Australian Government

Australian Centre for International Agricultural Research

Project proposal

project

Development of conservation cropping systems in the drylands of northern Iraq

project number	CIM/2008/027
proposal phase	Full Proposal for Extension
prepared by	Dr Colin Piggin International Center for Agricultural Research in the Dry Areas (ICARDA)
research program manager	Dr Paul Fox

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Contents

1 Project outline

Project number	CIM/2008/027
Project title	Development of conservation cropping systems in the drylands of northern Iraq
ACIAR program area	Crop improvement and management
Proposal stage	Full proposal
Commissioned organisation	International Center for Agricultural Research in the Dry Areas
Project type	Large
Geographic region(s)	Middle East
Country(s)	Iraq
Project duration	Three years
Proposed start date	1 July 2012
Proposed finish date	30 June 2015
Time to impact	Category 1

1.1 Funding request

		Amounts	Totals
Year 1 (F/Y)	Pay 1	2,548,176	3,775,150
	Pay 2	1,226,974	
Year 2 (F/Y)	Pay 3	1,751,196	2,730,238
	Pay 4	979,042	
Year 3 (F/Y)	Pay 5	1,584,754	2,394,615
	Pay 6	809,861	
Year 4 (F/Y)	Pay 7		
	Pay 8		
Year 5 (F/Y)	Pay 9		
	Pay 10		
Year 6 (F/Y)	Pay 11		
	Pay 12		
Total		8,900,003	8,900,003

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1.3 Project summary

The project builds upon two consecutive projects which were funded by ACIAR and AusAID to improve the productivity and sustainability of crop production in the drylands of northern Iraq. The first project CIM/2004/024: *Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq,* ran from July 2005 to June 2008; and the second project CIM/2008/027 *Development of conservation cropping systems in the drylands of northern Iraq* commenced in July 2008 to June 2012.

The project will be an extension of CIM/2008/027. It will be led by the International Center for Agricultural Research in the Dry Areas (ICARDA) in Syria and coordinated in Iraq through the University of Mosul (UniMosul) and the Ministry of Agriculture (MOA). Field activities in northern Iraq will be implemented by the Universities of Mosul, Anbar and Kirkuk, the Directorates of Agriculture (DOA) in Ninevah, Kirkuk, Salahahdin and Anbar, and the State Board of Agricultural Research (SBAR) in Baghdad and Ninevah. Australian training and research support will be provided by The University of Western Australia (UniWA) and the University of Adelaide (UniAdelaide).

Project CIM/2008/027 has been highly successful in demonstrating in Ninevah that productivity and profitability of crops in the drylands of northern Iraq can be increased by the application of conservation cropping technologies involving zero-tillage (ZT), stubble mulching, improved crop cultivars and better crop management. Additional long-term benefits of conservation cropping include improved soil structure and reduced soil erosion. Adoption of ZT by farmers in Iraq has increased from a zero base in 2005/06 to approximately 6000 hectares in 2010/11.

The project extension aims to consolidate the research and development conducted over the past six years and promote wider adoption of conservation cropping practices by farmers in Ninevah. Extension and research staff from different institutions in surrounding governorates (Kirkuk, Salahahdin, Anbar) will also develop experience and expertise and promote uptake of conservation cropping. Collaborating organisations in Australia (UniWA, UniAdelaide) will undertake research in Australia and contribute conservation cropping knowledge, experience and expertise to Iraqi collaborators through participation in project reporting/planning meetings and Iraqi study visits and postgraduate training in Australia.

The project extension will:

1. Promote ZT technology widely in Ninevah and also into surrounding governorates (Kirkuk, Salahahdin, Anbar) where dryland crops are prominent, through demonstrations, extension, research and training. This will require support for local capacities to produce and market ZT seeders.
2. Develop an in-depth research program on conservation cropping, with collaborative, multi-site research in Ninevah, ICARDA, South Australia and Western Australia. Research themes linked to the change from cultivated to ZT systems will focus on some/all of the following: agronomy, rotations, residues, crop-livestock interaction, pest-disease-weed dynamics and control, soil fertility-structure-biology dynamics and management and germplasm adaptation. This program will support the development of Ninevah as a centre of excellence in conservation cropping.
3. Develop and promote efficient and sustainable farmer-based seed production. Together with development of formal variety release systems, this will increase farmer access to and uptake of well-adapted crop varieties.
4. Evaluate adoption and impact of project technologies (especially ZT and improved varieties) through socio-economic surveying and evaluation.
5. Provide capacity development and training of Iraqi scientists in Mosul, ICARDA and Australia, including on-going support for six postgraduate trainees currently at The

UniWA and UniAdelaide. This will require re-evaluation of supporting funding to ensure trainees complete their postgraduate degrees.

2 Justification

2.1 Partner country and Australian research and development issues and priorities

2.1.1 Project progress

This extension to CIM/2008/027 is to build on the very promising progress made in the final two years of the project (2009/10 and 2010/11), following the severe drought of 2008/09. Much of the justification for the original project detailed in the Project Document remains valid.

The project has made great strides in Ninevah verifying and adapting conservation cropping, overcoming the main constraint of availability of ZT seeders, raising awareness and experience of ZT technology, and promoting adoption of ZT by farmers. There have been similar spillovers to Syria, where ICARDA has been conducting a parallel development and promotion program to verify and adapt ZT systems and provide working examples for visiting Iraqi trainees.

Some highlights of this progress in Ninevah were:

1) Long-term demonstrations in 12 districts evaluating production of barley, bread wheat and durum wheat under ZT and conventional cultivation (CC) systems with early/late planting and high/low seed rates, which have clearly shown possibilities for increased yields, profitability and sustainability from well-managed conservation cropping.

2) Field days and visits at these Ninevah demonstrations which have exposed and demonstrated ZT systems, new varieties, and promising new oat and pea crop introductions widely to farmers in Ninevah and, just recently, to the surrounding governorates of Anbar, Salahadin and Kirkuk.

3) Development and fabrication of effective local ZT seeders by a Ninevah farmer group together with a local engineering works. This has resulted in the development of affordable (US$1250) ZT modification kits for local John Shearer-type seeders and the modification of 20 farmer seeders. A prototype 2.3 m ZT seeder was also developed and tested for use by small farmers.

4) A very encouraging 6000 ha of ZT crops grown by 54 farmers in Ninevah in 2010/11 (Figure 2.1.1). About 80% of this area was actual adoption by farmers using their own or a rented/borrowed ZT seeder. Most farmers were impressed with the better crop performance, reduced costs and time savings with the ZT system.

Highlights of linked research, participatory extension and training in Syria were:

1) Participatory extension program in 11 locations where ZT seeders were made available without payment or charge for farmers to experience and evaluate ZT on their own farms. Many farmers have been impressed with the increased yields, reduced costs, simplicity and sustainability of the ZT system.

2) Development of effective and affordable ZT seeders in collaboration with seven local engineering works across the northern cropping area, which is providing diversity and multiple locations for purchase and maintenance for Syrian and Iraqi farmers and projects. Between 2008 and mid-2011, Syrian manufacturers made ~65 ZT seeders for local and regional clients.

3) About 15,000 ha of ZT crops grown by 350 farmers in 2010/11 (Figure 2.1.1). About 70% of this area was actual adoption by farmers using their own or a rented or borrowed ZT seeder. The rest was sown with local ZT seeders provided without charge by ICARDA, Aga Khan Foundation and Aleppo Agricultural Machinery Center.

Most farmers were pleased and impressed with the increased yields, reduced costs and time savings with the ZT crops.

