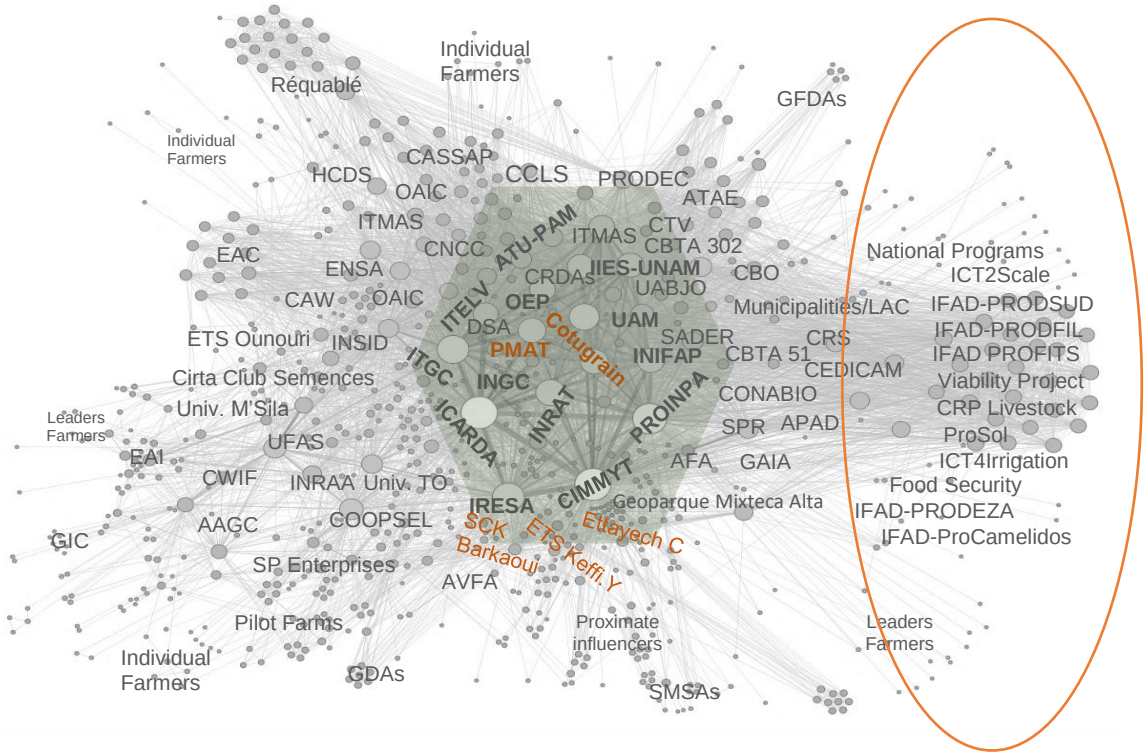
Private Public Partnerships

- **ITGC – PMAT-CLCA** in Algeria to Locally Produce Zero-till Seeders and Expand areas Under CA
- **INRAT-Cotugrain-CLCA** to scale forage crops and forage mixtures in Tunisia

05

Knowledge Hubs for Leveraging the democratization of knowledge and Communities Empowerment of Contextualized CLCA Systems (CA, Forage, Livestock) in Algeria and Tunisia

Generating Evidences & Valid Innovations to Support National Program, IFAD Portfolio and Other Development Initiatives



01 Uptake of Small Machinery Business Models developed by CLCA & Financial Support to their Beneficiaries: PRODSUD Project (IFAD), PRODFIL Project (IFAD), VIABILITY Project (AFD)

02 Uptake of Forage-related technologies, Varieties, and Packages Developed within CLCA: PROFITS Project (IFAD), Siliana – Tunisia

03 Building on ICT2Scale Digital Innovations for scaling CLCA innovations

04 Uptake of Knowledge & Scaling Hub Concepts and CLIO's developed and validated by CLCA: ICT4Irrigation & ProSol Projects (GIZ)

05 Production of Grass and Shrub Seedlings & Providing technical backstopping for the use of Quinoa husk for supplementary feeding of llamas, Bolivia: IFAD ProCamelidos Program

CLCA Technologies
From Pilot to Scale

Piloting Phase

Scaling Phase

Self-Sustained Scaling Mechanisms

ha under CLCA Technologies

Algeria **36**
Tunisia **50**

2013-15

319
477

2018-19

982
1,440

2019-20

1,732
2,000

2020-21

CLCA Phase-I

Adaptative Research

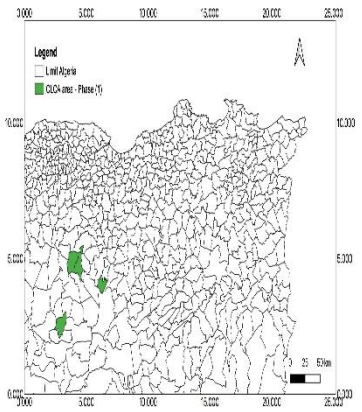
CLCA Phase-II

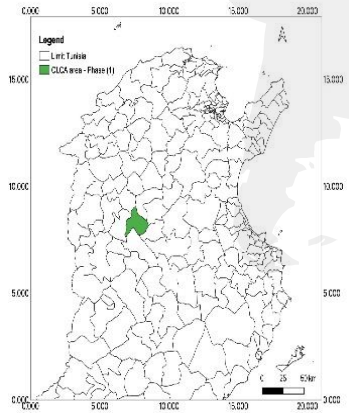
Demand-Responsive Research Supported by Ambitious R4D Partnerships

