Australian Government

Australian Centre for International Agricultural Research

Project proposal

project	**Adapting conservation agriculture for rapid adoption by smallholder farmers in North Africa**
project number	CSE-2011-025
proposal phase	**Full**
prepared by	ICARDA
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Contents

1. Project outline

Project number	CSE-2011-025
Project title	Adapting conservation agriculture for rapid adoption by smallholder farmers in North Africa
ACIAR program area	Cropping Systems and Economics
Proposal stage	Full
Commissioned organisation	ICARDA
Project type	Large
Geographic region(s)	North Africa
Country(s)	Morocco, Algeria, Tunisia
Project duration	4 years
Proposed start date	22 June 2012
Proposed finish date	30 June 2016
Time to impact	Category 2

1.1. Funding request

		Amounts	Totals
Year 1 (2011-12)	Pay 1	410,196	410,196
Year 2 (2012-13)	Pay 2	377,279	750,494
	Pay 3	373,215	
Year 3 (2013-14)	Pay 4	400,889	799,528
	Pay 5	398,639	
Year 4 (2014-15)	Pay 6	374,410	748,507
	Pay 7	374,097	
Year 5 (2015-16)	Pay 8	287,757	576,242
	Pay 9	288,485	
Total		3,284,967	3,284,967

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1.3. Glossary

ACIAR	Australian Centre for International Agricultural Research
ADA	Agence pour le Développement Agricole (Green Morocco)
AFD	Agence Française de Développement
AfDB	African Development Bank
AGENDA	Agriculture Environement et Developpement, pour l'Avenir NGO, Morocco
APAD	Association Pour l'Agriculture Durable (Association for Sustainable Agriculture) NGO, Tunisia
APSIM	Agricultural Production Systems sIMulator
ARC	Agriculture Research Center of Libya
AusAID	Australian Agency for International Development
CA	conservation agriculture
CA2Africa	Conservation Agriculture in Africa: Analysis and ForSeeing its Impact – Comprehending its Adoption
CBO	community-based organisation
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo (International Maize and Wheat Research Center)
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement.
CRP	CGIAR research program
CSIRO	Commonwealth Scientific and Industrial Research Organisation
ESA Kef	Ecole Supérieure d'Agriculture du Kef (Higher School of Agriculture of Kef), Tunisia
ESIER	Ecole supérieur des ingénieurs d'équipement rural de (Rural Equipment Engineering School) Medjez El-Bab Tunisia
EU	European Union
FAO	Food and Agriculture Organisation
FFS	Farmer field school
IARC	international agricultural research centre
IAV	Institut Agronomique et Veterinaire Hassan II (Hassan II Agriculture and

Hassan II	Veterinary Institute), Morocco
ICARDA	International Center for Agricultural Research in the Dry Areas
INAT	The National Agronomic Institute of Tunisia
INGC	Institut National des Grandes Cultures, Tunisia
INPV	Institut National de la Protection des Vegetaux, Algeria
INRA	L'Institut National de la Recherche Agronomique (National Institute for Agricultural Research), Algeria
INRAT	L'Institut National de la Recherche Agronomique (National Institute for Agricultural Research) Tunisia
IP	innovation platform
IPM	Integrated pest management
IRESA	Institution de la Recherche et de l'Enseignement Supérieur Agricoles Tunisia
IRR	internal rate of return
ITGC	l'Institut Technique des Grandes Cultures, Algeria
HSDS	Haut commissariat au développement de la steppe (High Commission for Development of the Steppe), Algeria
MAGHREB	Northwest Africa, west of Egypt i.e., Morocco, Algeria, Tunisia, Libya, Mauritania
MASHREQ	Arabian countries east of Egypt and north of the Arabian Peninsula, i.e., Iraq, Israel, Jordan, Kuwait, Lebanon and Syria
MENA	Middle East and North Africa
NARES	national agricultural research and extension systems
NARP	national regional coordinator
NGO	non-government organisation
OFMT	on-farm farmer managed trials
ORMT	on-farm researcher-managed trials
PNC	project national coordinator
PSC	project steering committee
R4D	research for development
R,D&E	research, development and extension
RMSD	Rencontres Méditerranéennes sur le semi direct (Mediterranean Network on

	no-till)
RRA	rapid rural appraisal
SANTFA	South Australian No-Till Farmers Association
SARD	Sustainable Agriculture and Rural Development Initiative (of FAO)
SIMLESA	Sustainable Intensification of Maize and Legumes in Eastern and Southern Africa
TCC	technical coordination committee
WANA	West Africa and North Africa
ZT	zero-till

1.4. Project summary

North Africa is a net importer of staple food, importing 27% of cereal grain requirements. Low productivity, high and volatile prices, and uncertain availability of food commodities affect the livelihoods of the region's poor. The region has a Mediterranean climate with highly variable and generally low rainfall that is further exacerbated by unfavourable climate change, as in southern Australia. Soils are poor and highly vulnerable to erosion.

Conservation agriculture (CA) practices offer the opportunity to conserve natural resources, cut down production cost while reducing yield fluctuation and associated risk. An integrated approach is required to adapt CA practices to become attractive to smallholders, and to test extension and supply channels for quality inputs, appropriate and affordable technology, and for best practice advice to small-scale farmers.

The project aims to promote adoption of CA by smallholder farmers in North Africa to reduce natural resource degradation and to increase productivity, profitability and sustainability of the crop/livestock systems in the region.

The project will identify and address the constraints to adoption of CA systems by small-scale (<10 ha) and medium-scale (<20 ha) farmers (smallholders); develop low-cost machinery and adapted cropping systems; and upgrade the CA capacity of the national agricultural research systems. This will be done through participatory research, networking and knowledge sharing among the three core countries (Algeria, Morocco and Tunisia) and Australian partners. The expected results from this partnership will spill over to other African and Middle Eastern countries.

Objectives:

1. **To identify constraints to adoption of CA by smallholder farmers and ways of enhancing adoption, most importantly identifying and testing socioeconomic options**
2. **To identify and test improvements in seeding machinery, and in weed and biomass management of CA systems**
3. **To enhance the capacity of NARES staff and other stakeholders to practice and promote CA**

The adaptive research approach to the development and adoption of CA systems will focus on engaging small-scale farmers, through an active program of integrated research trials and demonstrations. Initial surveys of a total of 300 farmers in the three countries will be targeted to identify constraints to adoption and the potential behavioural change required in three regional platforms covering the region's major agricultural systems. In each platform, three layers of participating farmers will be involved – the first through on-farm researcher-managed trials (involving 10 farmers/platform), the second layer involves farmer-managed trials (20 farmers/platform), with direct benefits to approximately 500 neighbouring farmers and with indirect benefits reaching about 5000 farmers, these forming the third layer of benefiting farmers. Associated capacity-building activities will be linked to the key research outputs. To this end, 530 farmers, 100 extension staff, 25 scientists, three non-government organisations (NGOs) and two traders in each country will be trained in relevant subject matter within the scope of the project. In addition, from year 2, Libya, Sudan and Mauritania will be engaged to receive CA training.

The development of strong linkages and networks between North African and Australian scientists will be fostered through this project to help build the capacity of scientists, extension agents and other stakeholders. A program of exchange visits among Australian and North African partners will enable up to 15 scientists/extension agents from the region to visit Australia, with up to seven Australians visiting North Africa. The project will be co-funded through contributions from each of Algeria, Morocco, Tunisia and the Australian Government through AusAID and ACIAR.

The project may develop some Intellectual Property, which will be handled subject to the policies of ACIAR and ICARDA. The overall objective of the Intellectual Property provisions will be to optimise the availability of IP for the use of smallholder farmers in Maghreb countries, and to minimise the chances of appropriation by other parties to the exclusion of the smallholder clients of both ACIAR and ICARDA

2. Justification

2.1. Partner-country and Australian research and development issues and priority

Agriculture in North Africa is constrained by unfavourable climatic conditions characterized by a dominant Mediterranean environment with low and erratic rainfall, contributing to low and highly variable and unpredictable yields. Most soils are shallow, and nutrient and organic matter deficient, with a low water holding capacity, and are highly vulnerable to erosion. Poor soil and crop management, often associated with excessive tillage practices, has led to increasing erosion and soil degradation that is further aggravated by overgrazing.

North Africa is a net importer of staple food, importing 27% of cereal grain sold worldwide. Wheat and barley are the major cereal commodities in North Africa, grown in mono-cropping or non-diversified cropping systems, especially in the lower rainfall (< 350 mm) areas. Agricultural areas are characterized by land fragmentation and dominance (80%) of small sized (≤ 10-20 ha) farms. Agriculture production is primarily based on rainfed cereal-livestock farming systems where sheep and goats feed on cereal stubble for 3-4 months/year. Such practices have further aggravated soil deterioration.

Conservation agriculture (CA) practices offer the opportunity to improve soil fertility through crop diversification, to halt soil degradation through minimal or no disturbance, enhance moisture conservation and retention through stubble or crop residue retention, and improve cereal-livestock integration through more balanced management of crop residues (Mrabet 2011, Nefzaoui et al. 2011). Such practices should improve the sustainable use of natural resources and the stability and reliability of crop productivity, while lowering production costs through reduced tillage. There is also indication of improved crop productivity as a result of CA adoption in dry Mediterranean climate areas (Kassam et al. 2012). Crop diversification has the potential to further enhance incomes and to improve financial robustness of smallholder enterprises (reduces risk and multiplies avenues for more remunerative activities, e.g. food/feed legumes, livestock).

CA has been introduced and tested in North Africa during the past two decade (Nefzaoui et al. 2011, Mrabet, 2011, ICARDA, 2012). In Morocco, CA resulted in appreciable savings in energy cost and labour requirements. In Tunisia, CA, based on direct seeding, resulted in reduced soil erosion on sloping lands and in reduced energy costs and labour requirements. There are also indications of improved soil fertility in both cases. However, farmer adoption of the CA technology remains low in both countries, covering only about 6,000 ha in Morocco and 12,000 ha in Tunisia. The low farmers' uptake of the CA technology is primarily due to the high cost of currently available no-till (or ZT) seed drills. Most are sourced from Europe and Brazil, but are only affordable for large farm (>100 ha) owners, many of whom have embraced the technology. Algeria's experience with CA is more recent, but faces the same challenge of unavailable low-cost ZT drills. The second most important challenge is the livestock competition for crop residues, much valued for feed in all three countries. An integrated approach is therefore needed to adapt CA through the supply of quality inputs, relevant technology and best practice advice in an appropriate local business context.

Australia shares similar soil and climatic environments characteristic of the North African Mediterranean environment, providing an ideal platform for sharing experiences and adaptive research opportunities. In particular, Australian expertise is a valuable asset to transferring experience in modelling and improving water use efficiency in rainfed systems of North Africa.

Australian knowledge of CA and ZT has developed over several decades with inputs from researchers, extension personnel, consultants, farmers and agribusiness input suppliers both in Australia and also internationally, such as through ACIAR's broad range of investments focusing on CA and ZT in Asia, the Middle East and East Africa. This work has demonstrated a base for collective knowledge development, improvements in productivity and sustainability, and importantly the potential for CA to be adopted by farmers over a wide range of scales and environments.

Farmers organizations engaged in CA adoption and promotion in Australia (e.g. the South Australian No-Till Farmers Association provide a valuable model to enhance CA adoption in North African countries. Australia has embarked on sharing its strong agricultural research and development expertise and success with conservation agriculture, in the similar Mediterranean environment of North Africa.

2.2. Research and development strategy and relationship to other ACIAR investments and other donor activities

Australian-Maghreb research collaboration on CA

Australian agricultural scientists have been cooperating with researchers in the Maghreb region, including Libya, Morocco, Tunisia and Algeria, for more than 25 years. Many of the earlier programs focussed on extending and adapting the Australian "ley" farming system and incorporating medics for improved livestock feed and rotational benefits. Related programs occurred in farm planning, including the establishment of demonstration farms and counterpart training of local agricultural extension personnel. These programs had a fundamental aim of adapting the widely respected Australian dryland farming technology to the North African situation with the aim of improving local food security. While the use of Australian methods of shallow tillage has been widely demonstrated during these projects, the more recent progression to a no-till style of crop establishment has yet to receive significant attention.

Australians and others with expertise in conservation agriculture, no-till mechanisation and participatory research have recently been investigating opportunities and collaborating with partners in Algeria, Tunisia and Morocco through small-scale pilot studies and workshops to identify opportunities to increase cropping yields in North Africa through research and adoption of new technology.

