

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 agroecological principles and participatory action research approaches.

PROGRESS HIGHLIGHTS Year III

Goal

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



CLCA PROJECT

Nothing makes us happier than seeing a happy farmer. Here is one of CLCA favorite 2020 photos that was taken in Tunisia while testing the hand-held seeder (Photo credit: Zied Idoudi, ICARDA)

Year III:
April 2020 to March 2021

GENERAL OVERVIEW

Year III of the implementation of the project was marked by the global rapid spread of the COVID-19 pandemic including in the project target countries of North Africa and Latin America. Implementation of the activities was confronted to the protection measures taken by the health authorities in the 4 countries from very tight lockdowns, suspension of international travels to partial restrictions of circulation between districts and bans of unnecessary meetings and gatherings. Apprehensions were very high in March-April 2020 that the pandemic would be detrimental to the implementation of the project activities. However, and looking back on how much was implemented in the field, it seems that the impact of the pandemic was generally minor to moderate (in the case of CapDev activities) and we would like to thank the large CLCA team from both the CGIAR centers and the partner institutions for their commitment, innovative thinking and quick reaction during very difficult times. In North Africa, a document was produced on [ways and means to maintain the contact with participating farmers](#) during the lockdown and on how to continue monitoring the project activities. In North Africa, the third year was home for the harvest of the 2nd year cropping season and the establishment of the 3rd year trials. All these core activities at the base of the various CLCA options under assessment took place in Algeria and Tunisia as scheduled in the plan of work and budget and the project team exceeded expectations in a way that **in Algeria**, the CLCA team was resourced to provide support to the new Canola strategy at the country level and they succeeded in supporting this strategy by the inclusion of some CLCA ingredients (no-till; optimization of rotation, etc.). **In Tunisia**, the CLCA crop options that were established in the field during the 3rd cropping season exceeded by 20% what was planned in the annual plan of work and budget.

In Mexico and **Bolivia**, due to current pandemic situation, it has been difficult to expand the network of collaboration. However, thanks to the work of our partners, activities have maintained a reasonable peace. **In Bolivia**, PROINPA, our main collaborator has maintained some of the field activities and continued to engage with farmers, farmers organization and local authorities as well as local NGO's. CIMMYT, together with the National Autonomous University of Mexico (UNAM) and the Universidad Mayor de San Andres (CIDES-UMSA) in Bolivia, organized a course on systems analysis with special emphasis on farm level sustainability assessment of mixed crop-livestock system. More than 30 participants followed a two-week course with six two-hour on-line sessions and assignments between sessions.



Face-to-face field day for women farmers on the use of the hand-held seeders, with full respect of COVID-19 protection measures, Tunisia (Photo Credit: ICARDA)



Fields of Durum Wheat "Oued El Bered" under Conservation Agriculture, Algeria (Photo Credit: ITGC Setif)

The course was organized for Bolivia and participants where mainly students and researchers from the UMSA and national NGOs agents. The course was very well evaluated by participants and we have had constant request for another course which we are planning to organize again but now with a mixed, Mexico and Bolivia, audience.

In Mexico, collaborations have continued with the Department of Crop and Animal Production of the Universidad Autonoma Metropolitana-Xochimilco (UAM-X) to test and assess the performance of the current and alternative crop and livestock management systems for improved the sustainability of mixed crop systems. Collaborations with the regional office of the National Institute of Forestry, Agriculture, Fisheries and Livestock Research (INIFAP) and with 3 local NGO's are on-going to test, implement and share alternatives for improved CLCA systems.

CLCA Adaptive Research: Paving the Way for Effective Scaling of Crop & Livestock Practices and Sustainable Use of Natural Resources

In Bolivia, the project has started to roll out some of the main alternatives promoted to reduce erosion and improve water use efficiency in the systems. During Year III, more than 3,200 meters of multi-species wind barriers were established in farmers' fields. Fifty-four farmers (23 women and 31 men) were trained in the production of seedlings for wind barriers and more than 15,000 seedlings were produced. More than 100 farmers in the region received information, through technical bulletins and explanations, about the use of native shrubs for reforestation and protecting soil against wind erosion.

In Mexico, runoff and erosion in agricultural fields with slope is a major issue of resource degradation. Among the alternatives tested and promoted in Year III of the project, erosion control is a major axis. Minimum tillage and soil cover, relay cropping, living barriers and controlled grazing are all technologies with great potential to reduce erosion due to strong rainfall events. An erosion model has been calibrated (OpenLISEM) to assess erosion of different land uses in a watershed of the Mixteca Alta. A simplified version is in development, that is based on RUSLE. Different scenarios can be assessed to better target in the landscape erosion control measures.

Experimental work on agronomy trials including forage trials, weeding management and soil health monitoring (SOM, erosion, water retention, WUE) continued in Algeria and Tunisia as planned in the annual workplan. Reporting of the main results of the 2019/2020 trials and the establishment of the 2020/2021 cropping season will be duly reported in the 3rd year progress report.

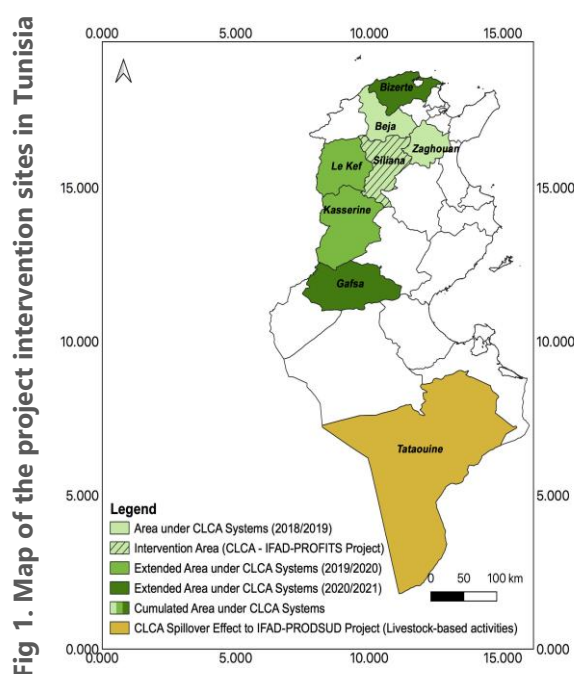


Fig 1. Map of the project intervention sites in Tunisia

In Tunisia, CLCA directly implemented 2,000 ha with 117 farmers between October and December 2020 in the different sites of the project. Fifty-seven women farmers (Pioneers) have been involved in on-farm trials and demonstration plots under CLCA systems. In addition to the districts of Siliana, Beja, Zaghwan Jendouba, Kef, and Kasserine (focus of Year II), the project activities were extended to the districts of Bizerte and Gafsa (Fig.1). This is almost a 40% increase compared to what has been directly achieved in the second year of the project (1,450 ha by 92 farmers).