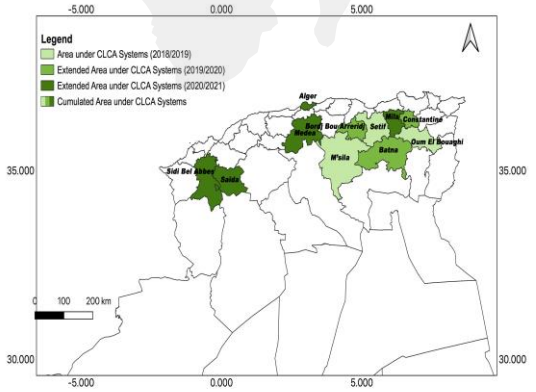
Knowledge & Scaling Hubs

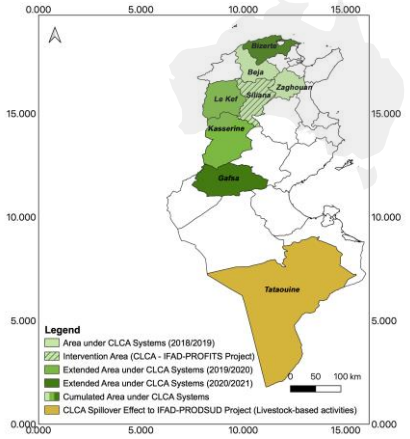
2,355
3,000

2021-22









https://mel.cgiar.org/projects/clca2

CLCA Socio-Technical Package for Agroecological System Transformation

NA Countries

Clustering Crop-Livestock Integration (CLI) Options Based on the Scale of Implementation (On-Farm, Landscape) and Resource-Orientations.

CLCA Options

No-till on Residues + Forage Diversification+ Livestock Management Interventions

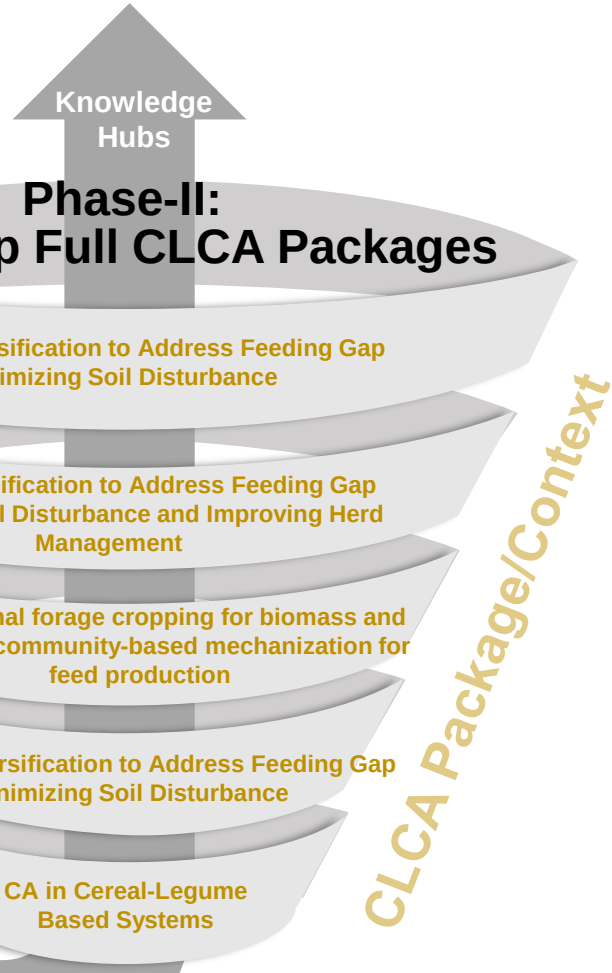
Minimum Tillage+ Forage Diversification+ Alternative Feed Options + Livestock Management Interventions

Conventional Till + Forage Diversification+ Forage Crops Seed Production + Small-Scale Mechanization of feed production

Minimum Tillage + Forage Diversification+ Alternative Feed Options

Cereal-Food Legumes Rotation + No-till on residues + Stubble Grazing Management

Phase-I: Adaptative Research & Options under Piloting



LAC Countries

Landscape-Piloting Stage

Mexico

- ✓ Living Barriers
- ✓ Controlled Grazing of Stubble and Forage Mixtures
- ✓ Relay Cropping with Fodders Species

Bolivia

- ✓ Improved Fallow
- ✓ Improved Pastures
- ✓ Windbreak with Quality Species

Show Cases of Poverty Alleviation and Food Security

Impact of Different CLCA Agronomic Innovations on Improving Sustainability Indicators in Algeria and Tunisia under Rainfed Conditions