A scoping study in Tunisia, "*Conservation Agriculture: Constraints and Opportunities in the North African Region*" held in July 2010 (ACIAR Report CSE 2010/027) and involving participants from Morocco, Algeria, Tunisia, Libya, Eritrea and Sudan, Australia and ICARDA, identified issues and priorities for research and development in CA that are shared across northern Africa. The priorities presented were relevant to the extensive research, development and adoption activities in Australia that have been generated in conservation agriculture over the past 30-40 years. Existing capacity to address these issues varies, and presented the opportunity to encourage a multi-country approach on which to investigate and overcome shared needs. The study found there is a need for socio-economic strategies for supporting smallholder adoption and for optimizing biomass production (and management) through enhancing crop water use efficiency, developing integrated agronomic management systems which take account of the fodder needs of livestock, to developing ZT crop establishment systems and machinery appropriate to farm size and affordability.

A workshop to review past Maghreb/Australian involvement held in Adelaide in September, 2011 confirmed the advantages that can be achieved through collaboration between Australian and North African research, development and extension communities. This workshop identified the main factors for success identified from past projects were local community ownership, national commitment, and developing and maintaining strong linkages and relationships between local and Australian R, D and E efforts. These findings have been taken into account in project development.

Linkages with CGIAR research programs (CRPs)

The project is mainly associated with the newly established CGIAR research program on dryland systems: "Integrated agricultural production systems for improvement of food security and livelihoods in dry areas (CRP1.1.) led by ICARDA.

The CRP1.1 targets two research themes "*Reducing vulnerability and mitigating risk in west Asia and North Africa (WANA)*" and "*Sustainable intensification in WANA".* The proposed CA project will contribute to three out of eight outcomes within CRP1.1 *"Sustainable intensification in West Asia and North Africa"*, namely:

- Vulnerable smallholder farmers increase their capacity to adapt to climate and other shocks by adopting and adapting natural resource management options that increase the resilience of their livelihoods (outcome 4)
- Smallholder farmers adopt and adapt integrated combinations of components and management options that sustainably intensify and diversify their production systems and livelihoods (outcome 5)
- The international research for development community (including other CRPs) become more aware of opportunities and constraints in dryland systems, and the added value of agro-ecosystem approaches for managing them, and increase investment in their development and implementation (outcome 8)

The sustainable intensification in WANA action site within CRP1.1 located in Meknès (Morocco) under mixed cereal-based systems is representative of favourable target regions of North Africa and addresses the same systems as the project. The knowledge and technologies generated within the three platforms will be out-scaled through CRP1.1 as IPGs (International Public Goods). The WANA CRP1.1 coordinator and the coordinator of the action site will be invited to national and regional coordination meetings of the CA project. Farmers and other stakeholders from CRP1.1 Meknès action site will be invited to participate at relevant platforms events related to on-job training and technology transfer. Similarly, CA project stakeholders will also attend relevant events at the CRP1.1 action site. Technical information will be exchanged between the two projects. A co-investment of 20 % ACIAR/AusAID funds will feed into CRP1.1.

Relationships to other ACIAR investment and other donor's activities

The project will complement, utilize and build upon the experiences and capabilities of other initiatives such as those funded by ACIAR, other donor agencies and the countries themselves (both past and current) across the region. The project will establish linkages as needed for information and experience exchange through participation to technical meetings, workshops and field days.

Examples of relevant projects/initiatives for linkages are:

- The successful ACIAR project "*Development of conservation cropping systems in the drylands of Northern Iraq*" and its next phase (discussions are underway about transferring the training in CA of Iraqi professionals from Syria to Tunisia).
- The SIMLESA Program: CIMMYT-ACIAR Sustainable Intensification of Maize-Legume Systems for Food Security in Eastern and Southern Africa (experience with the incorporation of forage legumes into cereal rotation systems in low rainfall environments will be shared with Ethiopia).

- In Tunisia: AFD (Agence Française de Développement)-funded project to support the development of CA from 2000 to 2011 focusing on large farmers (the agronomy results will be adapted for testing on smallholder systems);
- In Morocco: INRA-ICARDA integrated natural resources management project implemented between 2003 and 2011; AAAID (Arab Agency for Agricultural Investment and Development) promoted no-till between 2007 and 2009 (the agronomy results will be adapted for testing under this project);.
- In Algeria: The Government initiated limited CA activities from 2006 (the results will feed into the fine tuning of the CA systems for testing under this project);
- In Morocco and Tunisia, CIRAD-led EU-funded project (CA2Africa) to assess the impact of CA (2010-2012) (the knowledge of CA successes compiled through CA2Africa project will be used in the finalization of the research designs in this project);
- A Mediterranean Network on no-till (RMSD/ Rencontres Méditerranéennes sur le semi direct) involving Algeria, Morocco, Tunisia and other countries from Europe since 2000 (the knowledge of no-till from the network will be used in the finalization of the research designs in this project); .

Joint meetings with the management units of concerned projects during the first year of implementation will identify synergies and complementarities.

Project research and development strategy

The different CA-related research capabilities of the three countries, as well as the different rural development priorities, have shaped the design of the collaborative research across the region.

Three platforms in three different agro-ecosystems will be established across the region addressing complementary CA research issues:

- High potential crop/livestock: Fernana (Jendouba), North West Tunisia: Characterised by subhumid, high rainfall (≥600mm); deep soils with relatively good fertility; the farming system is mainly based on cereals (wheat & barley) and legumes associated with livestock.
- Semiarid crop/livestock: Chaouia/Ouardigha, Central Morocco: Characterised by low and variable rainfall (300-350 mm); silty-loamy-calcareous soils with medium fertility; the farming system is based on the integration of crop and livestock (sheep & goats).
- Semiarid arid highland crop/livestock: Setif, North Eastern Algeria: Characterised by highly variable rainfall (330-400 mm); high plateaus, calcarous soils, medium-low fertility, prone to erosion; the farming system is based on cereals with important livestock component (sheep).

Each platform will serve the analogous farming systems across the whole Mediterranean MENA region and complementarities and synergies will be systematically analysed. A key outcome should be the confidence to generalise results to a broader landscape.

The project will address three major research questions that encompass salient issues related to CA systems in North Africa and to bridge the knowledge gap, listed below along with example subsidiary research questions:.

Question 1: How is CA adoption driven by farmer and institutional behaviour and incentives (e.g. markets, research linkages)? For example:

- How is CA adoption influenced by farm size and crop/livestock balance?
- How is CA adoption influenced by specific local organisational and institutional support?
- How is CA adoption influenced by the degree of availability and cost of appropriate equipment (including seeding equipment) and inputs?

Question 2: To what extent do CA systems have household, livelihood and environmental benefits? For example:

- Noting that CA systems change weed and pest profiles, what changes in the management of weeds and pests will reduce biotic pressure?
- How will CA systems characterized by crop rotations and varying agronomic practices spread farmers' production risk?

Question 3: What are the biomass management trade-offs of CA? For example

- Noting the demand from livestock for crop residues, will CA remain beneficial even with low residue retention?
- What are alternative feeds and forages that might be incorporated into CA systems?

Firstly the project will identify and address the constraints to adoption of CA systems by small to medium-scale farmers. Secondly, it will develop cost-effective machinery and cropping systems taking into consideration the management of farmer risk and alternate models of farmer access to such technologies. Thirdly it will upgrade the conservation agriculture capacity of the national agricultural research and extension systems (NARES) through participatory research, networking and knowledge sharing between the 3 core countries (Algeria, Morocco and Tunisia).

The expected findings and information packages from this partnership will generate spill over to other African and Middle Eastern countries; and the Maghreb region in general; and Tunisia, because of its central location in particular, could serve as a hub on CA for training people from Africa and the Middle East.

From year two Mauritania, Libya and Sudan will join the project to benefit mainly from training and transfer of knowledge. ICARDA will identify the focal R4D institution in each country and select through it concerned research and extension personnel to be involved in the project. In addition, ICARDA will link this project with the AfDB-SARD- SC Wheat project addressing CA and led by ICARDA. The AfDB project will contribute in facilitating the participation of selected scientists from Mauritania and Sudan to major events. The ARC Libya-ICARDA bilateral project will provide support to Libya participation.

Tunisia will play a special role as hub for the training services to be provided to other countries in the region, which will be supported by the presence of the ICARDA regional office in Tunis. Consideration is being given to locating a substantial proportion of the external training for the Iraqi CA project in Tunisia. Moreover, preliminary analysis suggests that Tunisia would be a prime location for a regional dryland management hub to support CA research and capacity building through the MENA region. Factors in favour of this choice include the (i) presence of the ICARDA North Africa Regional Office in Tunis, (ii) the geographical location of Tunisia which is central in MENA with easy access to and from all countries in the region, (iii) a strong agricultural research and higher education system led by IRESA (Institution de la Recherche et de l'Enseignement Supérieur Agricoles) which includes more than 15 institutions, and (iv) a strong R4D and transfer of technology institution (INGC- Institut National des Grandes Cultures). In addition, the country has developed a good experience in CA and partnership with advanced centres in Europe and Australia.

3. Objectives

The project aims to promote adoption of conservation agriculture (CA) by smallholder farmers in North Africa (Algeria, Morocco, and Tunisia) to reduce natural resource degradation and increase productivity, profitability and sustainability of the crop/livestock systems in the region. More specifically, the project pursues the following three objectives:

1. **To identify constraints to adoption of CA by smallholder farmers and ways of enhancing adoption, most importantly identifying and testing socioeconomic options**
2. **To identify and test improvements in seeding machinery, and in weed and biomass management of CA systems**
3. **To enhance the capacity of NARES staff and other stakeholders to practice and promote CA**

Detailed activities and outputs/milestones are presented under section 5.

4. Planned impacts and adoption pathways

Countries engaged in the project have different research, development and capacity building requirements associated with CA and ZT development. This is reflected through their relative research experience, current and past research investments, and participation in regional and international projects.

There is a common and pressing need to gain a greater understanding of impact pathways and adoption constraints associated with the development of CA systems. This will be achieved through the project's socio-economic based research studies.

Also common to all countries is the need to identify and explore local research needs that address constraints to CA development. The project's adaptive research approaches conducted in partnership with the private sector (input suppliers, machinery manufacturers), CA farming groups and farmers will help identify local research needs, and also enhance pathways to adoption and impact.

The project's research partnership will develop and build on existing activities and resources, and provide an avenue through which participating countries can share experience, knowledge and expertise, whilst utilizing significant Australian experience and knowledge of CA and ZT. The project will also facilitate the linkages between the education, agriculture or science sectors to support the development of post-graduate experience and opportunity around CA.

As the project progresses, project participants from each of the core countries will identify further in-country opportunities and their knowledge will contribute to engagement and training at other institutions. This will be evident as the project progresses towards engagement of other neighbouring countries in years 3 and 4 of the project. Impacts will include a shift to more emphasis on CA systems in agricultural R&D, resulting in an improved capacity of researchers and extension agents in participatory research and development, and an enhanced capacity of farmers in the management of sustainable production systems.

4.1. Scientific Impacts

The key focus for science will be the collaboration and integration of different skills to fully explore the challenges of CA in a systems context. The project will also expand knowledge in a varied range of fields including an understanding of socio-economic factors affecting adoption of new technologies; development of effective and affordable machinery for conservation agriculture; critical plant, soil, weed and water factors influencing the success of conservation agriculture; and the trade-offs in biomass management and integration of livestock in conservation agriculture. These findings will be published in the scientific literature.

4.2. Capacity impacts

Capacity enhancement is a separate objective (objective 3) and a major focus of the project. The collaboration, exchange and interacting activities in the project will lead to significant capacity building of a range of stakeholders including research, development and extension stakeholders, educational institutions, North African machinery manufacturers, CA farmer associations and importantly small to medium-scale farmers as well as decision-makers through adaptive research and participatory approaches. As a result of the research project more than 100 scientists and 16600 farmers from the six target countries will gain understanding and experience in CA. This will help to ensure that the impact of the project continues beyond the life of the project and, to achieve longer-term CA capacity development.

The impacts will include more knowledge and capability amongst stakeholders, especially in the areas of agronomy, crop-livestock integration, machinery development, participatory research and development, sustainable and efficient production systems, socio-economics and policy. This will occur through project activities within countries and country to country exchanges. The project will also enhance the collaboration between agricultural researchers from Australia, ICARDA, and NARES from the MENA region. It also offers the opportunity for the development of long-standing working relationships between research, extension, farmers, NGOs, machinery manufacturers and policy makers.