In Algeria and similarly to Tunisia, the project activities expanded from the 6 target districts (M'Sila, Setif, Oum El Bouaghi, Constantine, Batna and Bordj Bou Arreridj) in second year to new districts mainly Mila, Medea, Alger, Saida, Sidi Belabbes (Fig. 2).

During the third cropping season in Algeria, the CLCA project directly facilitated establishment of 1,732 ha by almost 430 smallholder farmers (compared to 982 ha and 241 farmers in Year II). This was possible by involving 5 additional ITGC regional stations (ITGC-Beni Slimane/Medea, ITGC Oued Smar/Alger, ITGC Saida, ITGC Sidi Belabbes) and two new ITLV regional stations located in the regions of Saida and Sidi Belabbes.

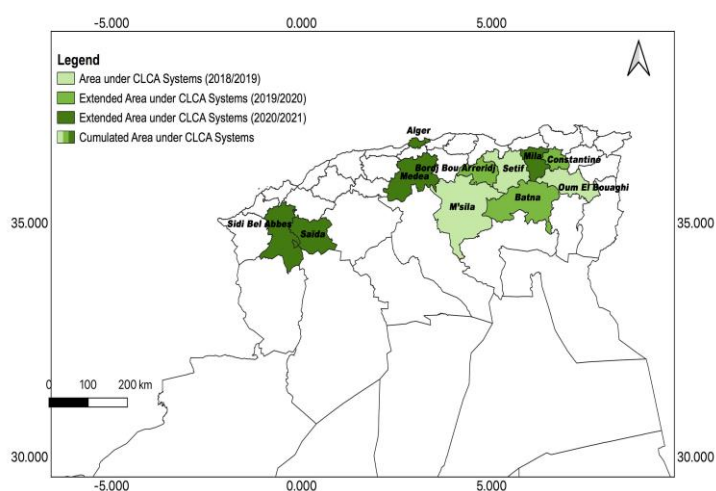


Fig 2. Extension of the project intervention area in Algeria

The Tunisian CLCA team was successful in publishing a prospective paper about the effect of tillage, previous crop, and N fertilization on agronomic and economic performances of Durum Wheat under rainfed semi-arid environment.

This publication was partly supported by CLCA Project <https://hdl.handle.net/20.500.11766/11886>. This work was conducted to assess the effects of the tillage practice, previous crop, and nitrogen (N) fertilization

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rate on the agronomic and economic performances of rainfed durum wheat in a semi-arid environment **in Tunisia**. Tillage practices included no-tillage (NT) and conventional tillage (CT). Preceding crops were either a common vetch or a bread wheat. The N rates applied were: 0, 75, 100, 120, and 140 kg N ha⁻¹. Our results show that, based on a 2-year experiment, tillage practices are not affecting grain yield, grain N, and gross margins. However, the N-use efficiency of durum wheat was significantly higher when wheat was grown using NT. Grain yield and N content in grain were 340 kg ha⁻¹ and 0.34 %; much higher after vetch than after bread wheat. For both tillage practices, the merit of 75 kg N ha⁻¹ is paramount to maximize yield through a more efficient use of available N.

Our results highlight the importance of no-tillage-based CA combined with rotation, including vetch, on enhanced yields, N-use efficiency, and gross margins. These findings provide the evidence of the positive impact of CA for rainfed durum wheat under semi-arid Mediterranean conditions.

Through the expansion of the network of devices to measure runoff (Wischmeyer, rainfall simulators) progress is being made in Tunisia to better estimate erosion in target sites of **Tunisia**. The objective is to generate data to estimate soil erosion by using plot modeling tools that can be extrapolated to landscape level. Detailed results will be presented in the technical annual report.

In Bolivia, 6 plots had their improved fallow with Lupinus incorporated into the soil to improve soil organic matter.

These are the first plots where an alternative promoted by CLCA reaches an aggradation of the soil through a sustainable quinoa management including improved fallow with leguminous crops.

Nodulation of these Lupinus was abundant, implying efficient nitrogen fixation. Sixty-three ha were implemented with best agronomic practices for quinoa, including integrated pest control management that represents a common challenge to attain reasonable yields. An average yield of a sample of plots was 661 kg of quinoa real per ha.

In Oaxaca, Mexico, CLCA alternatives including relay cropping of maize with sole or combination of forage species, intercropping and living barriers have been established in about 100 farmers plots of which 20 of them are being closely followed and registered with detailed technical itinerary.

These network of field in the region thanks to the coordinated work of 3 local NGO's and the INIFAP as

well as the alignment of CLCA activities with other projects in the regions promoting sustainable maize production.

Key publication on "Wheat Stubble from conventional or conservation agriculture grazed by Ewes: Biomass Dynamics and Animal Performances" has been released this year – offering a unique and strategic perspective for enhanced crop livestock integration under CA in the mixed systems of central **Tunisia**.

[This work](#) shows that sheep could be easily integrated in conservation agriculture cropping concept. These practices allowed to keep higher amounts of stubble residual biomass at a stocking rate of 30 ewes/ha and a grazing period going until 30 days, than the conventional ones. Also, animal conserve their body condition and normal metabolic profiles. Results of this study are strongly extension-oriented.

In Bolivia, besides the establishment of more than 3,200 meters of wind barriers with potential forage quality and the establishment of 5 ha of improved pastures, a site, detailed information was gathered from seven farmers managing about 100 animals per farmers on the way they are managed. All use "jipi", the husk of quinoa, as feed. Bromatological analysis of "jipi" showed that it has between 12 and 14.7 % of protein and can represent an important feedstuff for mainly pasturing llamas. Training of 20 farmers with use of probiotics for better nutrition of llama and sample probiotics were delivered by PROINPA. Bromatological analysis of native shrubs and grasses used in wind barriers is underway.

In Mexico, besides the implementation of living barriers with forage potential and relay cropping of maize with mixed forage species (including dolichus, sunflower, oats, common vetch, triticale, clover and canola). Controlled grazing of crop residues, complementation of animal nutrition with feeding block and silage of maize are being explored as means to intensify the livestock component of the mixed crop-livestock farmers.

In Tunisia, The CLCA livestock and feed research team have been publishing another key [paper](#) on "Foraging behaviour, digestion and growth performance of sheep grazing on dried vetch pasture cropped under conservation agriculture".

The results cover trials conducted in Phase I validated by others in Phase II of the project. The findings are further stressing the significant added value of vetch crops for animal feed and grazing of residues.