CLCA Innovation	Indicator		With CLCA Innovation	With Farmer Practice	+/-
Tunisia					
Conservation Agriculture, Improved Variety, Crop Diversification	Crop Yield (t/ha)	Wheat	2.57 ± 0.82 (CV = 30%)	2.42 ± 0.78 (CV = 32%)	+ 6.2%
		Forage Mixture	8.88 ± 1.65 (CV = 18%)	5.4 ± 1.02 (CV = 19%)	+ 64.4%
Conservation Agriculture	Net Return (US$/ha)	Wheat	168	158	+ 6.33%
Algeria					
Conservation Agriculture, Improved Variety	Crop Yield (t/ha)	Wheat	1.99 ± 0.5(CV = 25.1%)	1.65 ± 0.38 (CV = 23%)	+ 20.6%
		Vetch	1.23 ± 0.19 (CV = 16%)	1.07 ± 0.24 (CV-23%)	+ 14.9 %
Conservation Agriculture + Better Fertilizer & Weed Management	Input cost (US$/ha)	Wheat	409.09	424.89	+ 3.7 %
Conservation Agriculture	Benefit cost ratio	Wheat	Wheat/Lentil: 1.4 (+ 0.4)	Wheat/Barley: 0.4 (- 0.6)	+ 0,4

The values are average ± standard deviation (SD), values in bracket are coefficients of variance (CV)

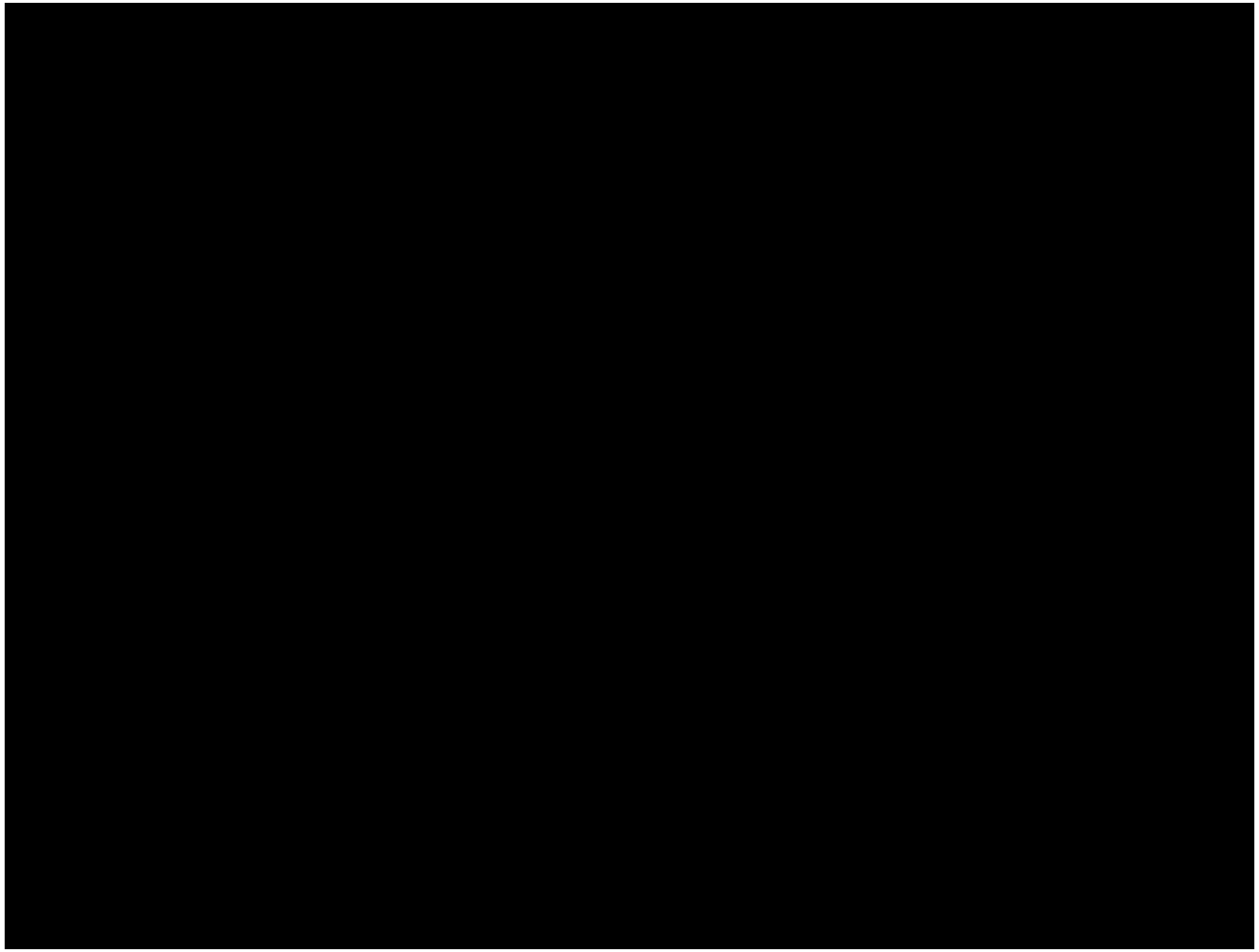
Devkota, M. *et al.* (2022). Better Crop-Livestock Integration for Enhanced Agricultural System Resilience and Food Security in the Changing Climate: Case Study from Low-Rainfall Areas of North Africa. Springer, Cham. https://doi.org/10.1007/978-3-030-92738-7_13