Planned activities in the 3 core countries will include: 9 in-country workshops, 3 leaflets, 10 brochures, 1 bi-annual newsletter, 1 website produced; 16600 farmers, 300 extension, 75 scientists, 3 NGOs and 6 industry partners trained; 75 farmer field school events and 2 regional workshops organized; 15 scientists/extension from the region visit Australia and 7 Australian scientists visit the region; 3 NGOs reinforced and 12 farmers and 15 scientists exchanged within the region. For the 3 associated countries (Libya, Mauritania, and Sudan): 6 scientists attend final regional workshop; 15 scientists and extensionists trained in year 3 and 4; project documents and publications made available.

Through involvement in the project, all staff will develop capacity to plan, implement and evaluate CA development projects. Capacity will also be enhanced in special technical areas including, conservation cropping, rotation, machinery, biomass management, livestock feeding, economic and policy research, statistical analysis and scientific report writing.

4.3. Community impacts

Agriculture is central to the social and economic fabric of all North African countries. The aggregate population of farm households across the Maghreb runs into the 10’s of millions, with 80% considered to be small farmers of low socio-economic status. Positive change to more productive, profitable and sustainable agricultural systems will directly affect the livelihoods of farm households and extend to associated local rural industries, contributing to structural change in local economies. Success in agriculture will contribute to all Millennium Development Goals, associated with agricultural development and the achievement of food security across the region.

Earlier ICARDA work in the region (Mashreq/Maghreb project), showed that women and children participate significantly in agricultural activities (30 to 40%). The extent and nature of their involvement varies depends on the environment, farming system or the type of enterprise. Women are involved in gathering straw, threshing and cleaning the harvested cereals and pulses, weeding, milking and feeding livestock. Changes to farming practices resulting from the adoption of conservation agriculture will, therefore, have positive direct and indirect impacts on women’s and men’s farm labour input.

There will also be benefits to family nutrition, from increases in production of livestock, cereals and pulses, which will have particular benefits for children through increased protein intake.

4.4. Economic impacts

CA and ZT have proven to be economically robust across many countries and agricultural systems. In countries such as India, the returns from reduced costs of cultivation under ZT in irrigated areas, such as in the Punjab region in Northern India, are evident, whilst crop yields maintained or even improved. In Australia, benefits associated with a ZT system are often strongest in drier years due to the ability to establish crops early under marginal soil moisture conditions. Such yields exceed those of conventionally sown crops, which can fail in poor seasons. A CA system incorporating ZT can have higher input costs and altered cash flow demands associated with fertilizers and weed control, requiring increased farmer access to finance.

It is evident from past research in the region (Mrabet, 2011; Abdelhafidh & al., 2011) that there is significant opportunity to increase economic returns and water use efficiency through adopting enhanced agronomic practices, including time of sowing and ZT systems. The management of biomass production represents an additional economic opportunity from the development an integrated crop-livestock production system for North Africa. The affordability of ZT equipment by North African farmers has proven to be a major constraint to the wider uptake of ZT and CA systems, and this is a key factor that will be addressed in this project. Experience across the region to date has relied on expensive equipment sourced from Europe and Brazil, both in purchase and in terms of tractor-power and spare-parts needs, with only the very largest farmers having acquired such equipment and a gradual saturation of this market. The availability of low-cost, small size and simple technology will reduce all these costs and offer opportunities to local industry in the rural areas. The involvement of local manufacturing industry in supplying these low-cost mechanised solutions will strengthen local economies and in the longer term rural employment via the development of a machinery servicing industry.

Through undertaking a range of case studies, as well as production systems benchmarking linked to project activities, the economic benefits and impact of a CA system incorporating ZT will be clearly demonstrated, and optimized on a country by country basis. An additional challenge will be determining realistic adoption rates based on non-agronomic constraints. Preliminary estimates are that the "yield gap" (realized vs. potential) in the partner countries could be in the order of 20-30% (Heng *et al*, 2007). This is also supported by information gained from field visits, which suggest that cereal crop yield potential falls far short of what Australian farmers aim for under comparable rainfall and soil conditions. Improved crop establishment, agronomy and timeliness through the CA system are expected to have a major impact on both closing the yield gap and improving yield potential.

While CA technologies require increased costs primarily related to ZT seed drill, the returns can improve farmer livelihoods and contribute to agricultural business development. Per hectare production increases are conservatively estimated to be 20-30% (e.g. 600-1000 kg/ha across low-high rainfall zones or $180-$300 per hectare for durum – sold at $300/tonne), which could have a major impact if translated more broadly... There may be additional savings (e.g. time, depreciation) and costs (e.g. possible use of more herbicides) which need to be quantified and considered.

Across the three countries at least 1600 farmers will benefit directly from the project (through trials and demonstrations), with 15,000 benefitting indirectly (through field days and extension). From previous project adoption rates experienced in the region, 70% of the 1600 farmers directly targeted and 35% of the 15,000 farmers indirectly targeted across the 3 platforms would be expected to adopt CA system within five years of completion of the project. With an average of 5ha per farm, and a net production benefit of $180-300 per ha, the expected direct economic benefit would reach AU$5.1 to 8.4 million annually. Based on previous economic analyses of operating cost under ZT (Abdelhafidh & al., 2011), this economic production benefit would be expected to also apply to individual farm profitability. A conservative estimate of farm areas practicing CA as a result of this project therefore is about 10,000 ha per country within 5 years and 30,000 ha within 10 years from project end. In total, the project is expected to result in an expanded CA area of 90,000 ha in the 3 North African countries (Algeria, Morocco and Tunisia) by year 2026.

4.5. Social impacts

In North Africa large percentages of the population (millions of farm households) are involved in and are dependent on production from small areas of land. Rural poverty is widespread, with large families (to provide the required labour), limited opportunities for women and youth, poor education, and enduring health issues. People living in seasonally arid or marginal areas are highly vulnerable to the considerable risk associated with failure in agricultural activities. CA addresses this risk by improving the reliability and productivity of farming systems.

The project will help build a common purpose, vision and effort around the development of CA across North Africa. Individual and community interactions will be encouraged and developed as part of an adaptive research model approach. Specific outcomes may be strongly facilitated through the development of participatory approaches, such as front line research and demonstrations initiatives, and engagement of farmer groups, CA organizations, NGO's, regional, national and international organizations.

In the longer term, more successful agriculture and increased mechanization will see a reduced need for labour in farming, a greater reliability of crop and livestock production systems, and improvements in the natural resource base. This impact and transition associated with the development of CA systems is relevant to government policy and so governments will be fully informed of the potential rate of change to existing systems.

It is expected that the adoption of CA will have a positive impact on women through the reduction of allocated time to weeding, increased income from livestock, and the opportunity for reduced and faster cultivation through sowing of crops with ZT.

With the potential of reaching more than 16,600 households, with an average of 7 members per household, the life of 116,200 in the rural population will be positively affected. These households that adopt the new technologies will be better able to adapt to crop production risks, enhance their food security, reduce vulnerability to poverty, and to develop resilience to drought and weather variability.

The project is taking appropriate measures to increase the participation of female scientists and support staff. Specific attention will be given to involving and empowering more women in project activities and training, and priority will be given to up-skilling female scientists via postgraduate studies and training visits.

4.6. Environmental impacts

A driver for CA and ZT in many environments has been the reduction in soil erosion and improvement of soil organic matter, both associated with wind erosion on light sandy soils, and water erosion associated with intense rain periods on the heavy soil types. Excessive cultivation, overgrazing of plant and crop stubble residues is characteristic of many of the cropping environments of North Africa. The development of cultivation 'hard pans', loss of stored soil moisture through cultivation are additional characteristics symptomatic of farming systems that are far from sustainable.CA addresses these impacts through reduction or elimination of unnecessary cultivation and also through the management of crop residues. This requires attention to be committed to local animal production systems and land-use patterns so that gains in one area of production (cropping) are not disruptive to another (livestock production).

ZT adoption results in up to an 80% reduction of fuel consumption (Mrabet, 2011) with consequent beneficial environmental effect. For this project, considering the number of beneficiaries and the adoption rates, the saving of fuel would be expected to be around 1.2 million litres or AU$1.2 million per year.

Widespread adoption of CA is associated with the use of pre and post-emergent herbicides in small quantities. In all cases consideration will be given to individual country expertise and understanding of herbicide use in CA systems, the availability of such products, in addition to government policy and controls, in order to ensure that these changes do not have unintended consequences.

4.7. Communication and dissemination activities

Working with the identified partner countries and other organizations will generate some communications challenges. Languages common to many (but not all countries) include Arabic, French and English as well as local languages. At an operational level most parties will have experience with these issues, but each country will have to take particular responsibility to ensure that knowledge and opportunity arising from the project is shared equitably amongst stakeholders. For most of the project management meetings, English will be the predominant language (with some translations provided on a need basis), and the basis for reporting to ACIAR and ICARDA.

A participatory approach to program development and interactions with all stakeholders (farmers, extension, researchers, decision-makers, manufacturers, and media) is fundamental to ensuring their participation in project design and implementation, and a continuous flow of information and feedback.

Part of the communications strategy for the project will be to ensure that all information and data arising is shared and reported on an annual basis. Material that is of value to a broader scientific audience will also be identified for publication.

Also embedded in the design of project activities are experimental and monitoring protocols that will reinforce the need to constantly expose farmers to ideas and opportunities for change. This will provide the basis for constant feedback relating to risks, concerns and unique local opportunities for farmers and other stakeholders interested in the successful application of CA.

Most of the information on CA and related ZT technology will be generated and disseminated at the project platforms (described in section 5.1. “Methodology”, figure 1) and surroundings areas. This starts firstly with the researcher-led testing of key CA technology innovations in adaptive research trials (crop varieties, soil and crop management, integrated weeds, pests and diseases management, crop rotations, specific ZT drills, socioeconomic studies, etc.). Prior diagnosis work will be based on direct contact and discussions among researchers-farmers-extension agents. The researchers play a key role at this stage, the extension agents as well as the farm owners will take part in some activities by providing logistic support as needed, making field observations and asking questions and proposing suggestions to the implementing researchers.

The participation of farmers and extension agents will be more active and crucial when identified promising innovations are being verified and demonstrated at the second level of engagement. At this stage 20 lead farmers will co-implement demonstration plots (along with extension and research staff). They will take a major role in managing the plots, guiding and interacting with interested farmers (about 25 such farmers per lead farmer) into practical learning during frequent field visits. The visits will be organized at determined periods through the growing season coinciding with specific CA related activities (sowing using the ZT drills, controlling the weeds, applying fertilizers, making observations on crops and soil, harvest, etc.). Fields days will be often (but not always) organized as part of a farmer field school (FFS). There will be 5 -10 such field days organized per platform through the season, depending on the demonstrated and debated theme and on the capacity of the lead farmer. Around 530 participants (mostly farmers, but also NGOs, private sector and policy makers) in addition to a large number of extension staff and researchers will be constantly engaged in guiding and discussing with other farmers, demonstrating particular techniques, answering questions, noting feedback comments, suggestions for innovation, etc.

At the third level, starting especially from year 3 onwards, these demonstrating farmers will become CA information disseminators, along with the active involvement of extension services. Further contribution to the awareness of CA technology will be disseminated on a wider scale to policy makers, press and media, and many other direct and indirect stakeholders. The project aims is to reach a minimum of 5000 stakeholders by project's final year.

At the governance and management level, the Project National Coordinator will play a key role in communicating among project team members (especially researchers and extension staff) and with the technical coordination committee (TCC) to assure a smooth implementation of planned activities by the different project team members and the timely preparation and submission of progress and annual reports to the TCC and project steering committee (PSC). The participation of high-level officials to the PSC will boost project visibility among policy makers and decision takers, and raise awareness of CA benefits among farming communities.

At the project implementation level, a participatory arrangement ensures the full engagement and inputs of the project national coordinator (PNC), thematic leaders within the project team, including both research and extension specialists, and lead farmers within the platform. Participants will be kept in continuous contact to ensure the timely implementation of planned activities, and information exchange among all participants. The particular focus will be on farmers who are both the target technology beneficiaries and resource persons for innovative suggestions of modification and better adaptation of the CA techniques to the local context.

Project-generated information will be built around project outputs, with an emphasis on the following themes: pillars and characteristics of the CA system, no-till (or ZT) seeders, crop and weed management, residue management and livestock feeding, constraints and profitability of CA, and adaptation of the CA system to local conditions. These topics will be addressed through practical sessions with technical facilitators and trainers in FFS, field days, training events, visits to machinery workshops, and participation in special meetings with different stakeholders, including policy and decision makers, and the private sector.