This study, in addition to other related field days and demonstrations, was at the origin of increasing the demand for vetch in the CLCA project locations and has led to the development of a strategic partnership between the INRAT CLCA team and a private company Cotugrain, which was documented in a 2020 CLCA movie about Public Private Partnership for vetch crops and forage mixtures.

KEY INFO-NOTES

A Private Public Partnership for Scaling Forage Seeds in Tunisia

During this 3rd Year, The CLCA Project in **Tunisia** is catalyzing the establishment of public private partnerships (PPP) in different “research for development” domains, thus aiming at enhancing the uptake of sustainable production practices in the semi-arid region where small, mixed crop-livestock farms dominate.

One of the latest PPP facilitated by ICARDA in this regard (through both CLCA I and II IFAD-funded projects) is a partnership agreement between the lead national agricultural research center (INRAT) in Tunisia and the private seed company (Cotugrain) whereby the two institutions are jointly developing forage options accessible to the farmers in the project area and get around the weaknesses of the conventional forage seed system in the country.

In the framework of such agreement, Cotugrain, through its network of contracted farmers, is handling the large-scale multiplication of legume forage varieties that are emerging from INRAT breeding program. The multiplication process being supervised and certified by the public administration.

The collected vetch and other legume forage seeds are then cleaned, mixed and packed in various proportions with conventional cereal forages to suit various bioclimatic contexts, and distributed to satisfy the growing demand of small farmers. This PPP while it shows innovative partnership and thinking on how to fill a gap in the formal seed system, is highly effective in promoting the scaling of the enhanced crop rotation through better forage and livestock integration. This is acknowledged through [interviews](#) with the head of the Cotugrain company in addition to other beneficiary farmers, who confirmed the yearly growing demand for these forage seeds and the benefits they are documenting in terms of livestock productivity.

<https://hdl.handle.net/20.500.11766/12366>



New CLCA forage mixtures gaining more space in the conventional rotations (Photo Credit: ICARDA)

Scaling Triticale through Seeds-Multiplication Activities in Algeria

Triticale can certainly play a significant role in alleviating poverty for many needy families in some areas of North African countries. Of particular interest, is its good performance under stressful environments and its diversified uses. With this specie, a substantial amount of biomass is available for grazing, cut and carry, dual-purpose cultivation (component of forage mixtures or grain production), silage and hay production. This crop has the ability to perform well on marginal lands, is drought tolerant, has a yield advantage over wheat when harvested for grain or silage, and, it has superior digestible energy and crude protein levels compared to barley.

The CLCA project team **in Algeria** was promoting this crop since the first year. It started with 800 kg of seeds freely distributed to farmers for multiplication purpose. Almost 33.5 tons have been commercialized to more than 20 farmers during the 2020/21 cropping season.

As consequence of the previous “triticale dynamics”, it has been estimated that a total quantity of about 40 t of triticale was used as grain feed for small ruminants by farmers in different CLCA sites (mainly sheep). A new triticale variety named “Oued Dhaheb” has been introduced by ITGC during this third year. The variety is characterized by high grain and biomass yield. The CLCA project aims at achieving by the end of the project a total area of 900 ha of triticale for seeds multiplication.

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In Bolivia, 54 farmers have been trained in the production of seedlings for wind barriers with forage potential, the skills obtained including the identification of native plants, the collection of viable seeds and their germination and seedling management represents an opportunity for a scalable business model while demand for seedlings for wind barriers and improved fallows increases.

In Mexico, a virtual workshop was organized following an on-line consultation to identify the most promising CLCA alternatives and their scaling pathways, including viable business models related to the production of seeds of forage species locally and the provision of technical advices for crop and livestock management.

Small-Scale Mechanization for Forage & Feed Production

Collaborating with the CGIAR Research Program on Livestock, CLCA project in **Tunisia** continues to place strong emphasis on [promoting entrepreneurship and rural businesses](#) for young entrepreneurs and farmers' associations through the provision of 4 seed cleaning and treatment machines and 20 mobile feed grinders which are locally manufactured at a low-cost.

The machines and grinders offer an innovative way to increase feed production and seed quality to enhance forage production across the country.

The service providers whether the farmer associations or young entrepreneurs can either use or sell the feed, or, like the seed cleaning machine, provide grinding services to other farmers for additional income. There is also added value to the grinders because they free up time for farmers, and especially women on whom the feeding tasks normally fall, so they can carry out other income-generating or household tasks.

The seed cleaning and grinding machines are good examples of people-centered research-for-development because the project started by consulting with, and taking on board, the farmers' needs, local knowledge and contexts. By putting farmers at the center of research in this way, CLCA Project believes that the solutions that are delivered not only have a higher success rate but are more likely to be shared and scaled up across the region because the farmers are motivated by their own stake in the development.

The CLCA team is also testing and verifying the productivity of small-scale pellet producing machine to produce feed with locally available feed ingredients. This machine will be placed in the forage knowledge hub for the women farmers' associations to promote the local production of high-quality feed and increase the efficiency of the feedlot system.



Small scale feed grinder used by young entrepreneur (Photo Credit: ICARDA)

In Algeria, the CLCA team has been also actively involved in the facilitation, design and promotion of a locally produced seeds cleaning machine. Three prototypes of this machine have been manufactured by 2 local manufacturers and purchased by local farmers for their personal use. The motivation of farmers who purchased these machines was to build autonomy vis-à-vis the fluctuations and the volatility of the market of seeds.

These units already available on the market at a relatively affordable cost (2,500 USD) especially for farmers' groups. The machine is currently manufactured with a sorter having 03 interchangeable sieves (sorting three seed sizes). The sorter is equipped with a liquid seed treatment devise. CLCA team are currently working on improving the shape of the machine and make it easier for use by farmers and more effective in terms of seeds quality.

Finetuning Machinery Equipment for Effective Weeding

An initiative called "**Optimize your Pesticides Use**" was launched in the framework of the CLCA project in **Algeria**. The objective was to convince input providers and other commercial cooperatives, selling pesticides on the market, to distribute spray nozzles free of charge to farmers who are purchasing from them pesticides for more than 5 ha.

This initiative has been adopted by the "CASSAP El Eulma" cooperative. In 2021, more than 920 spray nozzles were offered to farmers, thus referring to about 55 spraying machines. Considering that each sprayer is treating a total area of 120 ha annually, this means that such a simple intervention has led to the optimization of pesticides use on about 6,600 ha for cereal and forage crops. In addition to spray nozzles, the CLCA project was distributing one-page flyers presenting a simplified method for the calibration of sprayer machines.

Scaling No-Till through Machinery Service Provision Enterprises



"Boudour" Zero-Till Seeder in the Field (Photo Credit: Nasreddine Louahdi, ITGC)

The CLCA project has been actively engaged under sub-component 1.2 (on appropriate system development methodology to support wider adoption and decision making) to develop alternative viable service provision which can support, among others, the scaling of zero-tillage (ZT).