Show Cases of Poverty Alleviation and Food Security

Engagement with Local/Small and Medium Entreprises, which Creates Local Economic and Social Dynamics (Employment, Encouraging Youth Entrepreneurship, women empowerment) in addition to services provision for natural resources management and conservation

Small-Scale Mechanization for Better Crop-Livestock Integration

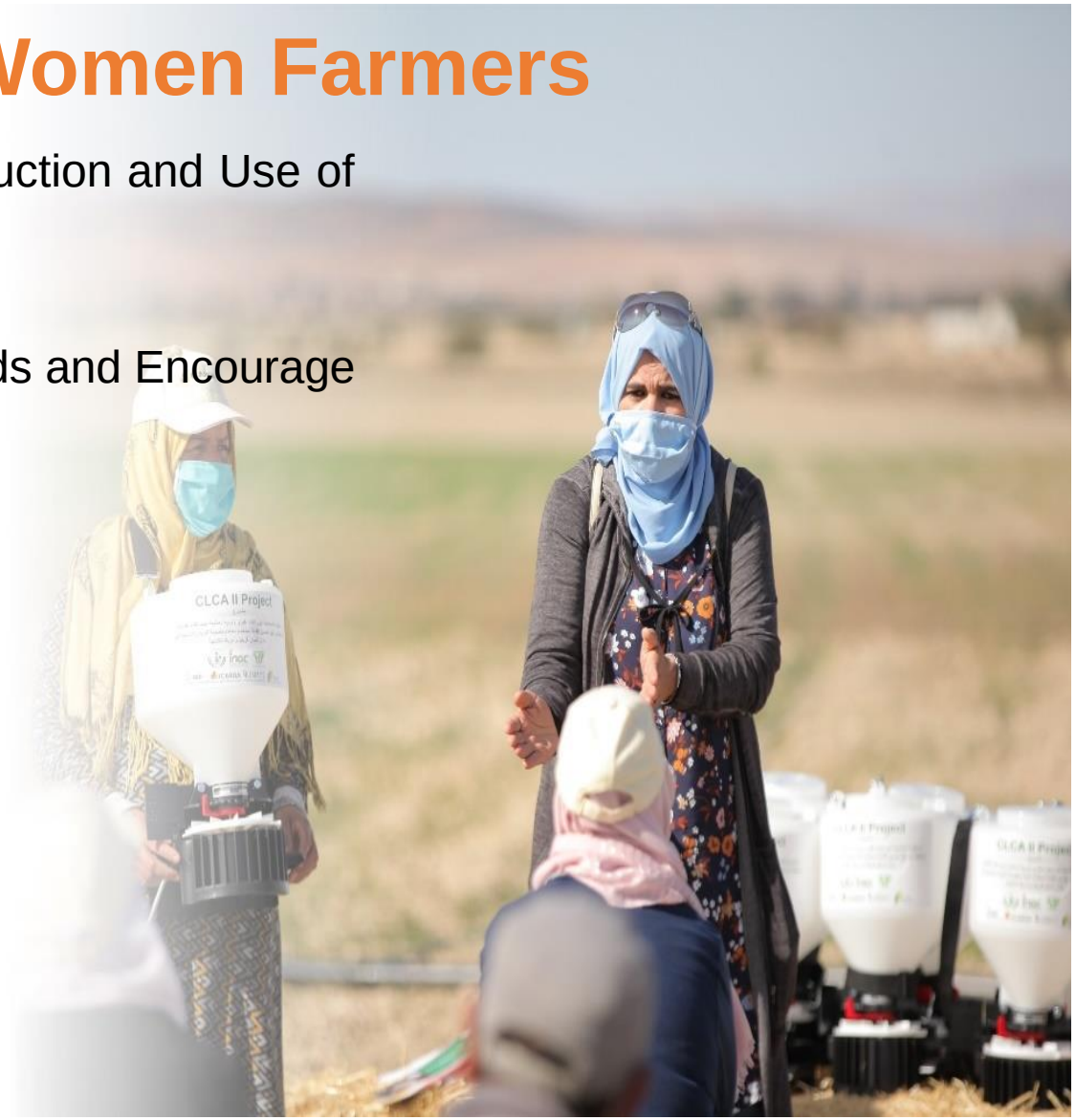
Economic Transformation of Mixed Livestock-Crop Farmers: Improving Production Efficiency, Cost Saving, Enhancing Investment Capacity and Generating Additional Income



Gender Based-Interventions for Innovative Solutions in North African Countries

Reaching out 1,200 Women Farmers

- Empowerment in Decision Making about Agricultural Production and Use of Productive Assets (SMS/Digital Activities)
- Enhancing Women Leadership in Communities
- Enhancing Women Access to Machinery, Reduce Workloads and Encourage Entrepreneurship for Youth and Women



Private Sector Engagement for Natural Resources Management and Conservation

Public Private Partnership for Scaling Forage Crops and Forage Mixtures in Tunisia

INRAT-Cotugrain-CLCA

Contextualized Forage Mixtures

Forages for Better Soil, Feed, and Biomass

Forage Mixture Corridors Across the Steppe to Increase biomass, Provide High-Quality Feed, and Increase Soil Organic Matter

Private Sector Engagement for Natural Resources Management and Conservation

Public Private Partnership for Enhanced Conservation Agriculture Practices: Boudour Zero-Till Seeder

ITGC-PMAT-CLCA

SUSTAINABLE INTENSIFICATION OF WHEAT-BASED FARMING SYSTEMS

THE CHALLENGE

To sustainably increase production and enhance climate resilience of small farmers' communities and their crop-livestock production systems in drylands.

