



Investing in rural people

Integrated crop–livestock conservation agriculture for sustainable intensification of cereal-based systems in Central and West Asia and North Africa

GRANT RESULTS SHEET



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The goal was to improve the livelihoods of resource-poor farmers through the adoption of integrated crop–livestock conservation agriculture

Goals and objectives

The three countries involved in this project (Algeria, Tajikistan and Tunisia), like most other countries in the region, are confronted with growing populations, increased urbanization, and changing food demands and preferences. The food security and livelihood security of rural populations in these countries depend largely on crop–livestock production systems. Crop productivity and biomass are typically low under low-rainfall dryland agricultural systems as a result of abiotic stresses and low input levels. Moreover, more frequent droughts and greater climatic risks further exacerbate abiotic stresses.

Conservation agriculture principles, such as no tillage, crop residue cover and crop rotation/intercropping, have proven to be key interventions for increasing crop productivity and improving resource use efficiency and soil health.

The current project was designed to address the above-mentioned challenges while building on past experience in conservation agriculture. It aimed to develop strategic practical options for integrating conservation agriculture cropping and livestock systems. It therefore attempted to reconcile the demand by livestock for feed with residue retention as practised in conservation agriculture. The goal of the project was to enhance the sustainability of natural resource use, increase the profitability of farms and improve the livelihoods of resource-poor farmers through large-scale adoption of conservation agriculture technologies capitalizing on the system synergies of crops, livestock and soils in the drylands of Central and West Asia and North Africa (CWANA).

Beneficiaries

Three major groups were targeted in the project:

- Resource-poor farmers whose livelihoods depend on mixed livestock–cropping systems in the target low-rainfall regions were the direct beneficiaries. At least 1,000 households were targeted in selected countries; a total of 10,000 family members, including women, in the target communities benefited from the project activities. Ultimately, other rural



Facts at a glance

Grant implementing agency

International Center for Agricultural Research in the Dry Areas (ICARDA)

Theme

Risks to and the vulnerability of the rural poor associated with climate change, land degradation and food production

Benefiting countries

Algeria, Tajikistan and Tunisia

Total project cost

US\$2 million

IFAD contribution: US\$1.5 million

Cofinancing (other donors):
US\$500,000

Effectiveness and duration

January 2013 to March 2016

Partners

Technical Crop Institute (ITGC), Algeria
Tajik Academy of Sciences, Tajikistan
National Agricultural Research Institute (INRAT), Tunisia

Linkages to IFAD investment projects

Algeria: Rural Development for Mountain Zones in the North of the Wilaya of M'Sila (Phase II)

Tajikistan: Khatlon Livelihoods Support Project (2009-2015)

Tunisia: Integrated Agricultural Development Project in the Governorate of Siliana (Phase II) (I-687-TN).

communities in similar agro-ecologies across CWANA will benefit from the improved options identified and promoted by the project.

- National agricultural research and extension system (NARES) partners were provided with new and innovative information material disseminated by the project. Extension agents were direct beneficiaries: based on a needs assessment, targeted capacity development was carried out to enable them to disseminate the new technology packages.
- Policymakers were exposed to integrated crop–livestock conservation agriculture (CLCA) technologies at both regional and national levels, demonstrating how these technologies can potentially improve the living standards of rural families and their resilience and adaptation to climate change.

Main results

Across all three countries, the development of site-specific crop–livestock integration practices as part of CLCA packages has made substantial progress.

The commitment and engagement of the farming communities and the NARES in the three countries allowed the project to make significant progress towards the development, adoption and spillover of non-rigid CLCA systems. While building conservation agriculture packages – particularly in Tajikistan, where conservation agriculture was newly introduced by the project – and optimizing stubble management without impeding the flocks' performance, the project has succeeded in introducing new fodder sources into cropping systems. It transformed relatively unproductive weedy fallows into productive forage-producing pastures (vetch and vetch-oat mixture in Algeria and Tunisia) and replaced summer fallow with mungbean production in Tajikistan (mungbean residues provide high-quality fodder), thus providing significant economic benefits for smallholder farmers and increased regional food security.

In relation to irrigated cereal production in the steppes of North Africa, the project also revealed a huge opportunity for significant reductions in irrigation water through a combination of conservation agriculture and improved irrigation systems. This offers the opportunity to reverse the depletion of scarce groundwater reserves and help maintain regional water and food security.

Skills and capabilities enhancement through a range of capacity-building and training experiences, as well as the participation of postgraduate (masters and PhD) students, has contributed significantly to the long-term capabilities of participant countries. Furthermore, the ex-ante baseline adoption survey collected a significant amount of socio-economic information that has proved invaluable in terms of researching the obstacles, other than livestock competition, for the adoption of conservation agriculture by mixed small farms in North Africa and Central Asia.

Lessons learned

- There is a need for further work on **the optimization of the packages in the three countries**, focusing on better integration between the different components.
- Systems built on the core elements of CLCA (including zero-tillage sown crops and strategic grazing of stubble residues) show potential for NRM

benefits. Fortunately, the participating countries, in particular Algeria and Tunisia, decided to continue the ongoing on-station and on-farm trials during the 2015/2016 and even the 2016/2017 cropping seasons. Data to be collected during the bridging period can be used to verify and confirm some of the results achieved so far over a longer time span. ICARDA will support this bridging period through remote technical backstopping.