This has resulted in a meaningful achievement **in Algeria** where 4 machinery service provision companies (3 farmers and 1 SME) have been supported by the CLCA team, through a [feasibility study](#), to purchase the [newly released Boudour ZT seeders](#) with the aim to rent them to farmers in their neighborhood, thus responding to the increasing demand for ZT by small farmers in the region of Setif. This has concretely resulted in:

- A total area of 880 ha has been served only by the four machinery service providers;
- In addition to seeding, and as trained by the CLCA team, the service providers were providing practical trainings to beneficiary farmers on seeding doses, importance of weeding prior to seedling, optimal fertilization of cereal crops, optimal grazing practices to preserve soil fertility...

- The CLCA project started in 2018/19 with a total of 5 ZT seeders (all owned by our National partner ITGC), and is running in 2020/21 with 39 seeders actively used by farmers in all project sites;
- Among the 39 seeders, 12 of them are concentrated in Setif, which can be labeled as the Excellence Knowledge Hub on Conservation Agriculture for Algeria;
- A well documented ["Business Model for "Boudour" Zero-Till Seeder"](#) in Algeria, which can further be used to promote the purchase of the seeder by service providers, cooperatives, and even SME of machinery service delivery. The study suggests that the annual usage of the seeder should be greater than or equal to 32 hectares to generate profit out of this investment.

Financially Viable Business Models for No-Till and other Agricultural Machinery Service Provision Enterprises

Some socioeconomic research activities have been designed to support the scaling of CLCA technologies through development of viable business models for No-Till and other small machinery adapted to small

crop-livestock systems in NA. these activities include:

- ❑ Economic and financial assessment of the ongoing/implemented CLCA technologies using FGD's, Rapid Rural Appraisal Surveys, and Partial budget analysis (PBA) in both target countries. This has resulted in the development of few (documented/published) tools and approaches including a "[Farmers Behaviour Survey Questionnaire Instrument](#)", "[A SWOT Analysis on Profitable and Sustainable Integrated Crops-Livestock Farming Systems under Conservation Agriculture in North Africa](#)", and templates for "extension survey questionnaire instrument" for [Tunisia](#) and [Algeria](#);
- ❑ Business Model Development for "Boudour" Zero-Till Seeder **in Algeria** has been documented with identification of the breakeven point (area threshold) for which the purchase of the Boudour seeder newly manufactured by PMAT would be profitable to acquire. This factsheet provides a calculation of the cost of direct seeding (hiring ZT seeder) for an individual farmer and for a group of farmers. It also provides an evaluation of the financial feasibility of investing in this seeder under both scenarios. Results suggest that the Break-Even Point (BEP) for the two (2) scenarios is quite similar, with an annual minimum usage of the seeder of about 32 ha hectares, that can allow to generate profit out of this investment;
- ❑ In both North African countries, the CLCA team is currently trying to develop fact sheets, [similar to the Boudour one](#) in Algeria, where they document cost-benefit evaluations of small machineries promoted by the project, including forage seeds cleaning machines, pellet machines, and feed grinders. The documentation of the benefits generated by these machines would be highly useful to further promote their respective scaling in the project sites.

Developing Comprehensive Trade-Off Models

Based on the farm typologies developed in each site of **LAC**, 3 farms were selected to develop a model to assess main trade offs in crop-livestock systems under conservation agriculture. Information gathering for parametrization was slower than expected due to Covid19 restriction measures and results could not be shared with partners and farmers in this year. However, farm level models are ready to conduct a multi-criteria analysis of different options, identify main tradeoffs and assess different scenarios.

In Bolivia a course was organized on the use of the MESMIS framework for sustainability evaluation, with special emphasis on farm level analysis of mixed crop-livestock system in the Altiplano of Bolivia. More than 30 participants followed the course and several participants showed interest in applying the framework to quinoa-llama systems. The MESMIS framework, a systems analysis tool, allows to derive and quantify specific indicators to assess several alternatives through multiple criteria, the evaluation can provide the basis to identify main trade-offs and synergies for the sustainability of the systems.

In Tunisia, a [Master thesis](#) has been successfully accomplished, under this sub-component, in partnership with Wageningen University. The research subject was about "Exploring crop-livestock integration in mixed sheep-cereal farms through a case study in Zaghouan, Tunisia". The objective was to conduct farm typologies and assess tradeoffs between soil conservation and livestock activity in each type, while identifying possible synergies and compromises between these two objectives and the crop-livestock integration (CLI) options which can help achieving such synergies. The [Farm Design Modeling Approach](#) has been used as a methodology for this tradeoff assessment in 05 farm types (which resulted from a typology conducted over a primary dataset from Zaghouan).

Results of this analysis show that crop-livestock integration in the CLCA site of Zaghouan are possible and can serve both profit as well as building organic matter and nitrogen levels in the soil. This is possible only when enough land is available per farm, referring to medium and large farms.

The optimization run showed that for most farms, improved integration could go hand in hand with the objectives of soil OM and N building and farm profitability. For the smallest farms however, higher integration resulted in a trade-off with profit. Moreover, optimized case-study farms show that most farming systems could benefit from a slight increase in feed- or fertilizing inputs and the cultivation of diversified fodder mixtures. To conclude, crop-livestock integration, the use of fodder mixtures and slight increase in inputs are promising alternatives to current farming systems.

[These results](#) have been carefully channeled to field actions and scaling oriented activities, where we start to focus promoting forage mixtures, in the smaller farm systems of Zaghouan and other similar areas. The forage hub established in Kef District (Sers region, North West of Tunisia) is also an illustration of this focus and the desire to concentrate on promoting CLCA technologies that enhance soil health and farmers' profit.

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Future research under this sub-component will focus on how to strengthen the links between soil, crops, manure management and livestock interventions which favor integration in semi-arid crop-livestock systems.

Ongoing studies under this sub-component are looking at identifying cost-effective crop livestock integration options which are highly cost-effective.

The aim is to evaluate the current crop-livestock (CL)

diversification among small-holders and providing evidence on how to improve CL productivity through diversification under CA system and reduce the effect of climate variability.

The study will also provide some highlights about characteristics of enabling environment that will facilitate and encourage production of these output combinations among smallholders in rainfed areas.

Synergies between CLCA and the Canola National Program in Algeria

During this third year, The CLCA project has contributed to the "national program for promoting the cultivation of Canola in Algeria". This happened by including the network of CLCA farmers, already well trained on CA packages and importance of crop rotations, in the list of the Canola beneficiary farmers. They received appropriate trainings and support.

Almost 80 ha of canola have been planted with zero-till seeders (which is 3% of the total canola area considered by the national program). Zero-till seeders generate gains in terms of time and precision which was key for a new crop such as Canola.