Public-Private Partnership for enhanced conservation agriculture practices: the case of Boudour Zero-Till seeder in Algeria

Conservation Agriculture (CA) is considered as an alternative to the conventional tillage (CT) for rainfed drylands as it avoids soil tillage , saves time, energy and labor while conserving water and nutrients in the soil to support crop production. Research evidence illustrates that CA gives at least the same yields as CT in the arid areas, often more, with less time and energy input and better environmental sustainability. However the adoption of CA technology is very limited in North-Africa compared to the other developed countries. One of the main hindrances to the adoption of CA is the limited availability of appropriate and affordable seeding machinery for small to medium sized land-holding (SLH) farmers. Commercially available seeders are made mostly in industrial countries with expensive cost (US $20,000-60,000), which places them out of reach of smallholders in developing countries. In this response, ICARDA in collaboration with national and private partners through different Projects (including the ACIAR CANA and the IFAD CLCA I) at different stages put its efforts to design, testing, development and scaling out the low-cost seeders in different countries in Middle-East and North-Africa. With this effort, the seeder prototype "Boudour" was developed in 2016 by the Agricultural Machinery Construction - Sidi Bel Abbes (CMA) in collaboration with Technical Institute of Field Crops (ITGC), National Company of Agricultural Equipment Production & Trading (PMAT) and the Spanish Company SOLA _ exclusively represented by CMA in Algeria. The low demand for such a machinery was not a good incentive for the company to engage in large scale production. But the partnership with the public field crops institute, who are closely working with farmers in the fields, and their willingness to support the company made a difference. A first wave of twenty (20) seeders were then manufactured in a first step.

ICARDA led IFAD funded Conservation Agriculture for Crop Livestock systems – CLCA-II Project in collaboration with ITGC, national private and public partners Project has countinued to put its effort for multiplication and promotion of the "Boudour" seeder at scale. With awareness program in the ground the demand for the Boudour seeder has increased and the PMAT has already mobilized the twenty (20) units of ZT seeder in different parts of the country through its different sales points along the cereal-production belt spreading from Northern East to Northern west Algeria (Algiers, Constantine, Mila , Sidi Bel Abbes, Setif). During the 2019/20 cropping season, 982 ha area was seeded under zero tillage mobilizing "Boudour" ZT seeder.

Together, ITGC and PMAT were able to convince the Algerian government about the relevance of this technology for small field crop farmers in Algeria and to include the seeder into the national nomenclature of subsidized agricultural machines. With this effort, the "Boudour" ZT seeder is now subsidized at 30% when the seeder is purchased individually and 40% when

ICARDA

Science for resilient livelihoods in dry areas

NOVEMBER 2020

FACT SHEET

Farm Mechanization and Conservation Agriculture for Sustainable Intensification in Dry Areas:

Business Model Development for "Boudour" Zero-Till Seeder in Algeria

Understanding the Context

One of the main hindrances to the adoption of Conservation Agriculture (CA) is the limited availability of appropriate and affordable seeding machinery for small to medium sized land-holding farmers. The International Center for Agricultural Research in the Dry Areas (ICARDA) has built a strategic partnership in collaboration with national and private partners through different Projects [including the ACIAR-CANA and the IFAD CLCA Phases (I & II)] to design, test, develop and scale up and out a low-cost seeder in different countries in the Middle East and North-African Countries.