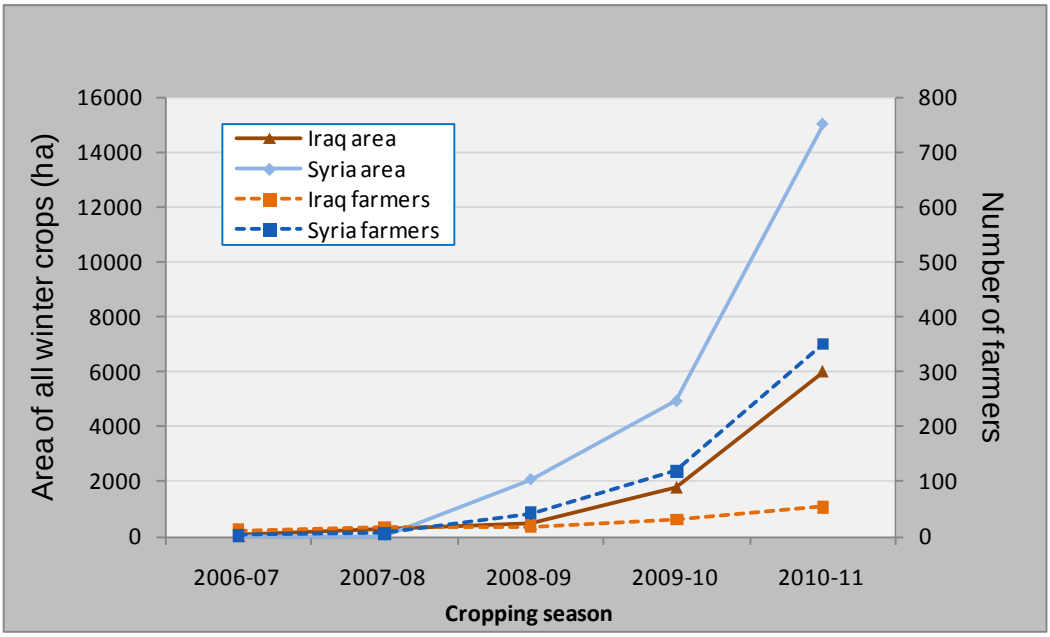

Figure 2.1.1 Area (ha) and number of farmers using zero tillage in Iraq and Syria between 2006 and 2011 under the ACIAR Iraq project.

There has also been good progress with:

1) Development of farmer-based seed production in Ninevah.

   In 2010/11, 21 farmer seed growers with access to irrigation harvested >1800 t of bread wheat, durum wheat and barley seed. This exceeds the 2011 project target of nine Village Based Seed Enterprise (VBSE) groups producing 100 t of seed, and provides an excellent foundation to proceed with local seed production of promising new varieties identified in the project, and make them widely available to farmers.

2) Socio-economic evaluation of adoption and impact of project technologies in Ninevah and Syria.

   Better seasons in 2009/10 and 2010/11 and increasing interest and uptake of ZT systems have provided the opportunity to evaluate adoption and impact of project technologies, and technical and financial aspects of farmer seed production. Socio-economic surveying was undertaken during 2009–11, providing a base for these studies in the project extension.

3) Training of scientists and farmers from Iraq and Syria, and others from the region, in conservation cropping related technologies and expertise.

   Training at ICARDA has been extensive, with 180 Iraqi and 69 Syrian scientists and farmers, plus 28 other scientists from ICARDA and the region attending 29 training events (Table 2.1.1), with an emphasis on project-related skills and technologies related to conservation cropping in the areas of agronomy, breeding, participatory extension, ZT seeder fabrication and operation, experimental statistics, GIS/remote sensing, socio-economics and seed production. This has built an understanding and capacity important to the successful implementation of the project and for further development of conservation cropping in Iraq, Syria and the region.

	2008-09 11 courses	2009-10 12 courses	2010-11 6 courses	Total 29 courses
Iraq scientists	58	47	38	143
Iraq farmers	14	18	5	37
Syrian scientists	12	14	10	36
Syrian farmers	10	14	9	33
ICARDA	2	10	9	21
Others		2	5	7
Total	96	105	76	277

Table 2.1.1 Number of courses and participants in project training at ICARDA.

The Australian training program has also been extensive: 18 Iraqis and two Syrians visited Australia for 2–6 month study visits (12 Iraqis, two Syrians) and long-term postgraduate study (4 MSc, 2 PhD). The postgraduate training was delayed by nomination and approval difficulties and only commenced in January 2011. One PhD trainee had difficulties and terminated his training; there are plans to replace him with a new MSc trainee. English capability of trainees has been very weak, requiring longer-than-planned English training and likely delays until 2012/13 before postgraduate studies can commence. Project extension would provide ongoing support and a technical base for these trainees.

In summary, since ZT technology was first exposed and introduced into Iraq by the previous project in 2006/07, the known area of ZT crops has increased to about 6000 ha in 2010/11. In project-related development in Syria, where the technology was similarly little-known or tested, total ZT area from project interactions was about 15 000 ha in 2010/11. The ongoing increase in awareness, research and development of the technology, keen involvement of manufacturers and farmers in ZT seeder fabrication and testing and taking up ZT, and higher yields and lower costs being experienced by adopting farmers, provide a good foundation and confidence for wider adoption and impact. In Iraq, interest and visits from other governorates are spreading ZT technology beyond Ninevah.

The project has greatly increased awareness and experience of ZT technology. The Ministries of Agriculture in both Iraq and Syria are considering adoption of conservation cropping as a major platform for future dryland cropping systems development.

This provides a strong justification for project extension and a sound technology base for further consolidation and expansion of conservation cropping.

2.1.2 ACIAR project review

ACIAR arranged a desktop review of the project by Dr John Angus, CSIRO agronomist, involving analysis of project reports and discussions with the ACIAR Crop Program Coordinator, Dr Paul Fox, and the Australian project leader, Dr Colin Piggin, in Canberra from 7–28 February 2011. The review was positive with some comments as follows:

"— This outstanding project is leading to rapid adoption of ZT in Iraq. ZT is leading to less soil erosion, less severe dust storms, lower cost of crop production and higher crop yields. It is a challenging project because of the degraded agricultural and scientific infrastructure in Iraq and the lack of access to the project area by Australian scientists. The economic and environmental impacts are very impressive in view of these challenges.

— Milestones on almost all activities have been met and some have been exceeded. Where they have not been met, there are good reasons such as recognition that the activities needed to be changed or institutional delays in selection of students.

— The project focuses on development of ZT and productivity of ZT crops. It follows an earlier project that addressed varietal assessment as well as ZT and other aspects of crop management. The decision to focus is amply justified by the evidence of 'early adoption' of ZT by farmers in Iraq and Syria. There was little or no ZT in the region before the project and adoption appears to be due entirely to activities in this project.

— Widespread adoption of ZT took many decades in other countries such as Australia and USA. In retrospect, the limiting factor was probably availability of suitable machinery. The focus on machinery development is the most impressive part of the project and is the main reason for its success."

ACIAR considered the review on 16 Mar 11 and:

1) Strongly supported extension of the present project in Iraq to build on its success.
2) Supported further long-term research ... to confirm and report on benefits of ZT and investigate methods of achieving water-limited yields, including interactions with promising practices such as broadleaf-crop sequences.
3) Supported training of local staff and supporting and encouraging regional machinery manufacturers.
4) Supported micro-economic studies and/or use of surveyed information to undertake a farm financial analysis showing the effectiveness of and farm financial gains with ZT.

2.1.3 AusAID Iraq Agriculture Strategy 2011–14

The project extension focus on developing and promoting wide adoption of more productive, profitable and sustainable conservation cropping is consistent with the AusAID Australia-Iraq Agriculture Strategy 2011–2014 (A strategy to guide Australian support for agriculture in Iraq, AusAID March 2011 draft), which is itself in full accord with Iraq's National Development Plan 2010 and the United Nations Development Assistance Framework 2010, which stress the importance of agriculture as a pillar for broad-based economic development and acknowledge problems caused by the historical mismanagement of agriculture within the country.

The Strategy recognises agriculture as particularly important when addressing poverty, with poverty rates in rural areas (40%) more than double that in urban areas (16%), through its capacity to provide opportunities for rural employment and its long and complex value chains with great economic multiplier effects and cross-sector linkages, especially with suppliers of non-farm goods and services located in rural communities. The Government's Poverty Reduction Strategy 2009 and the World Bank's seminal review on Confronting Poverty in Iraq 2010 both identify improved labour productivity and employment in agriculture as the foundation for poverty alleviation.

The Ministry of Agriculture's Strategic Plan for 2009–2015 sets the long term goal of achieving sustainable food self-sufficiency through the expansion of cropped areas and livestock numbers, and through improved productivity.

The AusAID's Agriculture Strategy for Iraq builds on three areas: the priority needs of Iraq, previous engagements, and Australia's comparative advantage. These areas are all relevant to the conservation cropping project in Ninevah.