The introduction of Canola in CLCA farmers network and sites also allowed to enhance the availability of forage resources by using rapeseed meal as animal feed, in addition to its high potential as melliferous crop.

Linkages to IFAD Investment Portfolio and Other Development Initiatives

In Tunisia, the CLCA project has established at the landscape level - where IFAD PROFITS project has its interventions - a measurement network of erosion in 2019/20. This activity expanded in 2020/21 by doubling the number of experimental plots being monitored for runoff. A much smaller measuring network was also installed in a private farm practicing CLCA technologies for nearly 16 years: an ideal, ground-based, long-term trial to generate scientific evidence of the impact of CLCA system on natural resources.

In 2019/20, Tunisian CLCA team also consulted with IFAD-PRODESU/Tataouine to identify groups of farmers who can benefit from feed grinders for more efficient stall-based feeding of small ruminants. Agricultural Development Group – GDA Nekrif, has been supported by CLCA during the same year through a donation of this machine. In December 2020/21, a follow up visit was made to this GDA and it has been revealed that the machine is being used on a routine basis to grind olive branches and leaves after pruning; the resultant product is used as animal feed and for composting.

It is important to highlight that the CLCA work on these small machines (especially grinders), similar efforts by ICARDA in the framework of the CRP

Livestock and the activities of a CRDI project working on the same type of machines, have led to a major institutional change at the level of OEP where this machine is now being endorsed and recommended by this major livestock institution for wider distribution, including through a specific agreement between OEP and IFAD-PROFITS.

CLCA activities in LAC are in good alignment with the objectives of IFAD investments in the countries. **In Bolivia**, our activities related to wind barriers with forage species, improved pastures and fallows can play a crucial role to re-dynamize the camelid production and intensify, in an integrated way, the quinoa and llama production by small scale farm household in the Central and Southern "altiplano". The political situation in Bolivia led to changes in the ProCamelidos team and all our previous contacts are lost. We are trying to re-establish communication with the recently formed team of ProCamelidos. **In Mexico**, technical alternatives promoted by CLCA including relay cropping with forage crop or mixtures, complementary feeding of sheep and controlled grazing are in somewhat good alignment with PRODEZSA as these actions should contribute to mitigate the negative effects of overgrazing in communal forest which is an important source of non-timber products in the region including firewood, mushrooms and wildlife. Unfortunately and up to now, PRODEZA team has not reacted to our communication to strengthen and formalize such alignment.



Proper feeding of the livestock and smart agricultural practices can co-exist – Experience from the forage hub in Tunisia (Photo Credit: Zied Idoudi, ICARDA)

Gender Based-Interventions for Innovative Solutions

The CLCA project aims at developing contextually specific solutions to promote the large-scale adoption of conservation agriculture within integrated crop-livestock systems in semi-arid conditions, across a spectrum of age and gender. However, gender gaps do exist and still need to be addressed. The Project aims at highlighting those gaps, their causes, and offers innovative solutions to bridge them.

In North African countries and during this third year, CLCA team deployed an extensive effort to progress towards the project indicator to target 40% of women and 20% of youth.

In Tunisia, several activities were implemented during this 3rd year to empower rural women based on their needs. These activities were divided into three main fields:

Empowerment in Decision Making about Agricultural Production and Use of Productive Assets

During the 3rd Year, Tunisian team is focusing on actively involving women and youth in the different

trainings and field days, but more recently – with the increased focus on digital extension in pandemic times – CLCA team in Tunisia has started to design specific digital activities through radio broadcasts and SMS messages which are crucial for upscaling agricultural technologies and enhanced practices such as CA, forage & feeding, animal health, and collective action.

This activity aims at enhancing the capacity of farmers women and men access to suitable technical information that is relevant for their small-scale mixed crop-livestock production system. The ongoing digital intervention is targeting 624 men (50%) and women farmers (50%) in different CLCA areas. Careful consideration was given to the inclusion of youth. Youth considered in this activity are about 30% of the total sample. Half of the beneficiary farmers are members of farmers' associations.

According to a representative CLCA survey carried out in 2018, women are at a disadvantage – as only 50% of women compared to 83% of men in the CLCA target areas

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own cell phones and digital illiteracy is rampant especially for women. To overcome this gender inequality, the project – in collaboration with the CGIAR Gender Platform – offered non-smart phones to 150 women farmers, complementing this with face-to-face training about the use of these phones to receive SMS, and connect to radio stations, etc. The distribution of phones and face to face trainings happened during December 2020. The selection of the beneficiary women farmers was based on their poverty level. Afterwards, about 200 SMS messages related to four agricultural topics and technologies are being sent to each of these women included in the sample of the 324. The messages and radio broadcasts include advises about enhanced technical CLCA practices related to: i) Forage crops cultivation and integration in crop rotation to enhance soil fertility and crops productivity, ii) Conservation agriculture for enhanced soil and water use efficiency, iii) Animal health for profitable livestock, and iv) Importance and benefits of organizing farmers into associations and cooperatives.

The total number of messages to be sent (to the whole sample of Women) is more than 124,800 (200 X 624) of which 62,400 will be sent to women farmers. Collaborating also with the Agricultural Extension and Training Agency (AVFA), the Tunisian team developed and recorded more than 50 one-minute radio spots concerning the four topics. These radio spots are broadcasted every Sunday morning via the national radio station "Tunisia National". An information message is sent every time for each beneficiary to follow these spots.

All these aspects would enhance the capacity of the targeted women farmers to cope with climate change and adapt their practices into a more resilient way. Evaluation will be done at the end of this activity to assess the impact on women farmers and withdraw lessons for wider use and application of these methods in other R4D projects.

Enhancing Women Leadership in Communities

The CLCA project continues to mainstream gender aspects in most of its activities. Women and Youth have been considered in CLCA upscaling activities such as farm-trials, trainings and demonstrations, as beneficiaries. A total of about 60 pioneer women farmers were considered in this perspective. At this level, we are working with gender-mixed and women-exclusive groups on themes such as conservation agriculture, crop rotations & forage crops, animal health & feeding practices, etc. The project is achieving a rate of 50% inclusion of women and youth in some of these thematics. This is partly contributing to changing social norms, especially in

in locations where these trainings have been traditionally only devoted to men.



A leading woman of the forage hub in Tunisia: harnessing the seeder (Photo Credit: Zied Idoudi, ICARDA)

Women and youth were also considered as main target beneficiaries for some specific CLCA field training activities such as animal health, feeding practices, forage mixtures, hand-held seeders, seed cleaning and treatment units, etc. A total of about 150 women farmers have benefited from these exclusively women and youth-oriented trainings.