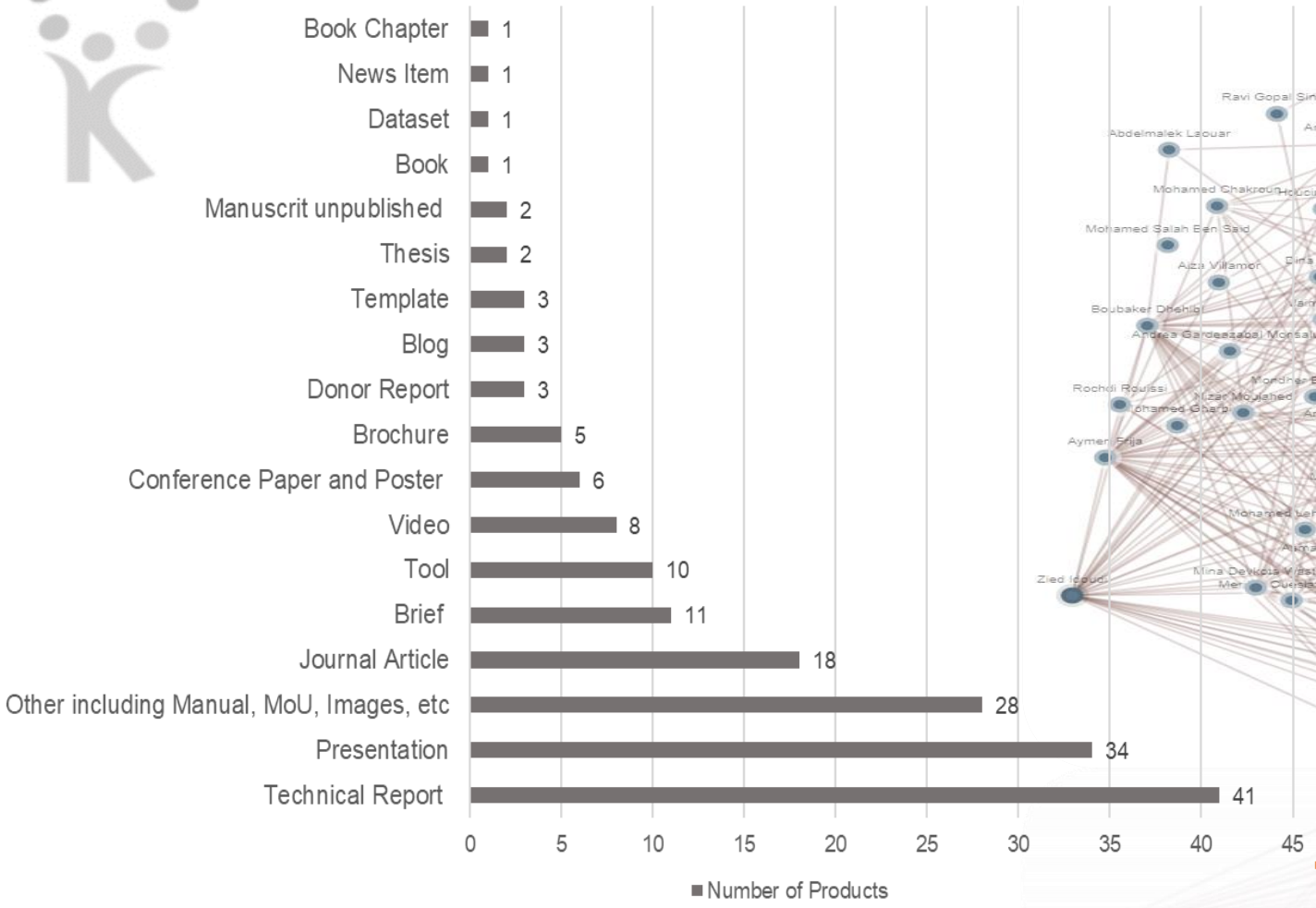
In Algeria, the Zero-Till seeder prototype "Boudour" was developed in 2016 by the Agricultural Machinery Construction-Sidi Bel Abbes (CMA) in collaboration with the Technical Institute of Field Crops (ITGC), National Company of Agricultural Equipment Production & Trading (PMAT) and the Spanish Company SOLA exclusively represented by CMA in Algeria. The low demand for such a machinery was not a good incentive for the company to engage in large scale production. Therefore, the partnership with the Public Field Crops Institute

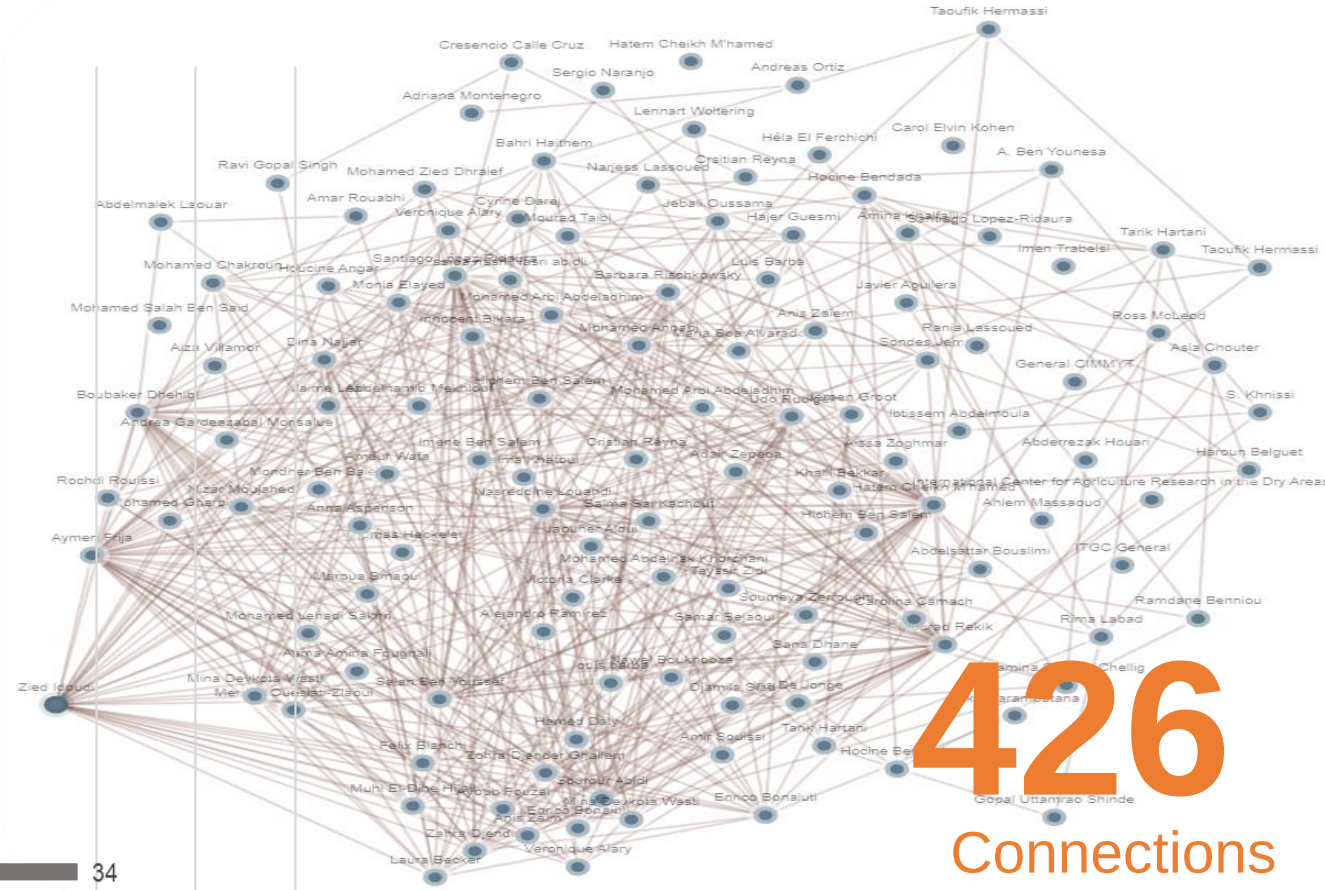
Local Production of Zero-till Seeders to Significantly Expand Areas under Conservation Agriculture