It is also relevant that the five governorates with the greatest concentration of rural poor, which make up 13.4% of Iraq's population but include almost a quarter of Iraq's poor, include the predominantly rain-fed governorates of Ninevah and Salahuddin, where the project extension is focused (along with Anbar and Al Ta'mim/Kirkuk).

The Strategy proposal that future work should support initiatives that directly or indirectly benefit dryland farming families, especially those in low to mid rainfall areas with a high barley dependence, is also directly fulfilled by the project extension.

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

2.2.1 Focus for the project extension 2012–15

Plans for the project extension have been developed though discussions with project partners and a major reporting and planning meeting of project partners in Amman, Jordan, from 16–19 July 2011. It was agreed to focus on five objectives, related to:

1) Promotion of wide adoption of conservation cropping in Ninevah and surrounding governorates (Al Ta'mim/Kirkuk, Salahahdin, Anbar).
2) Evaluation and adaptation of technologies to optimise production and sustainability of conservation cropping systems through research across collaborator sites in Ninevah, ICARDA, South Australia and Western Australia.
3) Development and promotion of efficient and sustainable farmer-based seed production.
4) Evaluation of adoption and impact of conservation cropping and identify constraints and enabling policy options for uptake by farmers.
5) Enhancing capacity of Iraqi research and extension institutions to develop and promote conservation cropping.

Some changes to the original project have been made in this extension. Two objectives (germplasm improvement research and GIS) have been omitted, with some germplasm development and promotion included under objectives 2 and 3. The WA Department of Agriculture has withdrawn from the project but the previous AgWA project leader, now an Adjunct Professor at UniWA, will remain involved in the project. Australian training and research support will continue to be provided by UniWA and UniAdelaide.

In Iraq, the project will expand activity to promote conservation cropping and farmer seed production in surrounding governorates, as well as in Ninevah. In Australia, active research programs will be developed on important aspects of conservation cropping such as stubble retention, livestock grazing and weeds, supported by university scientists and Iraqi postgraduate students and visiting trainees.

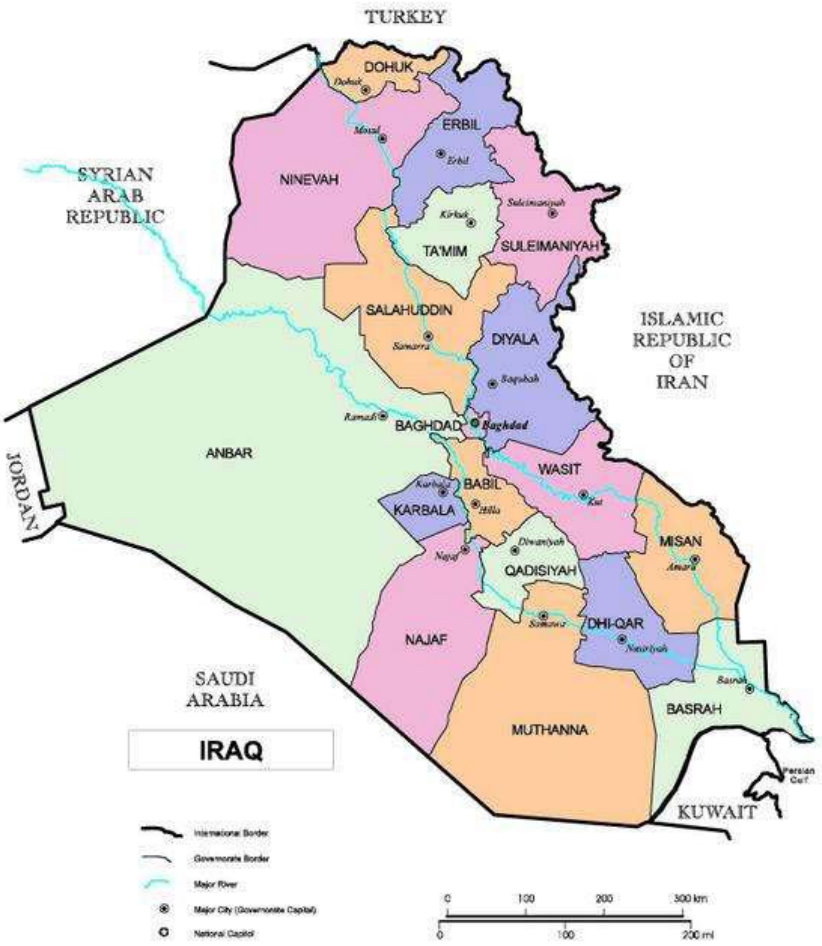

Figure 2.2.1 Map of Iraq showing the close proximity of Ninevah, Anbar, Salahahdin and Al Ta'Mim governorates

2.2.2 The critical need for improvement in production, profitability and sustainability of crop production in Iraq

In Iraq, the average national wheat area, inclusive of Kurdish regions, is around 1.8 million hectares and the barley area is around 1.4 million hectares. These figures fluctuate widely annually, mainly due to drought and irrigation water availability.

Grain production has fluctuated from 1.1 to 2.7 million tonnes for wheat and 0.2 to 1.3 million tonnes for barley in the 1997/98 to 2007/08 production years (which equates to 1998/99 to 2008/09 market years) (Figure 2.2.2).

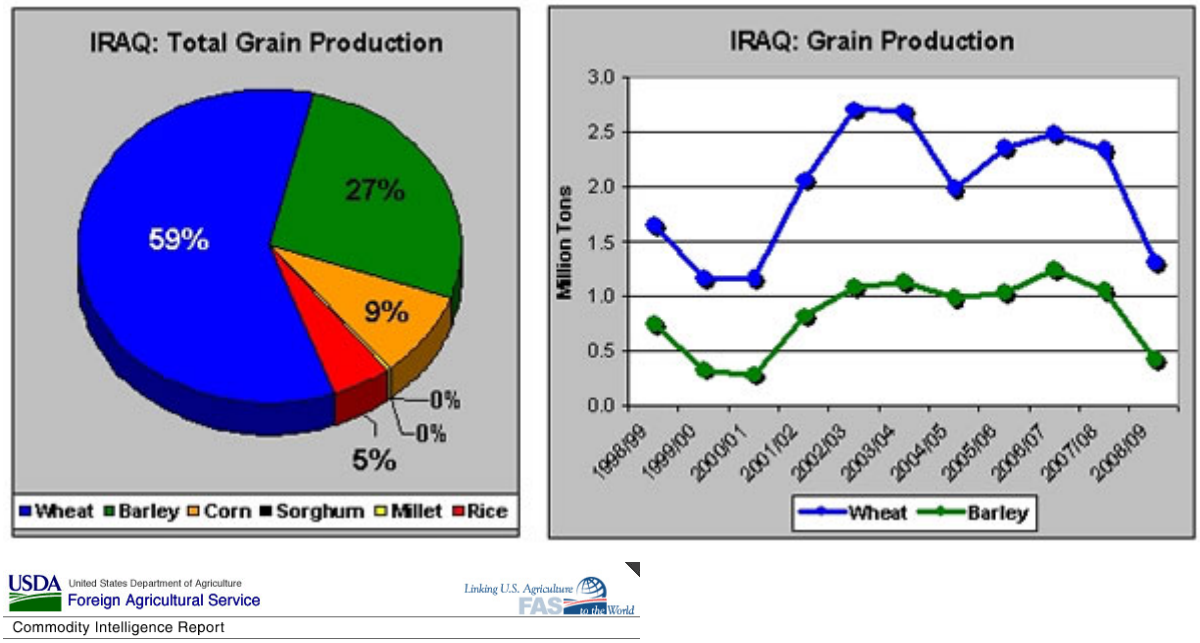

Figure 2.2.2 Grain production of wheat and barley in Iraq 1998/99 to 2008/09

The area of irrigated wheat has increased steadily from 0.6 to >1 million hectares, whilst the dryland area has fluctuated widely from 0.3 to 1.2 million hectares, from 1997 to 2007. The area distribution of irrigated:dryland wheat fluctuates from 40:60% in wet years to 70:30% in dry years (Figure 2.2.3).