A number of varied tools and methods of communication and dissemination will be used. This will include joint engagement of and dialogue among researchers, farmers, extension specialists, agricultural engineers, machinery manufacturers at field schools, practical training and demonstration events, and through dissemination through varied media including brochures and leaflets, policy briefs, audio-visual aids, radio and TV extension broadcasts, mobile communication technology (sms), and a specific project page on ICARDA website. This will include information and knowledge on practical hands-on applications, as well as discussions of matters relating to policy and promotion of CA.

5. Operations

5.1. Methodology

Project methodologies aim to adopt a highly participatory means of engaging and working with partner organizations, and importantly, farming communities. This approach involves farmers in levels of system monitoring, where they gain considerably from interactions with researchers, other farmers and a range of input suppliers. For countries that have limited experience and/or skills in CA, the gains can occur faster in these environments by having a high level of awareness of risks and uncertainties gained through research and associated capacity building activities. This approach, of working in genuinely participatory arrangements, is what clearly differentiates the Australian skill base and management approach from that found in many developing and emerging countries where more hierarchical arrangements tend to prevail. These experiences will be utilized in the development of project methodologies, providing a relatively fresh and innovative approach to capacity building of both researchers and farmers from across North Africa.

The specific methodologies are aligned to the project outputs and associated activities and are indicated in section 5.2 below.

Agro-ecological and socio-economic studies involving small-scale and medium-scale farmers will be conducted to shed light on the challenges and opportunities for CA adoption in the target regions. This includes GIS and remote sensing tools on one hand, and formal and informal surveys, rural appraisal and ex-ante and ex-post analyses on the other. These will be complemented with continuous dialogue and negotiation with farmers to better assess farmer perception and behaviour towards CA and to investigate and recommend CA favouring policies.

An inception workshop held in the first three months of the project life will generate a detailed work-plan and clarify the details of the management, monitoring and reporting.

Three platforms will be established, with one platform per country, to address research issues of three agro-ecosystems. However, each platform will serve the entire North Africa region through complementarities and synergies as appropriate.

Each platform forms a forum for technology learning and innovation (Tenywa et al. 2011) of multiple stakeholders, based on the concept of agricultural innovation systems as described in Buck and Scherr (2009) and The World Bank (2011) and conveniently represented in Figure 1.

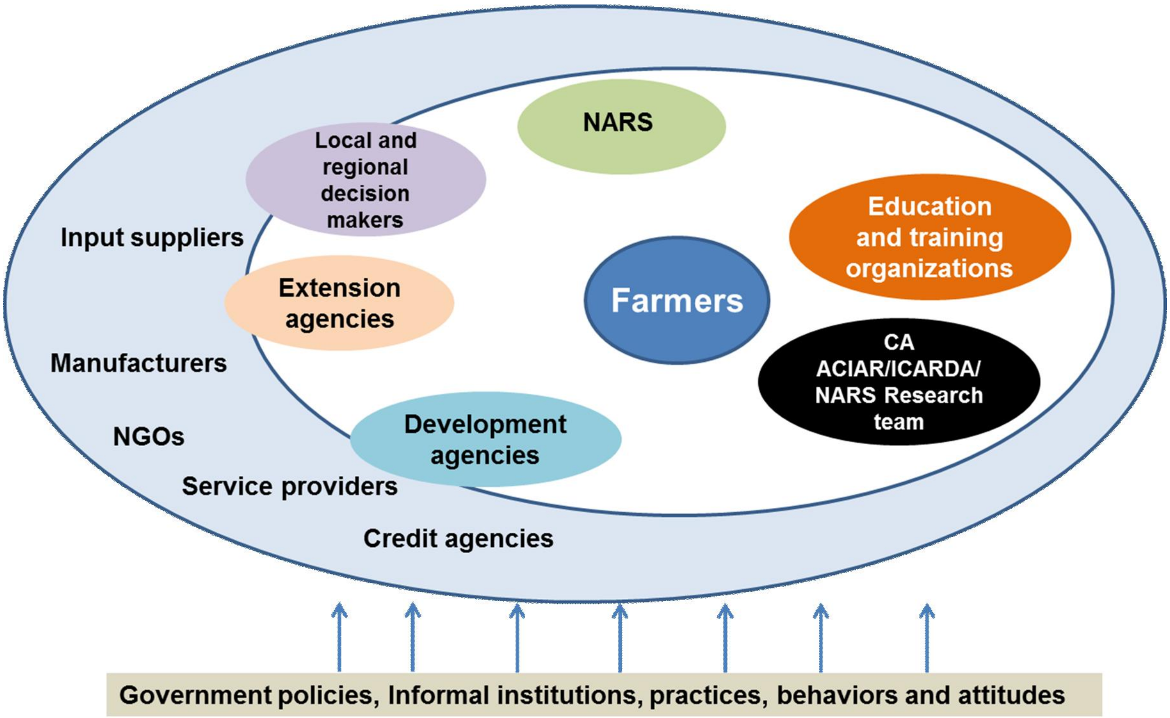

Figure 1. Conservation agriculture (CA) innovation system framework (adapted from the World Bank, 2011)

As CA is a new technology not widely known in North Africa, researchers, extension agents and large-farm owners already exposed to or practicing CA initially will play a key role in introducing the technology. However, other farmers including the smallholders (who make up 80% of all farmers in North Africa), farmer organizations, civil society associations, NGOs, input suppliers (stockists, machinery manufacturers, dealers, service providers), output marketing and finance support agencies, as well as policy and decision makers will be all involved, first in learning sessions and gradually in active participation to discussion sessions (all stakeholders), practical application, and innovative adaptation and implementation (farmers), and in contributing to encouraging and facilitating (policy makers), and promoting the adoption of CA (farmers and farmer organizations, extension, media, and other agencies).

The project will first hold multi-stakeholder meetings to introduce CA technology with details on application opportunities and challenges and to raise interest and trigger questions, comments and suggestions by participants. Full sessions will be devoted to assessing stakeholders (especially farmers) attitudes, expectations and potential weaknesses and difficulties. This will be complemented by a diagnosis study to provide a full picture of the local challenges to address.

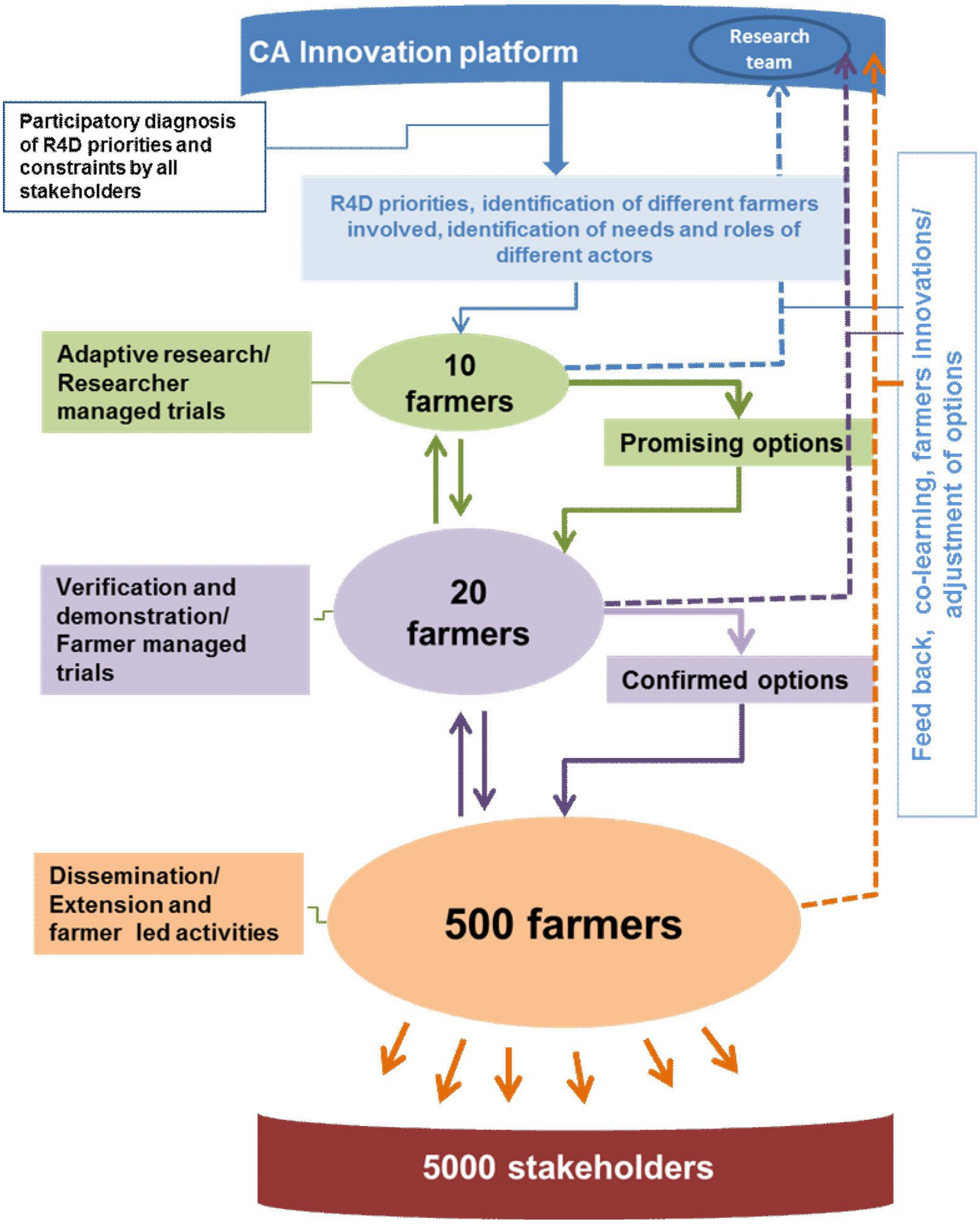

Figure 2. A schematic representation of the CA innovation platform for North Africa

The on-farm implementation of CA technology is based on the participation of farmers, extension and research specialists and other stakeholders through an interactive exchange of knowledge and skills that improve the competence of farmers while providing the researchers and extension agents with new farmers ideas (innovations) that are jointly discussed and should lead to better adaptation of the CA technology to local conditions. A skeleton of CA innovation platform for this project (Figure 2) comprises the following components:

- 10 on-farm researcher managed trials (ORMT) starting in year 1, using existing seeders, at the rate of 5 ha per farm trial (total 50 ha). This represents the nucleus where adaptive research will be conducted following rigorous scientific research methodologies.
- 20 on-farm farmer managed trials (OFMT) added in year 2, at the rate of 5 ha per farm trial (total 100 ha) based on promising ORMT results and implemented using a participatory approach. This group will form the base for farmers field schools (FFS) on 5 themes (ZT seeding machinery,

planting and crop establishment; integrated pest management (IPM); crop and soil management; residue management and crop-livestock integration; crop diversification and rotation) and for field days and visits.

- 500 participating farmers who are direct beneficiaries, through farmers participation in CA farmer field schools (FFS), site visits, field days, and awareness and training events, with technical support by project researchers and extension personnel and farmer exposure to successful CA practices in other countries.
- 5000 farmers, service providers, input providers, NGOs, CBOs, policy makers and other stakeholders, all of whom will be reached indirectly through different media sources (directly-participating farmers: a multiplier effect of farmer-to-farmer dissemination , extension, radio, newspapers and magazines, TV broadcasting, web portals, etc.)

A baseline survey will be conducted using a sample of 100 farmers per platform including the 30 farmers involved in on-farm research. A behavioural study using Likert scale will be applied to the same sample. A rapid rural appraisal (RRA) survey also will be conducted to identify constraints to CA adoption in each platform.

On-farm researcher- managed trials will address the major research questions with a minimum of three replications per trial.

On-farm farmer-managed trials aim at validating results obtained from on-farm researcher managed trials.

In all trials and demonstration plots, a check (standard) soil management, i.e. traditional tillage system will be included as a base for comparison with the CA system. During the initial 1-2 year phase, currently available no-till drills will be used until the low-cost seeders developed by the project are made available.

In all cases the experimental and measurement protocols associated with CA activities will encourage the various groups to broaden their scope and analysis of international literature and experience to ensure that local activities are robust and credible. By using some common experimental and monitoring approaches (including water use efficiency, seeder evaluation), data from all countries will be shared in scientific presentations. The analysis of data from across sites will provide valuable information on environmental interactions that may impact the generality of any findings.

The key focus for all science will be on the collaboration and integration of different skills to fully explore the challenges of CA in a systems context. This will include agronomists, soil scientists, crop protection specialists, agricultural machinery experts, livestock specialists, regional CA farmer organizations and those with socio-economic experience to assist with adoption planning and project evaluation. While CA developed at different rates across Australia, it was this experience with collaboration that provided shared insights, reduced duplication of work and contributed to effective participatory and modelling activities.