On-the-Job training for women Farmers on forage crops seeding, Tunisia (Photo Credit: ICARDA)

A similar, women and youth-oriented training on cheese making was organized in **Algeria** by our ITELV partner, for a group of 30 women for whom milk production and processing was their only income generating activity.

CLCA is further building a specific gender-friendly knowledge hub in North West of Tunisia, which is specifically designed to fit the need of women farmers in terms of good quality feed thus helping them to produce good quality milk and enhance the feeding of their small ruminants and cows.

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The hub is hosted by a women farmers' association (GFDA) which is representing and serving about 50 members.

Forage mixture trials, demonstration plots, trainings, etc. have been concentrated in this hub with the aim to generate site-specific knowledge and train local leader farmers on the considered technologies. These are expected to serve as vehicle for the transferred knowledge, even after the end of the CLCA project. Twenty-nine women farmers have been directly involved in the different field trainings organized on the matter in this site of Sers.



Participatory Capacity Assessment of Women Farmers' Associations in Tunisia to improve management skills, facilitate technical transfer, and ease their transition into self-sustained Knowledge Hubs (Photo Credit: Zied Idoudi, ICARDA)

Enhancing Women Access to Machinery, Reduce Workloads and Encourage Entrepreneurship for Youth and Women

CLCA team invested time, expertise, and resources in developing and promoting small machinery which would be useful for different farming aspects. A focus has been made on machinery particularly useful for crop-livestock systems. Women farmers were among the beneficiaries and received the appropriate training.

Particularly, ICARDA and its national partners provided farmer cooperatives in **Tunisia** with hand-held seeders, mobile seed cleaning & treatment machines and mobile feed grinders. A group of 25 women farmers (in 3 project locations) was recipient of freely distributed hand-held seeders. These were purchased and distributed to women farmers given the fact that they were previously seeding manually and without mechanization.



Hand-held Seeder: reduce seeding-related workloads for women farmers in Tunisia (Photo Credit: ICARDA)

The distributed mobile seed grinders mobile seed cleaning & treatment machines and mobile feed grinders, and the related trainings on these machines organized in the different locations in **Tunisia** and **Algeria**, have benefited a total of 1080 farmers, of which 40% are youth and women.

With the exercise of parametrization of the FarmDESIGN model, CLCA team in **LAC countries** made efforts to maintain labour disaggregated information in order to assess current and alternative systems in terms of the workload attributed within the household.

Appropriate Monitoring and Evaluation Frameworks

As of the start of the 3rd year, The ICARDA-MEL team, in collaboration with the CLCA team in LAC and NA countries – designed and developed a Monitoring, Evaluation, and Learning plan for the CLCA Project.

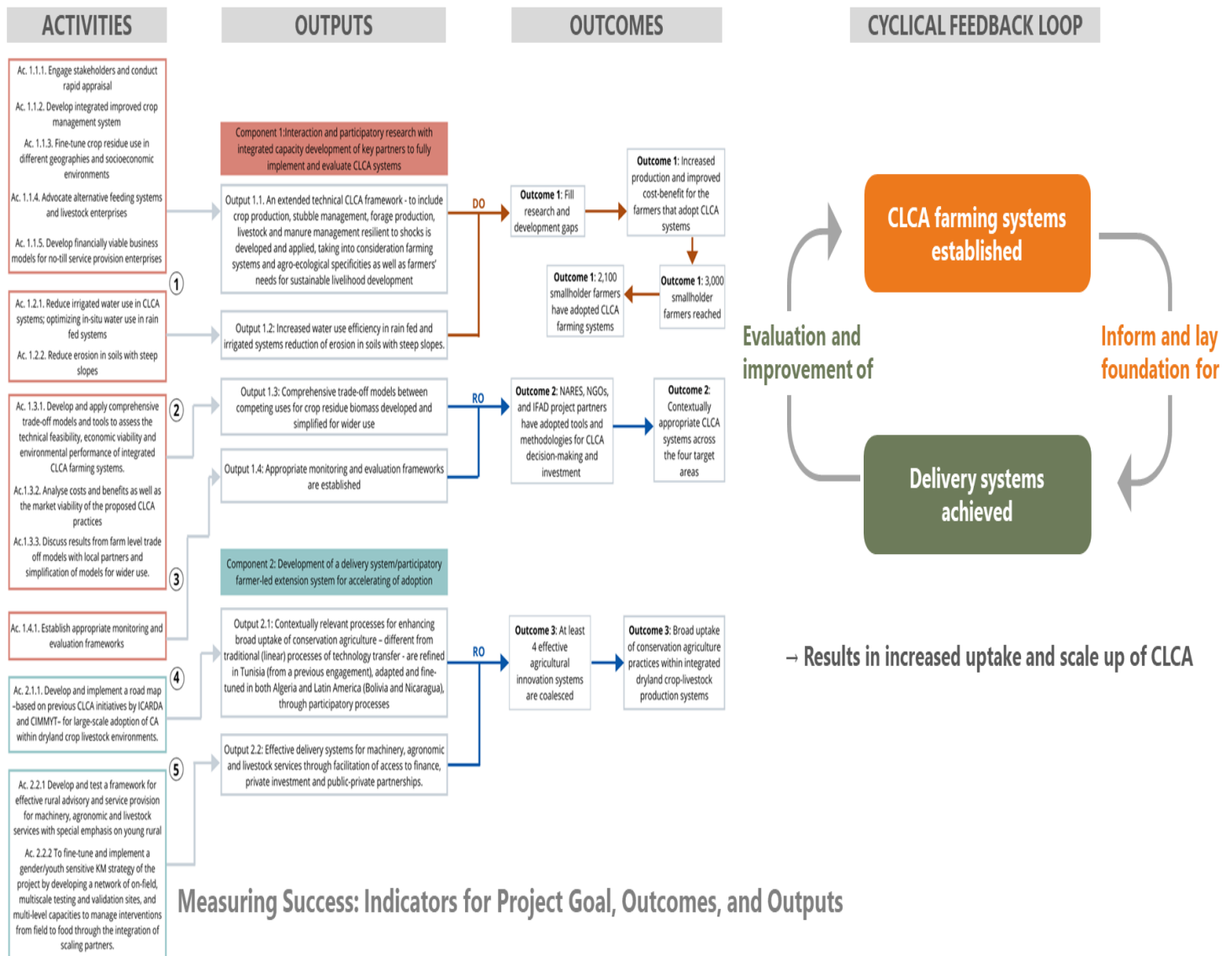
Implementation of MEL in research for development projects ensures that the results are accurately analyzed, shared, and reported. This process is essential for donor reporting and accountability. Yet, it equally works to ensure that the investment translates into sound research outcomes and shared learning. This process will ensure that the CLCA project generates results-based evidence to ensure that the project is on track to achieve its outcomes.