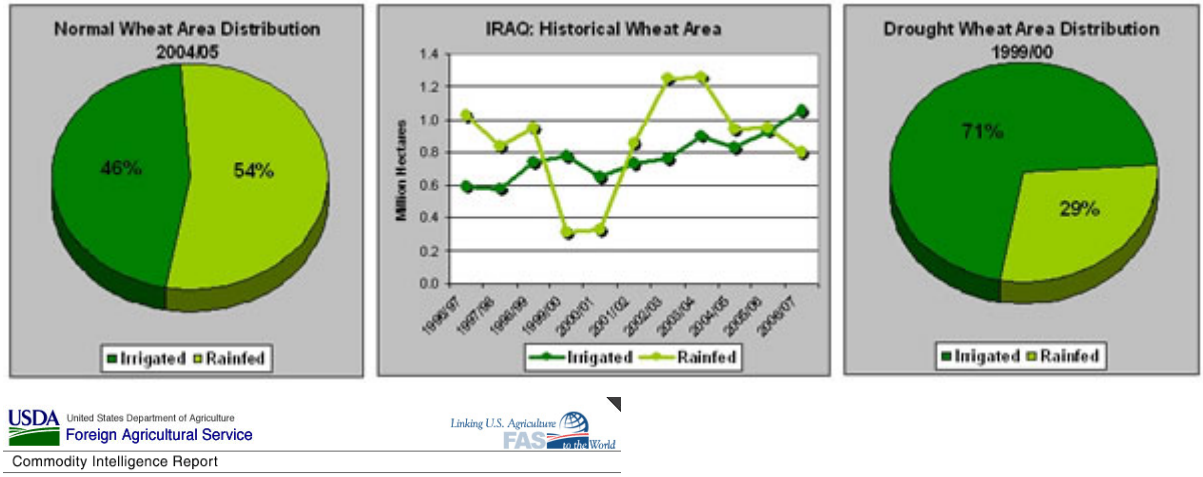

Figure 2.2.3 Areas of irrigated and dryland wheat in Iraq 1996/97 to 2006/07

Area and production figures for 2007/08, 2008/09 and 2009/10 indicate average wheat yields across irrigated and dryland areas were 1.2, 1.1 and 1.3 tonnes per hectare (Table 2.2.1). 2007/08 and 2008/09 were drought years, whilst 2009/10 was normal. Iraq is far from wheat self-sufficiency and imports about 4 million tonnes which is around 200–300% of current production and 80% of the requirement for human consumption. These yields are very low, given that they are averages for irrigated and dryland production, and there is great scope for yield improvement, reduced costs and conservation of natural resources with better crop management built around conservation cropping.

Table 2.2.1 Details of wheat production and use in Iraq 2007/08 to 2009/10

Wheat Iraq (000s)	2007/08	2008/09	2009/10
Area harvested	1133	1200	1561
Beginning stocks	795	717	517
Production	1304	1350	2088
Imports	3868	3800	3900
Total supply	5967	5867	6505
Exports	0	0	0
Feed and residual	500	550	950
Total consumption	5250	5350	5850
Ending stocks	717	517	655

Source: IFTRADE - International Food Trade Association (http://iftrade.org/)

Iraq has been plagued by droughts in the last few years and currently doesn't export wheat. The 2009/10 support price for grade 1 wheat is about $720/t, but only 10–20% of the Iraq wheat crop achieves grade 1 and 20–40% grade 2 quality. This suggests that 30–40% of the annual wheat crop is grade 2 or better, and that 60–70% of the crop is feed quality. These high prices cause inefficiencies in the production system, for example encouraging excessive ploughing which causes soil water loss and lowered yields, as well as soil degradation, although ploughing has been conversely discouraged by high fuel prices, which in response to the demands of the International Monetary Fund reform have risen in recent years by over 800%. This has further undermined agricultural competitiveness. The high prices also encourage cereal monocultures, with farmers reluctant to grow legumes and other break crops, which can provide a weed/pest/disease break and improve soil fertility, because of low and volatile yields and prices.

In Syria, the planted area of wheat is relatively constant at 1.7 million hectares. Production has fluctuated widely from 2 to 4.5 million tonnes between 2008 and 2010 (Table 2.2.2).

Syria imports about 1–1.5 million tonnes of wheat which is around 20–70% of current production and 20–35% of the requirement for human consumption. Syria has been plagued by droughts in the last few years and currently does not export wheat. The procurement price for soft milling wheat of US$400/t is approximately double international prices, whilst the hard durum wheat price is US$450/t. The government practically doubled procurement prices for locally-produced wheat when international wheat prices went up and local diesel prices increased by 357 percent in 2008. However, procurement prices were kept at the same high level as international prices declined.

Table 2.2.2 Details of wheat production and use in Syria 2007/08 to 2009/10

Wheat Syria (000s)	2007/08	2007/09	2009/10
Area harvested	800	1500	1700
Beginning stocks	3574	2513	2913
Production	2139	4000	4500
Imports	1500	1200	1000
Total supply	7213	7713	8413
Exports	0	0	0
Feed and residual	400	400	400
FSI consumption	4300	4400	4500
Total consumption	4700	4800	4900
Ending stocks	2513	2913	3513

Source: IFTRADE - International Food Trade Association (http://iftrade.org/)