Provision has been made for annual monitoring visits to facilitate adaptive management of the project.

In each country, the platform forms a forum for integrated project implementation with engagement of all stakeholders including: farmers, extension, multidisciplinary research team, NGOs, private sector and local decision-makers. The platforms are coordinated by the project national coordinator (PNC) who is responsible for submitting the plan of work to a technical coordination committee (TCC) and for its timely implementation. The PNC in collaboration with the research team in the country prepares a six-month progress report as well as an annual technical and financial report which she/he submits to the project technical coordination committee (TCC). The PNC organizes annual national coordination meetings and in-country training and visits (refer to section 5.3. for project governance and management).

5.2. Activities and Outputs/milestones

Project logic	Verifiable indicators	Means of verification	Key assumptions/risks
Aim: Promote adoption of conservation agriculture practices to reduce natural resource degradation, and to increase productivity, profitability and sustainability of the crop/livestock systems in North Africa	Natural resources degradation, production, profitability and sustainability of crop/livestock systems	Adoption/impact reports Follow-up case studies of randomly-selected farmers and households Cost-benefit analysis reports	Governments invest in CA and enact favourable policies
Outcomes			
1: wider adoption of conservation agriculture among small and medium-scale farmers in North Africa	# farmers and contractors using ZT Area under CA	Adoption/impact reports Follow-up case studies of randomly-selected households Cost-benefit analysis reports	Enabling institutional and policy environment; effective research-extension-farmers-private sector linkages
2. Affordable ZT seeding machinery available through local manufacturing	# seeder manufacturers # ZT seeders sold # ZT seeding machinery service providers	Adoption/impact reports Follow-up case studies of randomly-selected manufacturers Cost-benefit analysis	Private sector collaborate Enabling policies
3: improved productivity, profitability and sustainability of cereal crop-livestock systems in North Africa	- improved household income -improved soil quality and moisture conservation -# alternative feed resources included in the feeding calendar	- Social, economic and environmental impact reports - project technical reports and publications	Small and medium-scale farmers adopt CA practices. Small –scale farmers have access to new feed resources
4. improved capacity of NARES, farmers, NGOs, machinery manufacturers, and agricultural institutions to plan and implement natural resources conserving practices in Tunisia, Algeria, and Morocco and 3 neighbouring countries (Libya, Mauritania and Sudan)	# staff trained # farmers and other stakeholders trained -Institutionalization of CA programs in R&D projects	-Training reports -Impact study reports - National R&D reports	Governments invest in CA institutionalization and training, and enact favourable policies
Objectives			

1. To identify constraints to adoption of conservation agriculture by small holder farmers and ways of enhancing adoption, most importantly identifying and testing socio-economic options	- Farmer baseline and adoption surveys - 100 household surveys - Typology of production systems -Type and # of constraints -Type and # of recommended options - Environmental similarity analyses	-Survey reports - Databases -Adoption reports - Similarity maps	Availability of secondary data Farmers collaborate
2. To identify and test improvements in seeding machinery, and in weed and biomass management of CA systems : 2.1. Develop and test affordable ZT seeding machinery and crop establishment systems for small to medium-sized farms; 2.2 Fine-tune weed management and crop sequences for sustainable land and water management; 2.3. Optimize crop residue management and test alternative livestock feeding systems under CA	2.1. -Inventory of available ZT seeders and selection of appropriate type(s) -# ZT drill prototype(s) developed # of ZT drills manufactured 2.2. Best integrated crop and weed management developed & validated -APSIM model calibrated & validated 2.3 -Optimization of crop residue management - # alternative feed resources - Calibration & validation of decision-making model	Annual workplans and technical reports 2.1.- Reports - ZT drill prototype - Business register of manufacturers 2.2. Reports -APSIM documentation 2.3. Reports - Decision making model documentation	- Farmers collaborate - Manufacturers invest in low-cost ZT -
3. To enhance the capacity of NARES staff and other stakeholders to practice and promote CA	# training events/modules # Farmers field schools #NARES, farmers, & other stakeholders trained	-Annual workplans and technical reports - Training manuals and extension brochures - ICARDA capacity development database	-NARES select suitable candidates

Expected outputs/milestones with due dates, risks/assumptions and application are tabled below for all activities under each component objective.

Objective 1. To identify constraints to adoption of CA by smallholder farmers and ways of enhancing adoption, most importantly identifying and testing socioeconomic options

Operational coordinator: Dr. Boubaker Dhehibi (ICARDA)

No.	Activity	Outputs/ milestones	Due date of output/ milestone	Responsibility	Risks / assumptions	Applications of outputs
1.1	Characterize the 3 platforms and conduct similarity studies within country and across the region for efficient project implementation and result out-scaling	Report detailing agro-ecological and socio-economic characterization and typology of the different production systems in the target platforms and similarity analysis	Yr 1-4	Boughlala (Mor) Kahina I. (Alg)Thabel B. (Tun) Dhibi T-ICARDA FortuneJ. Aust .	Secondary data available	Results are used to target farmer groups and identify domains for application and outscaling within and outside country
1.2	Study farmers behavioural change and analyse constraints to adoption of CA systems in the three platforms (including mechanisation aspects and machinery supply industry)	Review of existing documentation in the 3 core countries, rapid rural appraisal (RRA) at each platform, and national workshop; 300 farmers surveyed for behavioural change in the 3 platforms	Yr 1-4	Boughlala (Mor) Kahina I. (Alg) Thabel B. (Tun) Dhibi T-ICARDA FortuneJ. Aust	Farmers collaborate	Use results to develop sound and acceptable CA packages to increase likelihood of adoption
1.3	Undertake a household survey to assess economic, environmental and social project impact through ex-ante analysis	Database on the livelihoods of at least 100 households per platform; Calculated ex-ante CA benefits at the level of 100 households per platform One paper published in a scientific journal	Yr 1-4	Boughlala (Mor) Kahina I. (Alg) . Thabel B. (Tun) Dhibi T-ICARDA FortuneJ. Aust	Database on previous CA research accessible	Ex-ante analysis results will be used to increase awareness and encourage CA adoption
1.4	Investigate enabling policy and institutional options to promote CA adoption	Review of existing policy and institutional set-up Report with recommendations for new policy and institutional options to favour uptake of CA	Yr 1- 3	Boughlala (Mor) Kahina I. (Alg) . Thabel B. (Tun) Dhibi T-ICARDA FortuneJ. Aust	Access to existing policy and official acceptability of policy change	Study results will be used to convince policy makers to enact favourable policy

1.5	Analyse and quantify the degree and rate of CA adoption at the three platforms at the end of the project	Adoption studies implemented within and around the platform at the level of 200 (out of the platform total of 500) participating farmers Scientific paper published	Yr 4	Boughlala (Mor) Kahina I. (Alg) . Thabel B. (Tun) Dhibi T-ICARDA FortuneJ. Aust	CA adoption started among farmers, beginning Year 2, 3	Favourable results will be communicated to decision makers for support and rapid outscaling
1.6	Conduct farmers perception study on CA system by end of project at the three platforms	Data from survey of 100 farmers per platform (same in activity 1.3) Report presenting analyss of results	Yr 4	Boughlala (Mor) Kahina I. (Alg) . Thabel B. (Tun) Dhibi T-ICARDA FortuneJ. Aust	Farmers collaborate	Farmers perception documented and disseminated to contribute to CA adoption

Objective 2. To identify and test improvement in seeding machinery, and in weed and biomass management of CA systems

Operational coordinator: Dr. Jacques Desbioles (Australia)

Sub-objective 2.1. Develop and test affordable ZT seeding machinery and crop establishment systems for small to medium sized farms

No.	Activity	Outputs/milestones	Due date of output/ milestone	Responsibility	Risks/ assumptions	Applications of outputs
2.1.1	Conduct ZT seeder international inventory and select suitable low-cost options for available and potential power sources in the selected platforms	Review report Suitable low-cost ZT drills acquired for evaluation by the project: Repot detailing availability and characteristics of low-cost seed drills from suppliers in in Australia, Europe (Spain, France, Italy), Brazil, Chile, India, China, Turkey -List of potential seed drill candidates with names & addresses of originating companies/institutions as well as technical characteristics and prices	Yr1-Semester1	Desbioles J. (Aus) El Gharras O. (Mor) Jadlaoui, M. (Tun) Harrad, . W. (Alg)	Suppliers respond	Review will help select potential seeders candidates for adaptation to North Africa conditions
2.1.2	Review existing conventional drills	modification kits (4) for existing local seeders developed in collaboration with	Yr 1, 2	Desbioles J. (Aust) El Gharras O.	Farmers accept to modify their	Disseminate results through platform

	available in the target core countries and develop improvements to enable ZT seeding	local manufacturers and tested		(Mor) Jadlaoui, M. (Tun) Harrad, . W. (Alg	seeders. Industry applicants available	demonstration
2.1.3	Design and test a new ZT drill prototype to meet key specifications identified in the target platforms	One ZT drill prototype developed and pre-tested in the targeted environment in collaboration with industry	Yr 2	Desbioles J. (Aust) El Gharras O. (Mor) . Angar H. (Tun) Ghalem Y (Alg)	Manufacturers collaborate	New drill prototype pre- tested and adjusted and shared with potential manufacturers
2.1.4	Undertake field performance assessment of a range of ZT drill options for successful crop establishment in relevant CA cropping contexts	9 platform-years of data sets on factors such as seeder type, soil and residue conditions, crops etc.. acquired over the duration of the project	Yr 2,3, & 4	Desbioles J. (Aust) El Gharras O. (Mor) Angar H. (Tun) 1.1.1		The different drills acquired/modified are tested with participation of farmers and drill manufacturers under field conditions
2.1.5	Engage local manufacturers and farmers in the development, manufacture and promotion of low cost appropriate ZT machinery options	Several manufacturers in the 3 core countries actively manufacturing and supplying successful ZT seeders in the 3 selected platforms - farmer organisations directly involved in evaluation and promotion activities	Yr 2,3, & 4	. Desbioles J. (Aust.) Fortune J. (Aust.) ElGharras O. (Mor) HajSaleh H. (Tun) Harrad, W. (Alg)	Suitable manufacturing applicants selected and engaged	Established process for machinery improvement through participation of drill manufacturers and users in platform testing, demonstration and communication/dissemination
2.1.6	Conduct economic assessment and investment opportunities of the new ZT drills in the relevant CA systems	Report presenting cost-benefit analysis and internal return rate (IRR) Business plan for investment in ZT drill	Yr 3 & 4	. Dhehibi, B. (ICARDA) Liomboui, H. (Mor) Thabet, B. (Tun) Mahnane S. (Alg) Desbioles, J. (Aust)	Favourable farmers response and manufacturer access to funding/credit	Encourage public-private partnerships to boost successful business plan implementation

Objective 2. To identify and test improvement in seeding machinery, and in weed and biomass management of CA systems

Sub-objective 2.2. Fine-tune weed management and crop sequences for sustainable land & water management

No.	Activity	Outputs/milestones	Due date of output/ milestone	Responsibility	Risks/ assumptions	Applications of outputs
2.2.1	Study the dynamics of weeds and develop an integrated management for weed control under CA systems, including consideration of herbicide resistance	Report on dynamics of weeds at 3 farms per platform Integrated weed management guidelines Options of weed management tested in 3 onfarm researcher managed trials/platform. Best options verified in 20 farmer-managed trials A guide for weed management	Yr1-4	Hajaj, B. (Mor) Ben Youssef, S. (Tun) Djenadi, F. (Alg) Gill, Gurgeet (Aust)	Farmer participation ensured for 4 years, no severe seasonal constraint	Confirmed successful options will be disseminated to a wider scale
2.2.2	Test crop sequence options to enhance diversification and sustainable productivity	Adapted crop species introduced and tested in rotation with dominant cereal crops in 3 farms per platform, and a publication in scientific journal initiated at the end of the project Trials established with wheat and barley crops grown in rotation with legumes, forages and oil crops Crop rotations conducted in 3 researcher-managed trials per platform Promising rotation options verified in 20 farmer-managed demonstrations	Yr1-4	Feindel (ICARDA) Ben Hammouda, M. (Tun) El Brahmi, E. (Mor) Zaghouane, O. (Alg) Mayfield, A. (Aust)	Farmer participation ensured for 4 years, no severe seasonal constraint	Promising rotation/species (legumes, forages, oil crops, etc) will be promoted for wider adoption

2.2.3	Assess soil quality/ health and water productivity under CA system	Paper published on results of assessment ofsoil fertility and health and water productivity d in 3 farms (same as in 2.2.2) Report on soil organic matter and moisture content and soil erosion in the rotation trials (activity 2.2.2), to include grain yield and dry matter of grown species and water use efficiency /productivity.	Yr 1-4	Feindel, D. (ICARDA) Haj Saleh, H. (Tun) Abail, Z. (Mor) Dekkich, N. (Alg)	Farmer participati on ensured for 4 years, no severe seasonal constraint	Promising crop and soil management options will be promoted
2.2.4	Test and validate decision tools/models for crop monitoring and risk management	Paper published on calibration, validation and testing of "APSIM" model involving scientists, extension workers and farmers for decision making and risk management Australian post-doc hired and posted in Tunisia for 2 yrs to adapt APSIM to NA conditions in collaboration with national scientists	Yr1-4	Sommer R (ICARDA) Moussadek, R. (Mor) BenHammouda, M. (Tun) Mudge, B. (Aust) Bouzarzour, H. (Alg)	Timely acquisition of APSIM software & training of national scientists	APSIM tool used by researchers and extension specialists to monitor crop response to management for risk forecasting

Objective 2. Identify and test improvements in seeding machinery, and in weed and biomass management of CA systems.