This [document](#) provides an overview of the monitoring, evaluation, and learning (MEL) plan for the CLCA project, defining the project approach, roles, and responsibilities for MEL. The plan provides a clear overview of the linkages between project's

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activities and the expected results and contributes to ongoing learning processes.

The Impact Pathway links activities, outputs, and outcomes, and the TOC explains the progression



By providing guidance for the operationalization of the monitoring and evaluation system, the MEL Plan will support annual planning and facilitate reporting following IFAD suggestions made after the 1st year reporting. The team is now using an improved LRAM “Log-frame Results Achievement Matrix” to report progress against the log-frame targets disaggregated by country/region, sex/age and stakeholder typology.

MID-TERM EVALUATION

The mid-term evaluation is finally underway and the kick-off was given in January 2021. Because of the travel restrictions preventing the international consultant from being in the field, we adopted a hybrid approach; the international consultant working remotely and he is supported by 2 national consultants, respectively in **Tunisia** and **Bolivia**.

Two inception meetings took place between the international consultant and the CLCA teams in NA and LAC during which the objectives of the evaluation were reviewed, the terms of references of the national consultants were agreed and the main milestones of the evaluation were set.

The contracting process of the 2 national consultants is now finalized and both are closely working with the international consultant in Australia. CLCA teams in both continents are and will continue providing all the support needed to the team of consultants.

The project [website](#) with more than 140 resources (progress reports, plan of works, tools, briefs, scientific publications, workshop proceedings, videos, M&E plan, etc.) has been made accessible to the team of consultants.

Knowledge Hubs for Self-Sustained Scaling of CLCA Technologies in NA Countries

Investing in enhancing the visibility of the CLCA technologies through better coordination of knowledge generation, documentation, simplification, and aggregation is crucial for self-sustained scaling. The approach, tailored by the CLCA team aims at capitalizing on ongoing (research and scaling) project activities for different CLCA technologies, and aggregate these activities under knowledge hubs (KH) that can ensure the self-sustainability of the scaling processes of these technologies in the project site, even beyond the CLCA project. This approach has been specifically designed for CLCA North Africa based on evidences and learnings from CLCA phase I and the first two years of the current phase. More highlights and details about the content of this approach can be found in the [“Self-Sustained “Scaling Hubs” for Agricultural Technologies: Definition of Concepts, Protocols, and Implementation”](#) published in 2020.

In Tunisia, a KH on forage mixtures has been established in a joint venture with an association of women farmers in the region of Kef (Sers). The site was selected based on farmers and local actors (public and private) demand for crop-livestock intensification through forage rotations.

The association includes more than 50 women farmers, all in need of forages of good quality for their livestock. All steps of [capacity assessment](#), [demonstration plots implementation](#), [selection of leader farmers](#), capacity development, coaching of the association leaders on management and financial aspects have been conducted.

More capacity development and networking activities are planned for the coming months to enhance the capacity of the association for self-dissemination of forage mixtures techniques and improve their autonomy.

CLCA team is currently working on identifying an appropriate site for consolidation of CLCA livestock activities and installation of a “Livestock KH”.

4 KH have been consolidated/empowered in Algeria. These hubs already exist, under a simplified form, since 2013. The CLCA project has been investing in further structuring the set of complementary technical and capacity development activities, in addition to investment in infrastructure and networking of the Hubs with larger network of farmers. In another words, we modeled our intervention to be consistent with our CLCA “knowledge and scaling hubs manual and protocol” for enhancing the autonomy and self-sustained scaling dynamics within these hubs.

The resulting dynamics are very interesting and are partly shown in the below additional bullets of this highlight. These include:

- A KH on CA hosted at a pilot farm of ITGC, well equipped with machineries, demonstration plots and platforms, documented agronomic results, in addition to a convenient meeting rooms for trainings. This hub is also composed of large network of leader farmers using and applying the technical packages of CA;
- A KH on forage crops, hosted at the COOPSEL Ras El Ma (Setif). This organization is a farmer’s milk cooperative, which is also commercializing forages for its 800 members;
- A KH on livestock, which is hosted at the ITELV station in Ain Mlila, and led by a “federation” of livestock keepers;
- A KH on mechanization which is hosted at the PMAT station of Setif, which is a platform for the commercialization of agricultural machines and also for training farmers on various aspects of agricultural machinery.

A capacity need assessment and a targeted investment plans were conducted for these different hubs and resulted in:

- Supporting the purchase of training tools and materials to facilitate field days and knowledge dissemination, Designing and printing technical documentation relevant for the respective technologies of the KH (more than 1500 flyers were distributed in 3 hubs), supporting the costs of organizing local training activities and investing in small machinery as a support to the different field days organized by the hubs, etc.;
- Capacity development activities have been particularly designed for the considered KH leader farmers, technicians, and extensionists. These capacity development interventions of the CLCA project were either tailored for the specific hub/technology, or common to all hubs (e.g. a seeder calibration training would involve farmers from all hubs – forages & cereal);
- The total area directly influenced by the CLCA project in the 4 hubs, through demonstration plots and field trials is about 1,750 ha, distributed as follows: KH on CA : 840 ha, KH on Forage: 350 ha, KH on livestock: 32 ha, and KH on machinery: 510 ha.

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Technologies implemented in these demonstration plots of the KHs includes, CA packages, seeding techniques, weed management, fertilizers use efficiency, smart complementary irrigation, forage mixtures, seeds multiplication, livestock management, varieties selection.

A total of 46 field days (13 in 2020/2021) were organized in these hubs since the beginning of the CLCA project. The total number of beneficiaries from the field days is about 500 farmers.

Key networking activities of the consolidated KHs were organized in 2020/2021. These include the involvement of the "COOPSEL Ras El Ma" cooperative, the network of "Réquablé", and the "CASSAP de Setif" all aiming at increasing the visibility of the CLCA technology hubs to a very large network of farmers and farmers' organizations.

This is also allowing the cross fertilization of hubs especially through organizations which are promoting both forages and cereal technical packages.

Partners involved in the four hubs are:

- ❑ Direction des Services Agricoles de Wilaya;
- ❑ Chambre d'Agriculture de Wilaya ;
- ❑ Réseau Réquablé de Setif ;
- ❑ Université de Setif, M'Sila et Bordj Bou Arreridj ;
- ❑ ITMAS Setif ;
- ❑ CASSAP Setif ;
- ❑ Cellule de la Femme Rurale de la Wilaya ;
- ❑ ENAF Batna (Ecole Nationale des Forêts) ;
- ❑ ITELV ;
- ❑ COOPSEL Cooperative.