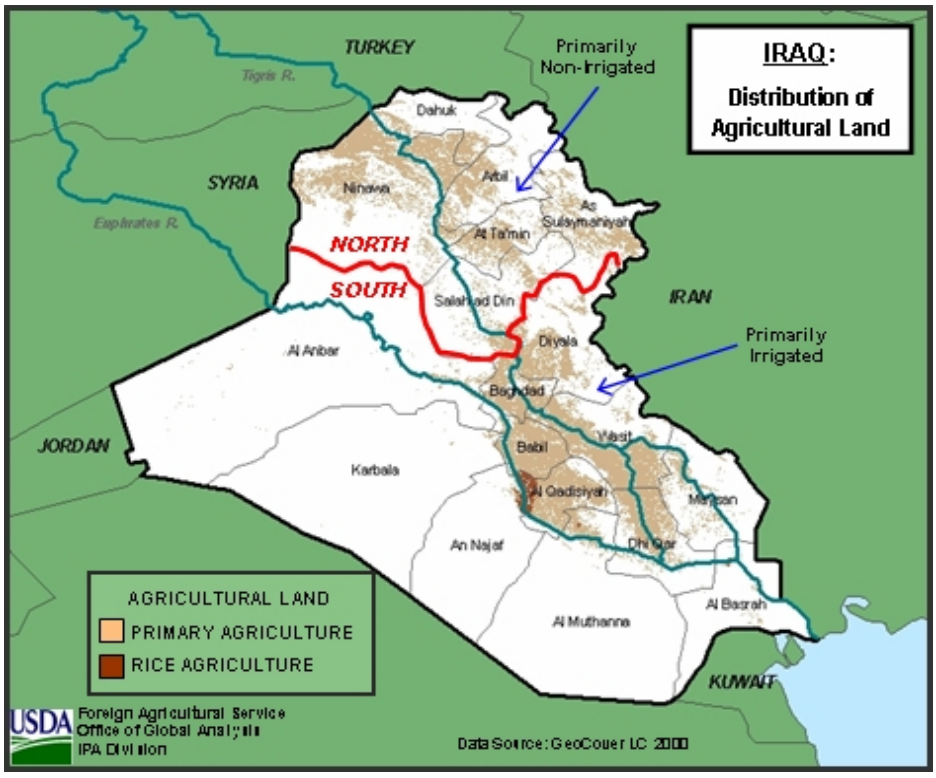

Figure 2.2.4 Northern dryland and southern irrigation cropping areas in Iraq

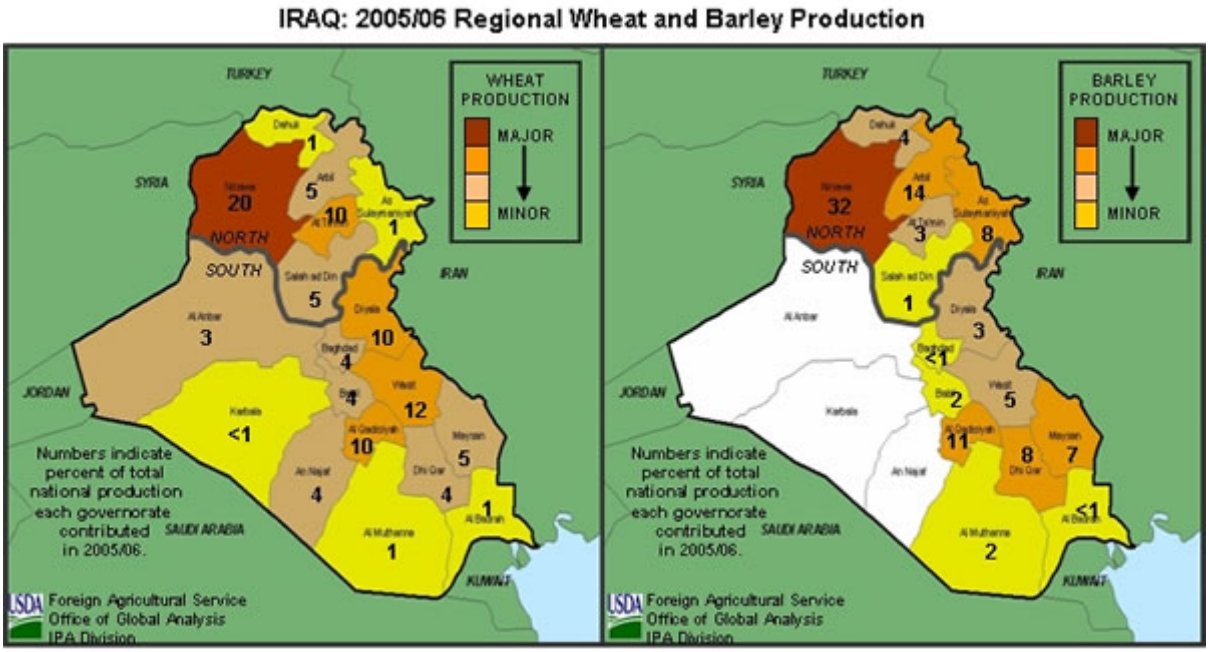

Figure 2.2.5 Percentage of total production of wheat and barley in Iraqi governorates in 2005/06

An idea of yields of dryland and irrigated wheat in Iraq can be deduced from 2005/06 figures of total production (Figure 2.2.2), percentage production (Figure 2.2.5) and total

areas (Figure 2.2.3) of wheat grown in the dryland north and irrigated south of Iraq (Figure 2.2.4). In 2005/06, total wheat production was 2.4 million tonnes, with 45% (1.08 million tonnes) grown on 0.95 million hectares in the dryland north and 55% (1.32 million tonnes) grown on 0.95 million hectares in the irrigated south. This suggests yields were 1.14 t/ha in the dryland north and 1.39 t/ha in the irrigated south. These remain very low yields, with much scope for improvement with better management. The extreme need to lift production is evident from the 2007/08 to 2009/10 wheat imports of 3.8–3.9 million tonnes in Iraq (Table 2.2.1) and 1.0–1.5 million tonnes in Syria (Table 2.2.2).

2.2.3 Interaction with other relevant projects

The project will interact with the following projects:

1) *Improving Food Security and Climate Change - Adaptability of Rainfed Barley Farmers in Iraq and Jordan*, funded by IFAD and managed by ICARDA. This project focuses on (i) identification and delivery of ready-to-use options and technologies for crops and small ruminants in rainfed barley-based production systems, and (ii) support improved extension services that help farmers to adapt and adopt available relevant technologies and to improve crop management practices (iii) empower and support women participation and access to technologies (iv) community awareness on climate change impacts on the lives of target group, and (v) downscale climate change models to local level. Group extension and demonstration plots are being used to disseminate knowledge, which will enhance adoption by target groups. The selected site in Iraq is in the barley-based zone in Setta, Sheikh Ibrahim and Tall Asmair villages in Al Mhalabia district in Ninevah governorate. The area receives low annual rainfall, barley is the main crop grown by farmers, and livestock (small ruminants) is a major farming activity. The 'best-bet' cropping technology is built around conservation cropping and small Syrian-made ZT seeders, which were introduced and developed in the ACIAR-AusAID project. The activity will be compatible with the ACIAR-AusAID project extension, expanding the area and research and extension staff involved in conservation cropping promotion, with close interaction between project teams.

2) *Addressing Regional Constraints to Achieving Food Security through the Development of Conservation Agriculture* (CA) in Morocco, Tunisia and Algeria, funded by ACIAR. The aim of the project is to enhance research and extension capacity for dryland conservation farming systems and directly enhance adaptive CA field research activities and evaluation of ZT machinery suited to small farmers across the region. Partners are the National Institute for Agronomic Research (INRA) in Morocco, the National Institute for Field Crops (INGC) in Tunisia, and the Technical Institute for Field Crops (ITGC) in Algiers, Algeria. The ACIAR-AusAID Iraq project has included some scientists from these countries in ZT machinery training courses and has facilitated the purchase of 10 small Syrian-made ZT seeders by INRA and two by the project for Tunisia and Algeria. Linkages will be maintained between the projects.

3 Objectives

Aim: The project extension aims to promote the adoption of conservation cropping practices to Iraqi farmers and thereby increase crop productivity, profitability and sustainability in the drylands of northern Iraq.

The key outcomes in northern Iraq will be:

- Wide adoption of conservation cropping systems by farmers in rainfed areas in Ninevah and increased system awareness, experience and uptake in surrounding Iraqi governorates (Kirkuk, Salahahdin, Anbar).
- An active R&D program focusing on continued development, monitoring and adaptation of conservation cropping in northern Iraq, with selected multi-site agronomic and evaluation research addressing priority issues of interest to involved collaborators across sites in Ninevah, ICARDA, South Australia and Western Australia.
- Improved technical capacity of Iraqi scientists and extension officers being used to develop conservation agriculture, and improved capacity by agricultural institutions/projects being used to plan and implement development programs.

These outcomes will be achieved through the following objectives and activities:

Objective 1: Promote wide adoption of conservation cropping (zero tillage, stubble retention) in Ninevah and surrounding governorates where dryland crops are prominent (Kirkuk, Salahahdin, Anbar).

Activity 1.1: Demonstrate and promote uptake of ZT cropping widely in Ninevah districts.

Activity 1.2: Develop awareness and experience and encourage evaluation and uptake of ZT cropping in surrounding governorates.

Activity 1.3: Facilitate farmer access to locally fabricated or modified ZT seeders for testing and evaluation in Iraq and Syria.

Objective 2: Evaluate and adapt technologies to optimise production and sustainability of cropping systems through research across collaborator sites in Ninevah, ICARDA, South Australia and Western Australia on better crop establishment and management and improved germplasm.

Activity 2.1: Investigate, verify and adapt conservation cropping technologies including agronomic practices, rotations, residues, crop-livestock interaction, pest-disease-weed dynamics and control, soil fertility-structure-biology dynamics and management and germplasm adaptation.

Activity 2.2: Fabricate, modify, evaluate and improve locally-made ZT seeders in conjunction with manufacturers and farmers.

Objective 3: Develop and promote efficient and sustainable farmer-based seed production and supply systems.

Activity 3.1: Provide promising new crop varieties/lines from ICARDA in Iraq for research, extension and seed production.

Activity 3.2: Develop a functional seed unit within the agricultural research system at Rashidiya RS and Mosul University to provide seed for research, demonstration and further multiplication.

Activity 3.3: Develop sustainable farmer/village-based seed production systems.

Objective 4: Monitor and evaluate adoption and impact of conservation cropping and identify constraints and enabling policy options for uptake by farmers.

Activity 4.1: Analyse improved technology option performance, profitability, WUE, and acceptance by farmers.

Activity 4.2: Assess effectiveness of improved management options on adaptive capacity of local communities to climatic variability.

Activity 4.3: Monitor adoption of improved technologies and identify constraints and provide possible solutions.

Activity 4.4: Assess the impacts of conservation cropping.

Activity 4.5: Identify enabling policy and institutional options.

Objective 5: Enhance capacity of Iraqi research and extension institutions to develop and promote conservation cropping.

Activity 5.1: Raise awareness and provide training in Ninevah for Iraqis (managers, scientists, extension officers, farmers).

Activity 5.2: Provide short- and medium-term training and joint data analysis at ICARDA presented by Australian and ICARDA scientists.

Activity 5.3: Continue long-term training/joint research and MSc/PhD graduate research at Australian partner universities.