Sub-objective 2.3. Optimize crop residue management and livestock feeding under CA systems.

No.	Activity	Outputs/milestones	Due date of output/ milestone	Responsibility	Risks/ assumptio ns	Applications of outputs
2.3.1	Technical and economic assessment of trade-off between surface cover and animal productivity	Guidelines written and paper published on grazing trials with different levels of residue retention conducted with 3 farmers' flocks per platform -Above to incorporate technical and economic assessment of the trade-offs, including balanced crop-livestock integration and long-term	Yr 1-4	Nefzaoui (ICARDA) Feindel, D. (ICARDA) ElKoudrim, M. (Alg) Ben Salem, H. (Tun) Soukhal, D. (Alg) Mayfield, A. (Aust)	Farmer participatio n ensured for 4 years, no severe seasonal constraint	Disseminate results through target region, to ease pressure on stubble and reach a favourable compromise between crops and livestock

		positive effects on soil properties				
2.3.2	Develop and test alternative integrated feeding options (forage crops, alley-cropping, by-products)	-Guidelines and paper published on alternative feed resources, covering adapted forage species, alley-cropping and feed blocks tested at 3 farms per platform,	Yr1-4	Nefzaoui (ICARDA) Feindel, D. (ICARDA) ElKoudrim, M. (Alg) Ben Salem, H. (Tun) Soukhal, D. (Alg) Mayfield, A. (Aust)	Suitable feed crops and by-products available at reasonable cost	Introduce low-cost alternative feeds in target regions
2.3.3	Evaluate the profitability and productivity of integrated crop/livestock production systems under CA utilizing decision support and modelling tools	Paper published on identification, calibration-validation and use of an appropriate modelling tool for decision making and risk management at the farm level	Yr1-4	Thabet B (T) Dhehibi, B. (ICARDA) Nefzaoui, A. (ICARDA) Boughlala, M. (Mor)	Suitable modelling tool accessible	Researchers & extension specialists assist farmers in better crop-livestock integration using the tested model

Objective 3 To enhance the capacity of NARES staff and other stakeholders to practice and promote CA

Operational coordinator: Dr. Mohammed El Mourid (ICARDA)

No.	Activity	Outputs/ milestones	Due date of output/ milestone	Responsibility	Risks / assumptions	Applications of outputs
3.1	Raise awareness on CA system potential benefits and shortcomings among farmers, private sector including manufacturers, NGOs, and decision-makers	-3 country workshops completed with participation of all stakeholders: the first at project startup, the 2nd in mid-growing season through field visit, and the 3rd is a field visit at end of season. -informative leaflets disseminated and appropriate media events held	Yr 1 thru 4	El Mourid (ICARDA) Haj Saleh, H. (Tun) El Brahmi, E. (Mor) Zaghouane, O. (Alg)	Full participation of all invited stakeholders	Dissemination of CA expertise and advocacy at the country level
3.2	Conduct on-job training of all stakeholders (farmers, extension, traders, scientists, NGOs)	500 farmers, 100 extension staff, 25 scientists, 3 NGOs, and 2 traders trained per country	Yr 1 thru 4	Fortune J (Aus) Feindel, D. (ICARDA) Angar, H. (Tun) El Brahmi, E. (Mor) Houassine, D. (Alg)	Selection & participation of suitable trainees	Expertise in developing and promoting CA systems in the target region

3.3	Use Australian experience to upgrade national expertise in CA through scientific and technical support, and exchange of visits and training that focus on systems analysis of longer term outcomes of CA	Up to 15 scientists/extensionists/ farmers from the region visit Australia; and 7 Australian scientists visit the region for scientific and technical support NARS visit to Australia: Yr1: 3 Yr2: 6 Yr3: 3 Yr4: 3 Australian scientists to NA: Yr1: 5 Yr2: 5 Yr3: 3 Yr4: 5 One Australian post doc posted for 2 yrs in NA: Yr2 & Yr3	Yr 1-4	Fortune J (Aus) Desbioles, J. (Aust) Mudge, B. (Aust) Mayfield, A. (Aust) Gill, G. (Aust) El Mourid, M. (ICARDA)	Selection of suitable participants (NA) and availability of needed expertise (Aus)	Expertise in developing and promoting CA systems in the target region
3.4	Conduct farmer field schools to enhance stakeholder co-learning and farmer-to-farmer innovation	5 farmer field school events per platform and per year held - FFS1: ZT machinery and planting & crop establishment. -FFS2: IPM (weeds, diseases, insect pest) -FFS3: Crop & soil management , & risk management -FFS4: residue management & crop/livestock integration -FFS5: crop diversification & rotation	Yr 1-4	Gharras O. (Mor) Gargouri, S. (Tun) Mudge, B. (Aust) Feindel, D. (ICARDA) Ben Hammouda, M. (Tun)	Suitable lead farmers available - Assiduity of participants	Farmers expertise in CA implementation & dissemination

3.5	Enhance knowledge sharing and dissemination through brochures, newsletters, website and media	At least 5 brochures covering different subjects, one bi-annual regional project newsletter, and one project website produced and widely distributed	Yr1-4	Devlin M (ICARDA) Fortune, J. (Aust) Amrani, M. (Mor) Darid, M. (Mor) Mouelhi, B. (Tun)		Widespread CA knowledge and awareness in the NA region

3.6	Promote CA networking in the region aiming at establishing CA hub in North Africa	At least 3 NGOs/associations reinforced in CA area; one regional inception and one regional final workshop held; intra-regional visits exchanged involving 15 scientists/extension and 12 farmers -CA regional hub established in Tunisia (Yr3) - Participation of NARES from Libya, Mauritania and Sudan to project training & relevant meetings in project core countries (Algeria, Morocco, Tunisia) -Linkages established with other CA projects & initiatives in the MENA region	Yr1-4	El Mourid (ICARDA) Zaghouane, O. (Alg) Haj Saleh, H. (Tun) El Gharras, O. (Mor) Fortune, J. (Aust)	Peaceful environment for travel within and across countries. Available resources for network sustainability.	Widespread CA awareness, knowledge and expertise in the MENA region

5.3. Project personnel

ICARDA will be responsible for the overall coordination and management of the project, including technical and financial reporting. The governance of the project is assured through the following bodies: Project steering committee (PSC), technical coordination committee (TCC), project technical coordinator (PTC) appointed by ICARDA in consultation with Rural Solutions and ACIAR, NARP Regional Coordinator (NARP-RC), and project national coordinators (PNC), appointed by the respective countries..

The project steering committee (PSC) is composed of the President of IRESA from Tunisia, the DG of ITGC from Algeria, the DG of INRA Morocco, the DG of ICARDA, Rural Solutions Representative, and ACIAR Representative. The PSC meets once a year to review and approve the project progress and annual plan of work and budget, and makes adjustments as needed

The TCC is composed of (i) the three PNCs (one per partner country), (ii) ICARDA Project Technical Coordinator (PTC), (iii) Rural Solution representative and (iv) ICARDA/NARP Regional Coordinator (RC) who chairs the TCC. The TCC is responsible for compiling the annual plans of work and budget submitted by the PNCs; the progress reports as well annual technical and financial reports. The TCC is also responsible for monitoring and evaluation and organizes annual regional technical and planning meetings, steering committee meetings, mid-term and final external reviews, training and regional workshops. Project achievements and plan of work and budget are discussed during the annual regional technical and planning meetings organized at alternating sites in rotation through the three countries.

A regional research technical coordination and planning meeting will be held annually at alternating country locations in which representatives of all institutions collaborating in the program will review the results of the season's work and finalize plans for the following season.

Project monitoring and evaluation (M&E) will be performed by the TCC based on indicators and outputs/milestones from the log frame using M&E specific templates. The M&E templates are submitted by PNC to TCC together with progress and annual reports.

The annual budget is approved by the PSC based on the annual plan of work and budget submitted by TCC. Rural Solutions manages funds allocated to Australian partners. ICARDA manages funds allocated to NARS partners and ICARDA. National in-kind and funds contribution are managed by the respective NARS. Fund disbursement to NARS by ICARDA will follow ICARDA's rules and procedures. Procurement of capital equipment and regional and international training and workshops are handled by ICARDA Regional Office in Tunis.

In close collaboration with the PNCs, the PTC will undertake the following responsibilities:

- Prepare a detailed work plan for the entire duration of the project;
- Prepare detailed annual work plans to be approved by the project steering committee;
- Monitor the timely implementation of the project activities;
- Organize the recruitment of consultants and holding training events, workshops, seminars and other meetings;
- Manage and supervise the use of project funds;
- Report to the PSC on progress made;
- Prepare annual and final technical and financial reports.

5.4. List of participants involved in the project

Commissioned organisation: ICARDA

Name	Sex (m/f)	Agency and position	Discipline and role in project	Time input (%)	Funding
Mohamad El Mourid	M	ICARDA North Africa Regional Coordinator	Agronomist, project leader Objectives 1, 2 , 3	15	ACIAR 10% ICARDA 5%
TBA (Short list of 3 candidates will be shared with ACIAR for final selection)	F/M	ICARDA technical coordinator	Agronomist with 10 years of experience in CA related research with proficiency in English and French (Follow-up of project activities with NARES, reporting and publication, organizing meetings & trainings, procurements of project inputs, monitoring & evaluation of the project) Objectives 1, 2, 3	100	ACIAR-ICARDA
David Feindel,	M	ICARDA Senior scientist	Agronomist (Implement in collaboration with NARES activities on crop rotations) Objectives 2, 3	15	ACIAR 5% ICARDA 10%
Ali Nefzaoui	M	ICARDA Senior scientist	Livestock and rangeland, crop/livestock integration (Implement in collaboration with NARES activities related to crop residues management and livestock feeding, forage production, CA adoption, training of stakeholders) Objectives 2, 3	15	ACIAR
Rolf Summer	M	ICARDA Senior scientist	Soil scientist (testing and validation of APSIM and other models) Objectives 2, 3	10% (in years 3 & 4)	ACIAR
Michael Devlin	M	ICARDA Communication specialist	Communication (website, news letter, brochures, media) Objective 3	10	ACIAR 5% ICARDA 5%
Boubaker Dhibi	M	ICARDA socio-economist	Adoption and impact studies Objective 1	15	ACIAR
Rachid Serraj	M	ICARDA scientist		5%	ICARDA
Aden Aw Hassan	M	ICARDA scientist		5%	ICARDA

Australian organisation: Rural Solutions SA

Name	Sex (m/f)	Agency and position	Discipline and role in project	Time input (%)	Funding
Dr Jim Fortune	M	Rural Solutions SA	Extension and adoption evaluation Objectives 1, 3	30	ACIAR 15% RSSA 15%
Mr Barry Mudge	M	Rural Solutions SA	Crop monitoring & WUE, risk management Objectives 2, 3	20	ACIAR 10% RSSA 10%
Dr Alan Mayfield	M	Rural Solutions SA	Crop Rotation and disease management Objective 3	20	ACIAR 10% RSSA 10%
TBA, Australian visiting scientists	F/M	Rural Solutions SA	Modelling Objectives 2, 3	8	% (not in budget)
Dr Jack Desbiolles	M	Senior Researcher, University of South Australia	CA Machinery expertise Objectives 2, 3	20	ACIAR 10% RSSA 10%
Dr Gurjeet Gill	M	Associate Professor, University of Adelaide	Integrated Weed management under CA systems Objectives 2, 3	20	ACIAR 10% RSSA 10%
TBA – post-doc	F/M	AU	Modelling Objective 2	100, from year 2	ACIAR
TBA – junio r scientist	F/M	AU	Adoption/socio-economics	100 for years 2 & 3	ACIAR