The "[Scaling manual](#)" developed through this CLCA activity and the concepts it vehicles was effective in raising about 600,000 USD from GIZ to fund 2 scaling projects in Tunisia aiming at promoting agroecological soil and water conservation practices as well as the use of ICT in irrigation.

The CLCA scaling approach has also brought the attention of other CGIAR donors, particularly the gender platform of the CGIAR by allocating a supplementary funding to ICARDA of 10,000 USD to support the scaling of gender-mainstreamed SMS and radio broadcast of agricultural extension recommendations.

Knowledge Sharing & Management: Main Knowledge Products of Year III



Forage for Biomass and Sustainable Crop-Livestock Systems: A Private Public Partnership for Scaling Forage Seeds in Tunisia (in local Arabic, English subtitles):

The **video** is a series of testimonies on (i) the challenges farmers are facing because of the insufficiencies in the conventional forage seed system, (ii) the solutions brought by the CLCA project and (iii) the impact of these solutions on the management of crops, the preservation of natural resources and the performance of the livestock. [MEL Link](#) & [YouTube Link](#) (**Tunisia**)



Self-Sustained "Scaling Hubs" for Agricultural Technologies: Definition of Concepts, Protocols, and Implementation:

This **manual** provides a set of conceptual definitions and practical protocols for generic implementation knowledge and scaling hubs based on field interventions and action research in Tunisia and Algeria. The manual also provides a highlight of what is called the "four-wheels approach" of partnership for scaling, which aims at connecting knowledge hubs thus involving them into a scaling dynamic. [Link](#) (**Tunisia & Algeria**)



❑ **SLM Technology** "Conservation Agriculture in Dryland Mixed Systems" in the Global Database on Sustainable Land Management (SLM) of WOCAT:

The World Overview of Conservation Technologies and Approaches (WOCAT) provides a large platform to share knowledge of Sustainable Land Managements (SLM's).

Conservation Agriculture in Dryland Mixed Systems has been recorded for this purpose. The documentation shows elaborated information on how the SLM is established, maintained and how it benefits land users and environment. [Link](#) (**Tunisia & Algeria**)

❑ **Solution** For Healthy Planet "Conservation agriculture draws on locally produced technologies to increase productivity while using fewer resources" in the Panorama Solutions Portal:

The Panorama Solutions portal aims to showcase inspiring solutions/innovations so they can be adopted and replicated elsewhere. The platform is structured in different thematic communities of practice. It connects over 200 solution providers ranging from NGO, UN institutions to private sector engagements. The solution shows that conservation agriculture is a "win-win" situation for both farmers and the environment producing more with less. [Link](#)



Technical **documents, flyers, and bulletins** were generated in **LAC & NA** related to CLCA topics adopting a simplified text for a wide range of stakeholders



Encouraging entrepreneurship with mobile grinders and seed cleaning machines:

This **blog** documents the launch and establishment of innovative businesses taken up by young entrepreneurs and farmers' associations in the field of small machinery to support the forage and livestock activities. [Link](#) (Tunisia)

Briefs/Factsheets

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

ICARDA with national and private partner (PMAT) developed and scaled out a low-cost locally made "Boudour" zero-till seeder in Algeria. PMAT has already manufactured twenty (20) ZT units. The Algerian government has been convinced to include the seeder into the national nomenclature of subsidized agricultural machines (30% when purchased individually, 40% when purchased by a farmer association). [Link](#) (Algeria)

Farm Mechanization and Conservation Agriculture for Sustainable Intensification in Dry Areas: Business Model Development for "Boudour" Zero-Till Seeder in Algeria:

To support the development of conservation agriculture (CA) equipment and ensure its availability, one solution is to provide CA mechanization services from private sector entrepreneurs. This factsheet provide evidence on how local manufacture of these could increase availability, ensure that equipment is adapted to local conditions, harnessing the power of partnership and reduce costs. [Link](#) (Algeria)

How can we reach farmers in difficult confinement times_COVID-19 Crisis? Which digital/ICT strategy for research projects? Case of CLCA:

The brief highlights potential ICT tools to enhance the effectiveness of reaching more target beneficiaries during the COVID-19 crisis: Case of CLCA Project. [Link](#) (Algeria, Tunisia)

CLCA Monitoring, Evaluation, and Learning Plan (Report):

This document provides an overview of the monitoring, evaluation, and learning (MEL) plan for the CLCA project, defining the project approach, roles, and responsibilities for MEL. The plan provides a clear overview of the linkages between project's activities and the expected results and contributes to ongoing learning processes. [Link](#) (Algeria, Bolivia, Mexico, Tunisia)



Journal Articles

Wheat Stubble from Conventional or Conservation Agriculture Grazed by Ewes: Biomass Dynamics and Animal Performances:

Sheep could be easily integrated in conservation agriculture cropping concept. These practices allowed to keep higher amounts of stubble residual biomass at a stocking rate of 30 ewes/ha and a grazing period going until 30 days, than the conventional ones. Also, animal conserve their body conditions and normal metabolic profiles. [Link](#) (Tunisia)

Effect of Tillage, Previous Crop, and N Fertilization on Agronomic and Economic Performances of Durum Wheat (*Triticum durum* Desf.) under Rainfed Semi-Arid Environment:

In a two-year experiment, were compared the effects of tillage, previous crop, and N-fertilization on agro-economic performances of durum wheat (DW) in Tunisian semi-arid conditions. Results showed no-tillage combined with rotation-including vetch recorded the highest agro-economic performances of DW. Results improve the knowledge of the DW-agronomy under conservation agriculture. [Link](#) (Tunisia)

Foraging behaviour, digestion and growth performance of sheep grazing on dried vetch pasture cropped under conservation agriculture:

This study aimed at investigating the replacement value of half time grazing of wheat stubbles by vetch and demonstrated that dried vetch grazing could be a solution to make possible mulching and biomass uptake by sheep under the context of CA. [Link](#) (Tunisia)



Several **CapDev** events were implemented in **Algeria** (13 CapDev: 430 participants) and **Tunisia** (10 events: 336 participants including 150 women farmers), on different CLCA topics for local farmers and cooperatives, extensionists, young scientists, trainers, etc.



Radio was used to reaching out the target audiences in Algeria and Tunisia. CLCA team promoted project activities and disseminated its results through broadcast events [**Algeria** (3), **Tunisia** (2)] [Link](#).



Contribution with an **oral communication** titled "Locally Adapted Machinery Solutions for Sustainable Intensification of Crop-Livestock Systems in **Tunisia**" to the 1st African [Conference](#) on Precision Agriculture (8-10 December 2020; [Proceeding Link](#))



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Vetch grown for direct, early summer-grazing by sheep in Kef district (Photo Credit: Zied Idoudi, ICARDA)

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