Activity 5.4: Support participation of Iraqi collaborators in relevant workshops and conferences.

4 Planned impacts and adoption pathways

4.1 Scientific impacts

The project will further develop knowledge and experience of conservation cropping technologies in Iraq and Syria through R&D on ZT, local ZT seeder fabrication and alternative crops. This will add to the so-far quite consistent findings across years and crops that ZT is productive and profitable, that early sowing increases yields, and that seeding rates can be reduced to 50–100 kg/ha, all significant advances in the region. The experience that affordable and effective ZT seeders can be fabricated locally removes a significant and commonly-reported constraint to ZT adoption. Comparisons of barley, bread and durum wheat, chickpea and lentil lines under CC and ZT at ICARDA, indicating that present varieties/lines are well-adapted to ZT, dispel concerns that new varieties might be needed before ZT can be adopted widely. These findings will be published in the scientific literature.

4.2 Capacity impacts

Capacity enhancement is a separate objective (Objective 5) and a major focus of the project. The project will enhance linkages with international crop science, especially in Australia, and provide training for over 500 Iraqi scientists and farmers during the project life. It is expected these staff will return to Ninevah after completion of training to utilise and reinforce the knowledge learned to promote further development and uptake of conservation cropping.

Some 180 scientists and farmers from surrounding governorates will visit Mosul to gain understanding and experience of conservation cropping systems. About 260 Iraqi staff will receive short-term (1–4 weeks) training at ICARDA in topics relevant to project activities. Five Iraqi scientists will undertake 2–6 month study visits, and six Iraqi researchers will complete MSc (4) and PhD (2) degrees, at the Universities of Adelaide and Western Australia.

Through involvement in the project, all staff will develop capacity to plan, implement and evaluate crop development projects. Capacity will also be enhanced in special technical areas including conservation cropping, seed production, economic and policy research, statistical analysis and scientific report writing.

4.3 Community impacts

In Iraq, there are no other projects developing and promoting ZT, according to Iraqi project collaborators. In Syria, a General Commission for Scientific Agricultural Research (GCSAR) project (2004–09) supported by the Arab Agency for Agricultural International Development (AAAID) and an Arab Center for Studies of Arid Zones (ACSAD) project (2007–11) with the Directorate of Extension and GCSAR have undertaken field trials/demonstrations, where crops were sown by project operators using imported ZT seeders. These projects have expanded awareness and experience of conservation agriculture in Syria but there was no adoption because of reliance on expensive, imported ZT seeders. When the ACIAR-AusAID project started in early 2005, there was clearly little awareness and no adoption of ZT, and no local construction or availability of ZT seeders in Iraq or Syria.

4.3.1 Economic impacts

The promotion and adoption of conservation agriculture and appropriate agronomic practices are expected to significantly benefit farmers in Iraq and Syria.

In the dryland/rainfed areas being addressed in this project, economic benefits will come from higher yields and lower costs. Although there is wide spatial and temporal fluctuation in rainfall and crop yields, project experience suggests that wheat and barley grain yield increases of 20% or 250 kg/ha with ZT and early planting are not uncommon. Costs are reduced because cultivation is eliminated. An associated benefit from drill seeding (not necessarily ZT) is that sowing rates, often around 300 kg/ha with local disc plough seeders which drop the seed above the discs, can be reduced to 50–100 kg/ha. Other costs may not change much as the dry Mediterranean summers mean few weeds and only occasional need for pre-sowing herbicides (glyphosate), whilst post-sowing crop management is similar for both systems.

In Iraq, with wheat costing US$700/tonne and barley $600/tonne in 2011, increased yield from ZT and early planting may be worth $175/ha for wheat and $150/ha for barley, with a saving of two cultivations worth $40/ha. Reducing the sowing rate from 300 to 100 kg/ha would save $140/ha for wheat and $120/ha for barley.

In Syria, with wheat costing $400/tonne and barley $200/tonne in 2011, increased yield from ZT and early planting may be worth $100/ha for wheat and $50/ha for barley, with a saving of two cultivations worth $40/ha. Reducing the sowing rate from 300 to 100 kg/ha would save $80/ha for wheat and $40/ha for barley.

The farm-level net return for dryland farmers adopting a location-determined conservation agriculture package (ZT, early sowing, low sowing rates) in Iraq could be $355/ha for wheat and $310/ha for barley. In Syria, it could be $220/ha for wheat and $130/ha for barley. These figures are used in benefit prediction in Table 4.3.1. It should be emphasised these are benefits to the farmer; calculations of national benefits would need to balance reduced expenditure on subsidies for fuel and imported grain subsidies and increased expenditure on subsidies for locally-produced grain.

To date, indications of acceptance and uptake of conservation agriculture have been highly positive. Use of ZT by farmers has increased from zero in 2005/06 when the project started to approximately 6,000 hectares in Iraq and 15,000 hectares in Syria in 2010/11. About 80% of this area in Iraq and 70% in Syria was actual adoption by farmers using locally purchased, rented or borrowed ZT seeders.

It is expected that this project will not only provide scientists and extension agencies with knowledge of productivity-enhancing, location-specific conservation agricultural technologies but will also result in a rate and level of adoption far beyond what would occur without the project.

Crop areas average around 1.8 million hectares for wheat and 1.4 million hectares for barley in both Iraq and Syria, with wide rainfall-determined fluctuations. Over half of these wheat areas and most of the barley would be rainfed or sprinkler-irrigated systems without bunding, where zero tillage systems can easily be used. The progression of adoption of the above-mentioned location-determined conservation agriculture package as a result of the project is difficult to predict. However, given the promising initial adoption, and with wide development and promotion in this project extension, areas are expected to increase considerably.

With its strong benefits and farmer interest in the technology, and based on past experience, it is reasonable to expect that at the end of the project the areas under ZT may be 100,000ha in both Iraq and Syria, being grown by around 1,000 farmers in Iraq and 2,500 farmers in Syria.

After that, uptake is likely to continue to expand to most cropped areas, as it has in Australia, over the next 20 years. Iraqi collaborators in Ninevah believe that all wheat (about 350,000ha) and barley (about 450,000ha) in the Province will be sown with ZT in 10-15 years.

The benefits to farmers from each 100,000 hectares of the conservation agriculture package adopted, using the figures above, which could be challenged or changed but are useful for sensitivity analysis, are illustrated in Table 4.3.1.

Table 4.3.1 Potential annual benefits (US$ million) to farmers directly attributable to the project for each 100,000 hectares of wheat or barley grown with the conservation agriculture package in Iraq and Syria

Country	Wheat	Barley
Iraq	35.5	31.0
Syria	22.0	13.0

ZT will be available to small and large farmers alike. The crops of these farmers have all been sown previously with conventional seed drills or disc seeders, either owned by the farmer or his seeding contractor or rented/borrowed from a neighbouring farmer. Local modification or manufacture of ZT seeders promoted by the project is making ZT seeders widely available to farmers and contractors so that, in the future, all farmers should be able to access ZT if they wish.

Small farmers using ZT contractors will not miss out on the savings from the lower cost of seeding without cultivation, through an expected change in the contractor:farmer harvest share arrangement from the conventional 60:40% to a 40:60% split more favourable to the farmer. They will also have the opportunity to negotiate cheap contract rates for early ZT sowing into unploughed soil, when conventional croppers' land is still being tilled and sowing contractors are not so busy. Such changes are expected and will be encouraged by Iraqi institutions involved in the project.

With a shift to ZT, all crops will be sown earlier, with consequent yield benefits, because small farmers, large farmers and contractors alike will not need to plough or wait for rain before sowing and will face fewer rain delays due to better infiltration, drainage and trafficability on unploughed than ploughed soils.

The project is having an economic impact on machinery manufacturers involved in developing, manufacturing and marketing ZT seeders. In Iraq, a group of farmers and manufacturers has developed a ZT modification kit for the widespread John Shearer/Rama conventional seeders, and fabricated a small ZT seeder, and these have been effective and have potential for wider marketing. In Syria, involved machinery manufacturers have sold over 100 ZT seeders, and several have added 2-3 staff to their workforces, increasing rural employment. There will also be an economic impact in Iraq from production and marketing of better adapted and more productive crop varieties through the village-based seed production program. This will provide increased income for producers and more employment in the marketing chain. These benefits will be evaluated under Objective 4.