>188 CLCA Knowledge Products

MEL DSpace/CLCA Web Site

125 Authors

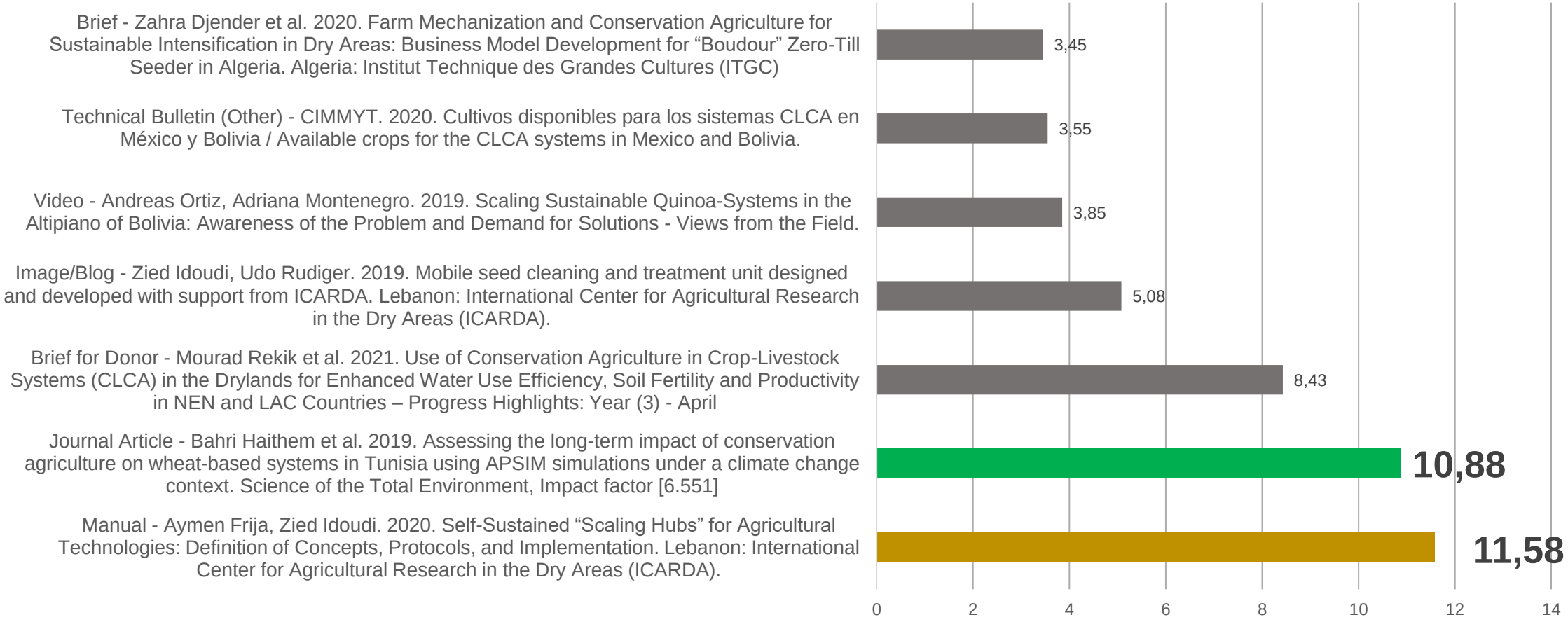




426 Connections

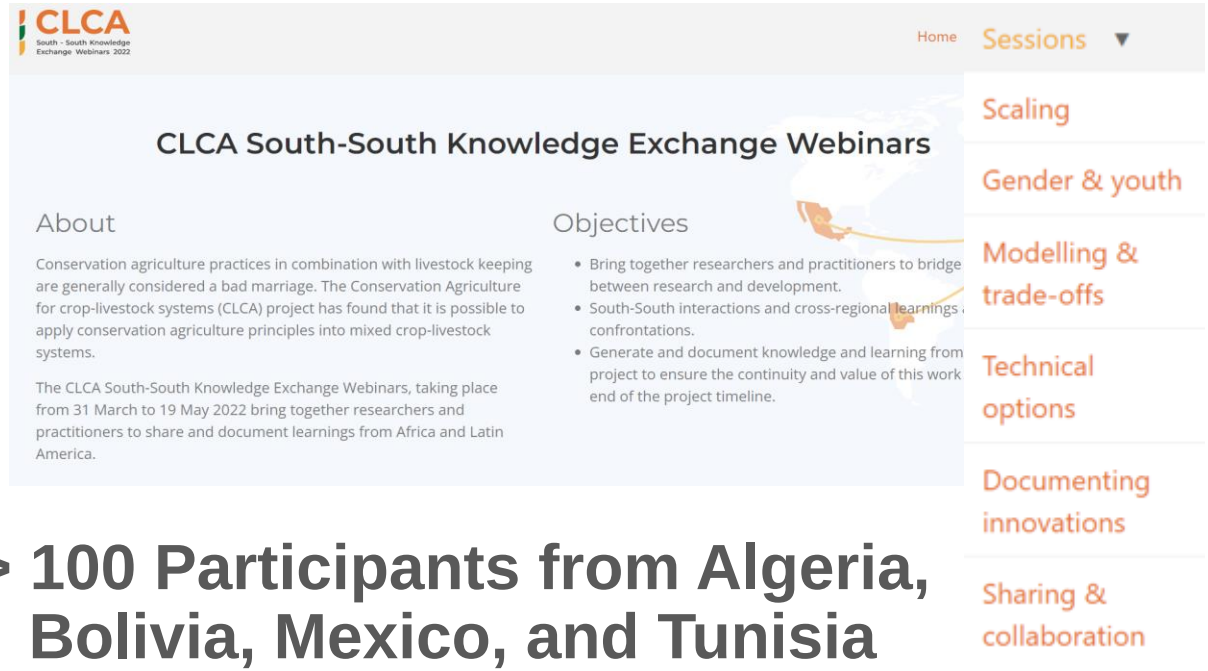
Connected Authors Through Publications

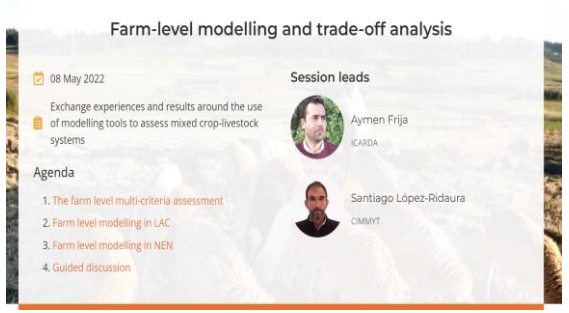
Top Altmetrics Attention Score

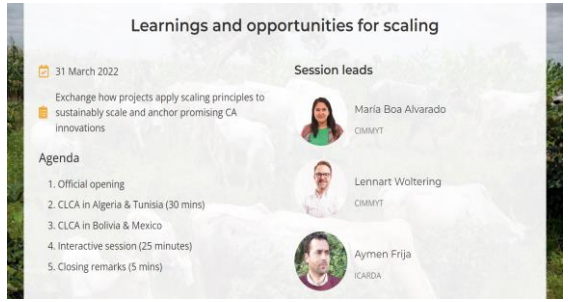


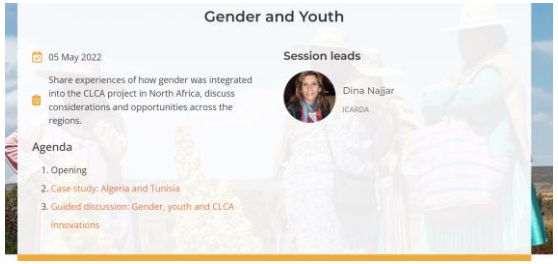
CLCA South-South Knowledge Exchange Webinars

13 March to 19 May 2022









> 100 Participants from Algeria, Bolivia, Mexico, and Tunisia

To share and document learnings from Africa and Latin America.

Webpage: http://clca-exchange.org/

RECAP & Take a Way Points

- ☑ Raising demand for forages as a key leverage for system transformation in small mixed-crop livestock systems
- ☑ Local production of zero-till seeders to significantly expand areas under Conservation Agriculture
- ☑ Forage mixture corridors across the steppe to increase biomass, provide high-quality feed, and increase soil organic matter
- ☑ Contextualized, collective provision of machinery services are key for system transformation and farmers livelihoods
- ☑ Animal Health management is key entry point to stable and functional sustainable crop-livestock systems
- ☑ Knowledge Hubs are key platforms to share local knowledge and support capacity development, community empowerment, and sustainable scaling of innovations.

Thank You !



Nothing Makes us Happier than Seeing a Happy Farmers