NARS core-teams: Morocco

Name	Sex (m/f)	Agency and position	Discipline and role in project	Time input (%)	Funding
Oussama El Gharras	M	INRA, scientist	National Coordinator and Machinery. Design & test ZT seeder Objectives 1, 2, 3	100	INRA
M. ElKoudrim	M	INRA scientist	Livestock production. Residues management and animal feeding systems Objectives 2, 3	35	INRA
M. Boughlala	M	INRA, Head of agro-economic research unit	Socio-economic and policy studies. Adoption and impact studies Objective 1	35	INRA
Hayat Liomboui	F	INRA scientist	Socio-economic, adoption and impact studies	30	INRA

Bouchra Amiri	F	INRA, scientist	Livestock production. Alternative feed resources Objective 2	25	INRA
Zhor Abail	F	INRA, scientist	Soil scientist. Soil management & fertilization Objective 2	20	INRA
Oumaima Iben Halima	F	INRA, scientist	Soil scientists. Soil management & fertilization Objective 2	20	INRA
Brahim El Yousfi	M	INRA, scientist	Plant pathologist. Integrated disease management Objective 2	15	INRA
Bader Hajjaj	M	INRA, scientist	Weed scientist. Integrated weed management. Objective 2	15	INRA
Rachid Mossadeq	M	INRA, scientist	Soil scientist. Crop-soil modelling Objective 2	20	INRA
Darid Mustapha	M	INRA specialist	Communication and Documentation, Head Objectives 1, 3	20	INRA
El Hassan Bourarach	M	IAV Morocco	Ag-engineer. Machinery design, advising students and linkages with Australian universities Objective 2, 3	20	IAV
Azzeddine El **Brahli**	M	AGENDA Morocco, NGO	Agronomist. Farmer, President of AGENDA, NGO. Transfer of technology and dissemination Objective 1, 3	25	AGEND A
Rachid Mrabet				10	Morocco
Mohamed El Asri				10	Morocco
Ahmed Bouaziz				10	Morocco
Hakima Bahri				10	Morocco
Abderrahim Ben Taibi				10	Morocco
Abdelwahed El Balghithi				10	Morocco

NARS core-teams: Tunisia

Name	**Sex** (m/f)	**Agency and position**	**Discipline and role in project**	**Time input (%)**	**Funding**
Halim Ben Haj Salah	M	INGC, scientist/ Director	Agronomist. Project management and coordination Objectibves 1, 2, 3	90	MOA

Hayet Maaroufi	F	INGC, scientist	Ag-economist; Adoption & impact studies Objective 1	40	MOA
Rajae Nabli	F	INGC scientist	Socio-economic, adoption & impact studies Objective 1	30	MOA
Dorsaf Hlel	F	INGC, scientist	Agronomist. Baseline surveys and data base Objective 1	40	MOA
Mohamed Jadlaoui	M	INGC, scientist	Ag-engineer. ZT seeder design & testing Objective 2, 3	35	MOA
Mohammed Ali Hannachi	M	INGC, scientist	Ag-engineer. ZT seeder design & testing Objective 2	30	MOA
Houcine Angar	M	INGC, scientist	Agronomist. On-farm trials and transfer of technology Objective 1, 2, 3	30	MOA
Bassam Mouelhi	M	INGC specialist	Information, Communication and Documentation, Head Objectives 1, 3	25	MOA
Moncef Ben Hammouda	M	ESAK, scientist	Agronomist. Crop monitoring and crop rotation; coordination with universities Objective 2, 3	20	MOA
Hassan Kharoubi	M	ESIER, scientist	Ag-engineer. ZT machinery testing Objective 2, 3	30	MOA
Boubaker Thabet	M	INAT, scientist	Ag. Economics. Policy and institution, economic modelling, advising students and linkages with Australian universities Objective 1, 3	25	MOA
Nadira Ben Aissa	F	INAT, scientist	Soil scientist. Soil quality assessment and monitoring, crop rotation Objective 2	20	MOA
Hichem Ben Salem	M	INRAT, Scientist	Animal scientist. Livestock feeding, alternative feed resources Objective 2, 3	15	MOA
Mohammed Annabi	M	INRAT, Scientist	Environmental Scientist. Soil erosion assessment and monitoring Objective 2	20	MOA
Salah Ben Youssed	M	INRAT, Scientist	Agronomist. Forage production and crop rotation Objective 2	20	MOA
Hatem Bechikh	M	INRAT, Scientist	Agronomist. Crop monitoring and rotation Objective 2	20	MOA

Samia Gargouri	F	INRAT, Scientist	Plant pathologist. Integrated disease management Objective 2	10	MOA
Leith Ben Bechr	M	APAD, NGO	Farmer and president of APAD, NGO. Technology transfer and dissemination Objective 1, 3	10	APAD
Amina Baccouri	F	APAD, NGO	Farmer and vice-president of APAD, NGO. Technology transfer and dissemination Objective 1, 3	10	APAD

NARS core-teams: Algeria

Name	Sex (m/f)	Agency and position	Discipline and role in project	Time input (%)	Funding
Omar Zaghouane	M	ITGC scientist/ Director	Agronomist, Director ITGC. Administrative coordination Objective 1, 2, 3	10	MOA
Djamel Houassine	M	ITGC scientist	Project coordinator. Agronomist. Crop monitoring and rotation Objective 1, 2, 3	100	MOA
Nacera Dekkiche	F	ITGC scientist	Soil scientist. Soil assessment and monitoring Objective 2	30	MOA
Youcef Ghalem	M	ITGC scientist	Ag-engineer. ZT seeder design and testing Objective 2, 3	30	MOA
Kahina Imessouadène	F	ITGC scientist	Socio-economics. Adoption and impact assessment Objective 1	50	MOA
Farida Djenadi	F	ITGC scientist	Agronomist. Crop monitoring	25	MOA
Abdelmalek Laouer	M	ITGC scientist	Agronomist. On-farm trials and dissemination Objective 2	20	MOA
Ratiba Amrani	F	ITGC specialist	Communication and Documentation, Head of Dpt Objectives 1, 3.	25	MOA
Mohammed Amrani	M	ITGC specialist	Design & editing specialist Objective 1, 3	25	MOA
Zahia Rahim	F	INPV scientist	Plant pathologist. Integrated disease management Objective 2	20	MOA
Said Mahnane	M	Trait d'Union, NGO	Socio-economics and transfer of technology. Objective 1, 3	20	Trait d'Union
Ali Achouri	M	Trait d'Union, NGO	Farmer and President of Trait d'Union, NGO Objective 1, 3	10	Trait d'Union
Wassila Harrad	F	PMAT	Private entrepreneur Manufacture of ZT seeder Objective 2, 3	10	MOA

Hamena Bouzerzour	M	University Setif, scientist	Agronomist. Crop monitoring, advising students and linkages with universities Objective 2, 3	10	MOA
Djamel Soukhal	M	HCDS, scientist	Rangeland & livestock specialist. Residue management and alternative feed resources Objective 2, 3	25	MOA
Lakhdar Broumi	M	HCDS, scientist	Rangeland & livestock specialist. Residue management and alternative feed resources Objective 2, 3	20	MOA
Khalid Abbas	M	INRAA scientist	Agronomist. Integrated weed management Objective 2	20	MOA
Farid Gassem	M	INSID scientist	Soil & water scientist. Soil moisture assessment and monitoring Objective 2	25	MOA

Summary table FTE

Objectives	Obj 1	Obj 2	Obj 3	Management
FTE	4.4	7.2	3.6	0.5

5.5. Description of comparative advantage of the institutions involved

ICARDA has a long experience in working in win-win partnership with North Africa NARES for more than 30 years. It has implemented CA programmes throughout North Africa, West and Central Asia; moreover ICARDA implemented successfully an ACIAR funded CA project in Iraq and Syria with spill over in North Africa.

Rural Solutions has a strong expertise in helping Australian farmers to manage, field crops sustainably; they provide on-site business and technical advice- plus courses, benchmarking analysis and crop report. Rural Solutions has experience in working abroad in Asia and Africa. They will bring the successful Australian experience and know-how to North Africa region.

Australian universities will provide scientific expertise and training through scientific short visits, exchange of students and scientists with North African universities to promote long-term linkages and sustainable partnership.

NARES focal institutions are the core agricultural research bodies in Algeria, Morocco and Tunisia. They have been collaborating with ICARDA since late 70s. Moreover, they have a good experience in field research on different aspects of CA, technology transfer and relationship with extension and farmers. They have developed fair experience in CA and will provide infrastructure, equipment and financial contributions.

5.6. Summary details of the role of each participant involved

The role of each scientist involved in the project is indicated in Tables (column "Discipline and role in project") under section 5.4.

The role of each institution is summarised in the following table.

Institution	Role in the project
ICARDA	Coordination, management, research, training, workshops, dissemination and communication, technical and financial reporting
Rural Solutions SA	Coordination of the Australian partners, research, training, communication
INRA, Morocco	Coordination of the Moroccan research team, research, technology transfer, country reporting
IAV Hassan II, Morocco	Research, linkage with universities
ADA (Green Morocco), Morocco	Policy support, dissemination
AGENDA (NGO), Morocco	Dissemination, technology transfer and farmers organisation
IRESA, Tunisia	Overall coordination of the Tunisian team
INGC, Tunisia	Research, technology transfer and extension, coordination and country reporting
ESA Kef, Tunisia	Research, technology transfer, linkage with universities
INAT, Tunisia	Research, linkage with universities
ESIER, Tunisia	Research in machinery, linkage with universities
INRAT, Tunisia	Research and technology transfer
APAD (NGO), Tunisia	Technology transfer, dissemination and farmers organisation
ITGC, Algeria	Coordination of the Algerian team, research, technology transfer and country reporting
INPV, Algeria	Research and transfer of technology
HCDS, Algeria	Research and transfer of technology
INRAA, Algeria	Research
University of Setif	Research, linkage with universities
Association Trait d’Union (NGO), Algeria	Technology transfer, dissemination and farmers organisation

6. Intellectual property and other regulatory compliance

The overall objective of the Intellectual Property provisions will be to optimise the availability of IP for the use of smallholder farmers in Maghreb countries, and to minimise the chances of appropriation by other parties to the exclusion of the smallholder clients of both ACIAR and ICARDA. Results obtained through collaborative research shall be published under the name of collaborating parties. All inventions, improvements, original works and/or discoveries, which are conceived during this project by one or more collaborators of either party will remain their property, which will have the right to seek intellectual property protection.

Each party would grant the other party the right to use such inventions, improvements, original works and/or discoveries internally for research purpose only. Each party would grant all partners in the national agricultural research systems of collaborating countries the rights to such inventions, improvements, original works and/or discoveries internally for the benefit of their smallholder farmers, but not for commercialisation of the IP. Each party will not transfer to third parties or sell or commercialize in any form the intellectual property conceived or made during this collaborative project without prior written approval of all parties. These IP provisions will be applied in a way consistent with the ACIAR Project Agreement.

Project ID	CSE/2011/025
Project title	Adapting conservation agriculture for rapid adoption by smallholder farmers in northern Africa
Assessment provider	Mohamed El Mourid
If not Australian project leader, provide title	Regional Coordinator, northern Africa conservation agriculture
Date of assessment	16/06/2012

Plant or animal germplasm exchange

Does the project involve:	**Yes**	**No**
provision of germplasm by Australia to a partner country?	x	
provision of germplasm from a partner country to Australia?		x
provision of germplasm from or to an IARC or another organisation and a project participant?	x	
use of germplasm from a third party		x
material subject to plant breeders/variety rights in Australia or another country?	x	

If "yes" to any of the above, for each applicable country provide brief details of the material to be exchanged: canola varieties from Australia; legume germplasm from ICARDA

If the germplasm exchange can be finalised before the project commencement, provide a Materials Transfer Agreement.

If the specific germplasm to be exchanged cannot be identified until after project commencement, indicate the type of material likely to be exchanged.