4.3.2 Social impacts

Reduced cultivation and quicker, earlier sowing of crops with ZT will allow more time and leisure to farmers and more opportunity for family interaction and recreation. Human health should improve with less cultivation and less stubble burning resulting in less smoke pollution and dust storms, which are common in the region. These are predicted impacts which will not be quantified but, from experience elsewhere, are likely to be realised if/when ZT is more widely adopted.

Social impacts were discussed in the Phase II proposal (CIM/2008/027, July 2008), and are summarized and updated below.

There are about 70,000 rural households in Ninevah province with an average of 12 members per household, making a rural population of about 840,000. With the potential of reaching about 10-15% of these households with the new technologies, the life of thousands of Iraqis will be positively affected as these households will be able to better adapt to crop production risks, enhance their food security, reduce vulnerability to poverty, and develop resilience to drought and weather variability, and live in a cleaner environment following adoption of the new technologies.

From the baseline survey in the original project, it is clear that women and children contribute significantly to farm work in Iraq. Contributions to total agricultural activities averaged 12% for women, 4% for children and 84% for men. The extent and nature of involvement varies depending on the environment, farming system or the type of enterprise. In cereal and legume cropping, women are involved in cleaning and packaging seed for planting, gathering straw, threshing and cleaning the harvested seed. With crop legumes, they are also involved in manual weeding and harvesting. In mixed crop and livestock enterprises, they also work on collecting milk from animals, manufacturing dairy products, and manual feeding. Changes to farming practices resulting from the adoption of conservation agriculture will, therefore, impact directly and indirectly on women's as well as men's farm labour input.

There will also be benefits to family nutrition, including women and children, from increases in production of cereals and pulses, with the latter especially important for increasing protein intake.

The strengthening of village based seed and machinery enterprises to be addressed by the project will also stimulate local business development. With the significant role of women in seed issues related to planting, harvesting and feeding livestock, the project will take steps to encourage village employment opportunities for women in established Village Based Seed Enterprises.

Gender issues in Iraq are complex and gender equity needs to be considered sensitively with respect to cultural and religious norms. It should also be understood that sensitivities to gender in relation to employment in Iraq are significant and gender equality is neither easily analysed nor addressed. However, the project will take appropriate measures to support the inclusion of female scientists and support staff. Specific attention will be given to involving and supporting more women in project activities and training.

4.3.3 Environmental impacts

Improvements in soil, water and atmospheric conservation and sustainability can be expected in the future. ZT brings better soil structure, better soil-water dynamics, better nutrient recycling, improved trafficability, less erosion, and the opportunity for increased soil organic matter (OM) and carbon (C) sequestration. Pollution will be less, as stubbles are retained on the soil surface and burning is reduced. Dust storms and erosion, which can be severe in the region, should be reduced. These benefits will not been quantified but are well known from other experiences and publications.

4.4 Communication and dissemination activities

The project has a specific extension component (Objective 1) to promote adoption of project technologies. Better crop management technologies from earlier testing and research will feed directly into the extension component, where farmers will be involved with DOA, University, SBAR and seeder manufacturer teams in testing selected ('best bet') technologies across demonstration sites in farmer fields in 11 old sites and 10 new districts in Ninevah, and in four sites in each of the three new governorates of Anbar, Al Ta'Mim and Salahahdin. A program of visits by staff and farmers from new districts and governorates to established Ninevah demonstration sites and farmers will be undertaken. Field days and farmer group visits will be conducted at demonstration locations. Farmers

in these new areas are already aware of and very interested in some of the improved varieties and crop management technologies, especially ZT, tested in the original project.

Some 'best bet' conservation cropping guidelines identified from project investigations and experiences which can be selected for testing by extension officers and farmers depending on their situation are as follows:

1) keep fields uncultivated - ploughing is unnecessary and costs time, money and moisture

2) don't burn stubbles and retain as much residue as possible on the soil surface

3) stubbles can be grazed where livestock are a component of the farm enterprise - livestock are integrated into ZT systems in many countries and this does not negate the many benefits of ZT

4) sow seed and fertilizer through surface residue into narrow slits in the soil using a ZT seeder

5) sow early, as soon as soil conditions are favourable following seasonal-break rains

6) where rains are late, consider early dry sowing, which is successfully used in many countries

7) use optimum sowing rates of 50-100kg/ha for temperate cereals/small-seeded pulses and 100-150kg/ha for large seeded pulses

8) control established weeds before sowing with Roundup/Glyphosate (this is often unnecessary where there is little summer rain)

9) manage soil fertility and control pests, diseases and weeds, which may have different incidences and dynamics than in conventional systems, to optimize yields

10) manage major soil problems (hard pans, acidity, salinity) according to best practice to optimize yields

11) use diverse rotations of cereals, legumes, brassicas, other break crops and forages

The extension component, in particular the capacities of Iraqi extension systems and officers to implement effective participatory extension programs with farmers, will be enhanced through interaction, planning and evaluation together with institutions and scientists from Australia, where farmer involvement in technology development and promotion is extensive. Special support will come from Dr Jim Fortune and other extension specialists from Primary Industries and Resources South Australia, contracted through the University of Adelaide, who will coordinate the planning and delivery of field-based technical training in South Australia as well as providing input into specialist workshop training from ICARDA.

Development and promotion of ZT technology will be enhanced through on-going collaboration with local machinery manufacturers and innovative farmers involved in ZT modification of local John Shearer-type seeders and fabrication of local ZT seeders. This component will be supported by the Agricultural Machinery Research and Development Centre at the University of South Australia, with regular involvement of Dr Jack Desboilles in project meetings and training.

The socio-economic component (Objective 4) will help promote uptake of technologies by evaluating adoption and impact and identifying constraints. This will help project research focus on major technical constraints and provide guidance on how technical and policy constraints can be overcome.

Awareness, experience and adoption of project technologies in Iraq, especially those associated with conservation cropping, will be enhanced by Iraqi researcher, extension officer and farmer visits to ICARDA for project meetings and training courses. There will also be special visits by scientists and leading farmers from cropping zones across

northern Syria to inspect and discuss aspects of project research, including: agronomy trials on ZT, stubble mulching and alternative crops; agronomy demonstrations in farmers fields; development and testing of small, locally-made ZT seeders; and crop improvement trials on better crop varieties for Iraqi conditions. This activity in Syria is essential as a risk management strategy, and will continue because:

1. It provides controlled research and demonstration sites for testing of new technologies and crops/varieties.
2. ICARDA-Australian collaborators cannot visit demo/research sites in Ninevah.
3. It provides field sites for training and visitors.

As in the first two projects, there will continue to be valuable spillovers in Syria from project agronomy research and demonstrations conducted in and around ICARDA. Regional awareness and adoption will be enhanced by linkages to some other outside groups.

Some project research, development and training will be undertaken by ICARDA in collaboration with GCSAR Research Stations at Kamishley, close to the Iraqi border in NE Syria, and at Salamiya. The Kamishley Station has an imported Brazilian ZT seeder which can be used for some collaborative ZT research and training. Iraqi personnel can travel relatively easily to Kamishley for research interaction and training.

ICARDA also collaborates with the Arab Center for the Studies of Arid Zones and Dry Land (ACSAD) on conservation cropping, including interaction in implementing field research and demonstrations on ZT around Syria. This collaboration will be furthered by the continuation of the ACIAR/AusAID Iraq project and encourage wider Middle East spillovers.

The project has an established web page on the ICARDA website. Major project activities and findings are available on the site to increase awareness of and access to technology developments by researchers, extension officers and farmers.

5 Operations

5.1 Methodology

Objective 1: Promote wide adoption of conservation cropping (zero tillage, stubble retention) in Ninevah and surrounding governorates where dryland crops are prominent (Kirkuk, Salahahdin, Anbar).

The project will continue the program of demonstrations established across high rainfall areas (HRA), medium rainfall areas (MRA), low rainfall areas (LRA) and supplementary irrigation (SI) in the original project (Phase 1 and 2). Based on discussion at the project meeting (July 2011), sites and participating host farmers and farmer groups will be selected for on-farm demonstrations in the existing 11 districts plus 10 new districts in Ninevah. On-farm demonstrations will be also established in three new governorates (four demonstrations per governorate).