- **The development of CLCA packages is relatively complex** and needs to take into consideration a wide range of interacting components, such as best practice agronomic and livestock management; integrated pest, weed and disease management (across crop rotations and extending for a number of years); risk management and decision support frameworks for farmers (including simple but realistic detailed economic analysis, minimizing production risk, providing clear market signals from a market chain approach); and adapting and modifying conservation agriculture practices according to local physical, social and economic constraints. It is not possible to conduct local research to validate all concepts and practices required, owing to limitations in available resources and time. This is where the application of scientific and practical farmer experience is important in developing “best management practices” and applying them as part of structured farmer group-based learning experiences. At least in Algeria and Tunisia, R&D contributed to generating evidence that conservation agriculture is needed to arrest and reverse the downward spiral of resource degradation and diminishing factor productivity, by decreasing cultivation costs and making agriculture more resource efficient, competitive and sustainable.
- We are well **beyond the proof of concept stage** and, in the target countries, farmer acceptance of zero tillage as an alternative technology for the rainfed crop–livestock system is already a reality. Reaching out to large farming communities to achieve the sustainable adoption of CLCA practices requires a number of institutional, technological and policy-related changes.

Forages replacing weedy fallows for increased feed quality and livestock productivity (Tunisia)

Allocating one third of the land for a weedy fallow to be grazed in late winter and early spring before ploughing for the next crop is a common practice in North Africa.

Farmers believe that, this way, they gain a no-cost fodder resource while the soil recovers its fertility. Common vetch and sulla were chosen to replace the fallow since these are the only forages for which certified seeds can be found in the local seed market.

Seeding directly into the weedy fallow is made possible by the use of a no-till seeder.



Glyphosate for weed control will no longer be required because vetch, cereal vetch mixture and sulla perform well and suppress weed competition. A new institutional arrangement has been developed in Tunisia for vetch seed production. With the help and assistance of national partners of the CLCA project, local farmers from the region of Siliana succeeded in establishing a farmers' cooperative for seed production and distribution. The *Office de l'Élevage et des Pâturages*, the main public institution with a mandate to develop rangeland, forage and livestock production in the country, is helping this particular cooperative to collect and process the vetch seeds.

Way forward

The project was successful in generating momentum, in collaboration with other projects, on improved practices in livestock, forages and conservation agriculture that address socio-economic realities on the ground. The project developed and tested innovative non-rigid scenarios for integrated CLCA systems; these scenarios respond to the constraints and the realities of each site. The CLCA technologies and interfaces developed by the project are scalable in North Africa and Central Asia, bearing in mind the existing suitability maps and policies in the different countries on expanding conservation agriculture.

We are well beyond the proof of concept stage; farmer acceptance of zero tillage as an alternative technology for the rainfed crop–livestock system is already a reality

In North Africa, for example, the governments of Morocco and Tunisia predict that conservation agriculture practices will occupy (at least) 1.5 million ha and 100,000 ha, respectively, in 2025. There are no official predictions for Algeria, but we anticipate at least another 2 million ha. The project's discoveries regarding mild grazing of cereal stubble and the associated different options for sheep supplementation; potential water savings through irrigated crop production systems (33 per cent less than for conventional irrigation of the irrigation cost – it will take much longer to perceive any effect on soil organic matter rebuilding); and the substitution of vetch for fallow and the resulting feed biomass for flocks (8 per cent increase in the livestock gross margin) should be packaged as modules to work in parallel with the extension of conservation agriculture in the crop–livestock production belts of North Africa.

Double cropping is the most pertinent technology developed by the project in the irrigated areas of Tajikistan and was enabled by conservation agriculture. Many crops – mungbean (an increase of 17 per cent in the net return), kidney bean, maize, sorghum, pearl millet, etc. – can be used for double cropping with no-till technology. Double cropping can be extended to irrigated areas throughout the southern part of Kazakhstan and Kyrgyzstan, and to several regions of Tajikistan, Turkmenistan and Uzbekistan with a total area of 1.0 million ha. Similarly, alley cropping is a suitable technology for the rainfed conditions of Tajikistan, where soil erosion represents a big threat to crop production; it provides additional feed biomass in areas where winter is very harsh, endangering livestock productivity and even survival. This technology can be extended to all rainfed areas of Central Asia, especially sloping areas where soil erosion is a problem. The potential area for adoption is around 0.5 million ha. For a follow-up project, an integrated R&D framework is being proposed that would combine the adaptive research programme, including integrated capacity development, with the active development of a farmer-driven participatory extension delivery system for the adoption of CLCA systems by smallholder farmers.



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Knowledge generated

Knowledge was disseminated through training courses for various stakeholders, field days, student involvement, training of trainers. Links were created with an IFAD-funded project in Siliana, Tunisia, an ACIAR-funded project named CANA (Conservation Agriculture in North Africa) in the Maghreb (Algeria, Morocco and Tunisia), an FAO project in Central Asia (Azerbaijan, Kazakhstan and Uzbekistan) and a DfiD/GIZ project in Tajikistan. Awareness was also generated through flyers, academic publications, factsheets, project posters and national news coverage.

Tunisian scientists prepared three flyers (in Arabic, English and French) on the following topics: conservation agriculture for animal husbandry and breeding in Tunisia; integrated crop–livestock conservation agriculture for sustainable intensification of cereal-based systems in North Africa and Central Asia; and conservation agriculture for sustainable intensification of cereal production systems in North Africa. In Algeria, the national team produced a flyer on the potential introduction of the shrub atriplex in alley-cropping systems. Conservation agriculture and its benefits in integrated crop-livestock systems was the subject of a national television programme (<https://tv.echoroukonline.com/>).

For Tajikistan, a flyer was prepared on conservation agriculture in the local language. These flyers have helped to generate awareness in broader audiences and were made available at government offices, through extension, and public partners. In total, ten factsheets were produced under various activities of this project. The project introduced conservation agriculture to Tajikistan where it had not previously existed so it became national news (<http://www.cac-program.org/video>), with a large audience being given an overview of the practice and its benefits.