Country	**Details of plant or animal germplasm exchange**
Algeria, Morocco, Tunisia	Germplasm of cereal (wheat, barley, oats) and pulse and forage legumes (chickpea, lentil, faba bean, pea) from ICARDA's crop improvement programs or between the three target countries

Proprietary materials, techniques and information

Does the project involve provision (from one party to another) of:	**Yes**	**No**
research materials or reagents (e.g. enzymes, molecular markers, promoters)?		x
proprietary techniques or procedures?		x
proprietary computer software?		x

Other agreements

Is any aspect of the project work subject to, or dependent upon:	**Yes**	**No**
other materials-transfer agreements entered into by any project participant?		x
confidentiality agreements entered into by any project participant?		x

Foreground, background and third party Intellectual Property

This includes, but is not limited to patents held or applied for in Australia and/or in partner countries and/or in third countries. For example, Foreground IP includes any new germplasm, reagents (such as vectors, probes, antibodies, vaccines) or software that will be developed by the project.

Foreground IP (IP that is expected to be developed during the project)

Ownership of or rights to Foreground IP other than as detailed in the ACIAR Standard Conditions must be approved by ACIAR.

	Yes	**No**
Is it expected that there will be Foreground IP?	x	

If "yes",

for each applicable country provide brief details of the IP and who will have rights to use the IP (e.g. Commissioned Organisation, Australian collaborating organisation/s partner countries).

If a patent, give details of patent status (provisional, application, granted), priority date and designated countries.

Country	Details of foreground IP
Algeria, Morocco, Tunisia, Australia	Design for zero tillage equipment. Full rights. Rights for Commissioned Organisation and Australian Organisations for research purposes only

Background IP (IP that is necessary for the success of the project but that has already been created and is owned by parties to the project)

Any agreements in place regarding Background IP should be provided to ACIAR prior to project commencement.

	Yes	No
Is it there Background IP?	x	
If "yes", are there any restrictions on the project's ability to use the Background IP?		x
would there be any restriction on ACIAR or the overseas collaborator claiming their rights to IP for the project based on the Background IP (refer ACIAR Standard Conditions)?		x

If "yes", for each applicable country provide brief details of:

the source of the Background IP.

whether the Commissioned Organisation and/or Australian collaborators and/or developing country collaborators own it.

any conditions or restrictions on its use.

Country	Details of background IP
Commissioned Organisation	Germplasm: subject to SMTA
Commissioned Organisation	Local ZT seeders: subject to acknowledgment of collaborative contributions of donors and partners

Third Party IP (IP that is owned by or licensed from other parties)

Agreements governing the use of third party IP can be related to research materials, research equipment or machinery, techniques or processes, software, information and databases.

	Yes	No
Is there any relevant Third Party IP that is essential to the project?		x
If "yes", would there be any restriction on ACIAR claiming its rights to IP for the project (refer ACIAR Standard Conditions)?		

Other contracts, licences or legal arrangements

	Yes	No
Are there any other contracts, licences or other legal arrangements that relate to the project?		x

7. References

Abdelhafidh H., H. Nhaili, L. Zaibet, M. Benhammouda. 2011. Journal of earth science and engineering. Volume 1. Number 1. pp:9-17

Angar, H.; Ben Haj Salah, H. & Ben-Hammouda, M. 2010. Semis Direct et Semis Conventionnel en Tunisie: Les Résultats Agronomiques de 10 Ans de Comparaison. *Actes des 4e Rencontres Méditerranéennes du Semis Direc*t, pp. 9-13, ISSN. 1111-1992, Sétif, Algérie, 3-5 Mai 2010

Bruggeman, A, Ouessar, R. H. Mohtar (eds) 2008 Watershed Management in Dry Areas, Challenges and Opportunities, ICARDA Aleppo.

Buck, L.E. and Scherr, S.J. 2009. Building Innovation Systems for Managing Complex Landscapes. p.164-186. *In* K.M. Moore (Ed.) The Sciences and Art of Adaptive Management: Innovating for Sustainable Agriculture and Natural Resource Management. Soil and Water Conservation Society. Ankeny, Iowa. ISBN 978-0-9769432-7-3.

Heng, L.K., Asseng, S., Mejahed,K, &Rusan, M. (2007) Optimizing wheat productivity in two rain-fed environments of the West Asia-North Africa region using a simulation model. European J Agronomy 26: 121-29.

ICARDA. 2012. Conservation agriculture : opportunities for intensified farming and environmental conservation in dry areas.*Research to Action 2*. ICARDA, Aleppo, Syria.

IPCC. (2007). Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II, and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds)]. IPCC, Geneva, Switzerland

Kassam, A., Friedrich, T., Derpsch, R., Lahmar, R., Mrabet, R., Basch, G., Gonzales-Sanchez, E. J., and Serraj, R. 2012. Conservation agriculture in the dry Mediterranean climate. Field Crops Res. (2012). Doi: 10.1016/j.fcr.2012.02.023.

Mrabet, R.; 2011. No-tillage agriculture in West Asia and North Africa. In P. Tow et al. (eds.) Rainfed farming systems. 1015-1042. DOI 10.007/978-1-4030-9132-2-40.

Nefzaoui, A., Ketata, H. and El Mourid, M. 2011. Agricultural Technological and Institutional Innovations for Enhanced Adaptation to Environmental Change in North Africa. In: Eds. Stephen S. Young and Dr. Steven E. Silvern “International Perspectives on Global Environmental Change”. ISBN 978-953-307-815-1

Nouralla A., Ed., (2008) Kingdom of Morocco Country strategic opportunities program, IFAD Public document (unpublished)

Oliver, Y.M., Robertson, M.J., Stone, P.J., Whitbread, A.M. (2009) Improving estimates of water-limited yield of wheat by accounting for soil type and within-season rainfall. Crop and pasture Science 60, 1137-1146.

Sadras V., Angus J., (2006) Benchmarking water use efficiency of rainfed wheat in dry environments, Australian Journal of Agricultural Research, V57, pp 847-856.

Tenywa,M.M. , Rao, KPC.,Tukahirwa, J.B., Buruchara, R, Adekunlu, A.A., Mugabe, I., Wanjiku, C., Mutabazi, S., Fungu, B., Kashaija, N.I.M., Pali, P., Mapatano, S., Ngaboyisonga, C., Farrow, A., Njuki, J. and Abenakyo, A. 2011. Agricultural Innovation Platform as a Tool for DEvelopment Oriented Research : Lessons and Challenges in the Formation and Operationalization. Learning Publics Journal of Agriculture and Environmental Studies, Vol 2(1). 117-146.

The World Bank. 2011. Agricultural Innovation Systems: An Investment Sourcebook. Overview. 20pp. Washington, DC.

8. Additional notes on CA

KNOWLEDGE MANAGEMENT - The unique features of considering CA systems in new environments

This section provides some broad insights into why the unique aspects of each environment need to be considered when building a vision for the application of CA.

It is complex

While it is complex, CA can be rewarding and motivating, and we know from experience that it delivers outcomes. CA includes elements of cultivation, mechanisation, weed management, crop rotations, agricultural systems, environmental management, and learning and capacity building across a range of stakeholders. From an agronomic and farm business perspective, it will also involve impacts and management decisions over a range of time scales (this crop, next year's crop, investment in machinery).

There is a high degree of connectivity and interdependence

CA and its adoption require acknowledgement and evaluation of a wide range of interactions that can occur in making decisions about optimum solutions for crop establishment and management in a given environment. Experience has also shown that many factors will change over time as new developments arise in for example machinery, herbicides, crop varieties and these interact with considerations of costs. Increasingly these complexities are being addressed and supported with a range of computer models in an attempt to test the enormous range of options that arise.

The demographics of the population serviced differ widely

CA has been adopted in many countries and regions around the world. The people involved in this process will vary widely in their practical and technical knowledge, attitudes to risk, and communications networks. As CA is a whole systems approach a strong understanding of local farmers and their needs will always be essential in designing programs to facilitate change.

The stakeholders differ across locations

CA has a wide array of stakeholders (actors) in all of the environments where it has been extensively adopted. In some cases the inputs are technical (crop agronomy, weed and pest management, mechanisation), in some cases they are about group participation (on-farm trials, field days, farmer field schools) and in others about services (public and private advisors, financial institutions).

CA does not have a set of standards for all circumstances

Modern CA (about last 40 years) has clearly demonstrated that while there are many overlapping principles for success, there is no simple blue-print at the local level. This underpins the need to develop a deep understanding of local systems. In this way the unique local issues can be addressed based on the broader international experience, but guided by the prevailing environment.

Local innovation is important to understanding and prediction (risk management)

Any agricultural system that makes simultaneous demands on plant, soil, water and possibly livestock interactions will have evolved to meet local challenges. The adoption of CA will need to be tested and adapted to meet local conditions so that farmers can fully understand changes that can occur and how to manage risk. In developing countries it is also important to recognise that farmers may face significant challenges due to restricted access to equipment and inputs. In some cases they may, for example, delay planting because they have to sell labour to others to earn money for the purchase of inputs.

Success may be measured in different ways

Success can be measured as economic, social, cultural and environmental outcomes. In many cases the primary driver for CA has been soil degradation, particularly erosion, but the value it has delivered in many environments comes quite directly from improved crop profitability, more robust production system and improving soil resources. In developing countries the advantage may be measured by extent of communal activity where both production and trade of agricultural goods can both be improved through participatory activities.

Additional Background material

North Africa is typically a dry region. Four subregions can be distinguished:

- Subhumid coastal region: ≥ 500 mm rainfall, relatively good soils,
- Semiarid elevated region: flanking the first region from the south: 300-500 mm rainfall, light soils, calcareous silt loam,
- Arid, lower altitude region: 100-300 mm rainfall, silt-sandy soils,
- Sahara desert region.

The average per capita share of freshwater resources is less than 1000 m^3 (Table1).

Table 1. Selected agricultural characteristics for three North African countries

Characteristic	Algeria	Morocco	Tunisia
Population (million)	34.4	31.6	10.2
Total area (million ha)	238.1	71.02	16.36
Cultivated area (million ha)	8.4	8.99	5.04
Contribution of agriculture to GDP (%)	8	17	10
Rural population (% total population)	35	44	33
Employment in agriculture (% total employment)	14	45	18
Irrigated area (% cultivated area)	6.9	16.6	8.0
Total annual renewable water resources (km^3)	11.67	29	4.6
Annual per capita renewable water resources (m^3)	339.5	917.5	451.9
Wheat self-sufficiency (%)	29	58	50

Conservation agriculture (CA) was introduced about 30 years ago in Morocco and Tunisia, where it now covers 6,000 ha and 12,000 ha, respectively. Algeria's work on CA started only 7 years ago and is currently gaining momentum, covering about 5000 ha. In addition to the obvious benefits of reduced labour and energy cost, and some yield advantage (generally realized a few years from the start), the most striking effects of CA in semi-arid regions of North Africa is the reduced erosion, especially in sloping areas. CA also provides flexibility in terms of field crop management, allowing timely planting and input application, despite unfavourable field conditions that do prevent such operations in conventional agriculture (e.g. planting in wet soil). CA prevents soil ploughing which has been identified as a major cause for the loss of soil organic matter, and a subsequent drop in soil fertility, not to mention the release of the greenhouse gas CO_2. Furthermore, cover crops, residues and crop roots contribute to better soil structure and composition with enhanced build-up of organic matter, while crop residues protect the soil and minimize soil evaporation. CA therefore contributes both to climate change (CC) mitigation through reduced GHG emissions and enhanced C sequestration, and to adaptation through soil water retention and infiltration, and increased water use efficiency. Therefore, CA is an effective technology to conserve natural resources while minimizing the effect of drought on crop production, ultimately contributing to better food security in North Africa.

However, the viability of CA is seriously challenged when livestock is a vital component of the cropping system, as is the case in North Africa. This may for example comprise top-soil compaction caused by excessive animal grazing during the wet season. Much more important however is the competition for crop residues; on the one hand vital to provide the above-mentioned beneficial effect of CA (soil erosion protection, water conservation, C-sequestration), on the other hand, they are much needed as fodder resources during the dry season. In such a situation, partial stubble grazing could offer a compromise. Results in Tunisia indeed show beneficial effects of CA (improved soil organic matter, better soil infiltration, higher wheat yield) despite the low amount of crop residues (1-2 t/ha).Another solution maybe the adoption of some sort of compensation payments to farmers for environmental services and sustainability of natural resources that will help farmers secure alternative feed resources for the dry season.

Other challenges to CA adoption in North Africa are (a) high weed infestation at the initial stage of CA adoption, and (b) the unavailability of suitable CA-ready seeders. In fact, the adoption of no-till (NT) technology in Tunisia is limited to farms of size ≥100 ha, where farmers could afford a high investment for the purchase of NT equipment. ICARDA and collaborating partners are pursuing efforts in North Africa to promote local manufacturing of low-cost NT drills, which will expand CA adoption to small- and medium-scale farmers who represent the majority of North African farmers.

9. List of appendices

1. Budget template
2. Support letters
3. CVs of project team members