These demonstrations will be implemented by project teams involving researchers, extension officers, machinery manufacturers, and farmers. They will be monitored throughout the season and farmer visits and field days will be held at each site during the year to inspect and discuss the demonstrations and trials and promote understanding and adoption of improved CA and crop management technologies.

Activity 1.1: Demonstrate and promote uptake of ZT cropping widely in Ninevah districts

Based on the results from the previous two phases of the project, the best bet conservation cropping technologies such as ZT, stubble retention and improved crop management practices (e.g. seeding rate, time of sowing, row spacing, press wheels) will be demonstrated in the 11 established districts.

For the 10 new districts, demonstration trials will be established to compare ZT/stubble retention vs. farmer's conventional cultivation (CC) , with inclusion of some other improved technologies verified in earlier Ninevah R & D such as best-adapted varieties, time of sowing and seed rates.

These demonstrations, located on farmer fields with strong farmer participation, will be monitored throughout the season. Farmer visits and field days will be held at each site during the year to inspect and discuss the demonstrations/trials and promote understanding and adoption of improved CA. Farmer to farmer interaction will be facilitated and encouraged in visits and field days.

Activity 1.2: Develop awareness and experience and encourage evaluation and uptake of ZT cropping in surrounding governorates

Experts from Ninevah will visit and hold meetings in the new governorates early in the project to build relationships with relevant players, provide information on the best-bet technologies developed in the earlier projects, and identify priorities for the governorates.

On-farm demonstrations will be established in 3 new governorates (each having 2 districts with demonstrations in Yr 1 and 4 districts with demonstrations in Yr2 and Yr3) to compare ZT vs. CC systems, with inclusion of some other improved technologies verified in earlier Ninevah R & D (optimum varieties, time of sowing, seed rates).

These demonstrations, located on farmer fields with strong farmer participation, will be monitored throughout the season. Farmer visits and field days will be held at each site during the year to inspect and discuss the demonstrations/trials and promote understanding and adoption of improved CA. Farmer to farmer interaction will be facilitated and encouraged in visits and field days.

Activity 1.3: Facilitate farmer access to locally-fabricated or modified ZT seeders for testing and evaluation in Iraq and Syria

Six existing plus two new ZT seeders (from Syria) will be made available to farmers in Ninevah to experience and evaluate ZT (without payment from or to the project and with farmers supplying their own inputs).

In each of the three new governorates, two new ZT seeders (from Syria) will be made available for demonstrations and farmer use (farmers supplying their own inputs).

Other ZT seeders currently owned by farmers or new ones modified or fabricated with project support will also be made available in all governorates for demonstrations and farmer use to raise experience and adoption of ZT.

ICARDA will continue a program to raise awareness, experience and adoption of ZT in Syria by providing information and local seeders for farmers to test ZT technology. This program will be run in conjunction with Syrian extension, research, private and NGO (especially the Aga Khan Foundation) groups, which have collaborated extensively in this program. It will be used as an essential resource for demonstration and training of Iraqis in participatory extension and development of ZT systems and ZT seeders.

Objective 2: Evaluate and adapt technologies to optimise production and sustainability of cropping systems through research across collaborator sites in Ninevah, ICARDA, South Australia and Western Australia on better crop establishment and management and improved germplasm.

Activity 2.1: Investigate, verify and adapt conservation cropping technologies including agronomic practices, rotations, residues, crop-livestock interaction, pest-disease-weed dynamics and control, soil fertility-structure-biology dynamics and management and germplasm adaptation

A series of studies will be conducted by The University of Western Australia (UWA) and University of Adelaide (UA) scientists using long-term established conservation cropping sites. These sites (experiments and farm sites) have in common the key components of conservation cropping, namely permanent residue cover, minimum soil disturbance, crop rotations and integrated weed control. The impact of grazing on crop productivity with conservation cropping will be studied in experiments managed by UWA that include sheep grazing of crop residues during the summer (fallow). The effects on crop productivity, soil properties, water use efficiency and farm profitability/economics will be determined. In addition, other long-term sites will be used to compare the effect of weed management and retaining high crop residue levels on weed, disease and insect levels compared with low levels of residue (or removal of residues).

Field surveys will be conducted by UniAdelaide to understand the impact of stubble retention on nutrient cycling, soil moisture retention and key soil biological processes in regions of south eastern Australia (Eyre Peninsula, Yorke Peninsula, the Wimmera, Murray Mallee and north eastern Victoria). Multivariate statistics will be applied to indicate the roles and impacts of soil characteristics and climatic and management factors on the productivity of conservation cropping in these regions. This component of work will determine the impact of retaining stubble on key soil biological processes. In addition, the impact of retention or removal of stubble on carbon and nitrogen cycling, moisture and key soil biological processes will be investigated in experiments established by collaborators at the University of SA (J. Desbiolles and co-workers). In this work program, opportunities will also be available to test the impact of retention or removal of stubble on carbon and nitrogen cycling in similar experiments established at ICARDA, Syria, as a comparison with Australian systems.

At the University of Mosul farm (Ninevah), students as part of postgraduate study will undertake a range of specific studies on soil, crop, weed, pest and foliar and soil-borne disease issues within different tillage treatments in a long-term trial. In these trials treatments will compare ZT and CC crop establishment with additional treatments of early/late sowing, ± stubble removal and potential (stress-free) growth. All rotations will be compared with the farmers' rotations of continuous barley in LRA or continuous wheat in

MRA. Potential alternative rotations include: 3-course rotations of barley/safflower/oats in MRA, and wheat/oats/field pea in MRA and HRA; and 2-course rotations of barley/safflower in LRA and *w*heat/field pea in HRA. A survey for all weeds occurring under each tillage/planting method will be undertaken within the demonstrations of alternative tillage methods under Objective 1, with the aim to provide recommendations for weed control programs. At each site, under each tillage treatment, information will be collected on the weed seed bank at different depths. An IPM pilot site will be established in each of the locations (HRA, MRA, LRA) for the management of diseases and insect pests of cereal and food legume crops. Other specific IPM studies will be undertaken by MSc students from the University of Mosul.

Superior cultivars of wheat, barley, oats, lentils, field pea and chickpeas (one or two varieties of each plus a check variety) will be included in a multi-site evaluation by SBAR (Mosul) using ZT technology. These sites will be an integral component of the process for approval for release of the nominated varieties and production and dispersal of seed for wider extension, farmer seed production and adoption.

At ICARDA, trials investigating performance of crops (wheat, barley, oats, chickpea, lentil, peas, brassicas) under ZT and CC in relation to various management options (time of sowing, sowing depth, seed rate, press wheels, rotations) will continue. Crop production and the dynamics of soil structure, soil nutrients, soil moisture, weeds, etc will be monitored and evaluated. These trials will be used for technology verification and adaptation and for raising awareness and understanding with Iraqi and other visitors and trainees.

The overall results and experiences from these research programs in Iraq, ICARDA and Australia will be used to develop better crop, soil, fertilizer, weed, pest and disease management practices for use in ZT systems.

Activity 2.2: Fabricate, modify, evaluate and improve locally-made ZT seeders in conjunction with manufacturers and farmers.

Cropping is already highly mechanised in Iraq and Syria and there are many local machinery manufacturers, both engineers and farmers, making and marketing conventional drill and disc seeders. The project has worked with about 10 of these in both Iraq and Syria and successfully developed effective and affordable ZT seeders which are being purchased and used by farmers. This program will be expanded to identify and involve more interested manufacturers, farmers, engineers and students, to develop local capacity to modify and manufacture ZT seeders, undertake constant evaluation and improvement, and make them widely available to farmers and contractors so all farmers can access ZT technology if they wish.

For Iraq, the proposed approach is to adopt a process of capacity building in-country by involving project-based machinery counterparts as technology ‘champions’ in the process. To initiate this, one industry-focused counterpart (e.g. farmer or manufacturer from Ninevah) and one research-focused counterpart (e.g. academic researcher, engineer from Ninevah) will engage in a short-term work experience training exercise at UniSA (early 2012). On return to Iraq, these counterparts will lead development and training of involved engineers, manufacturers, farmers and students, focussing respectively on machine design and manufacturing issues, and on-field research and machine performance issues and mentoring associated with student projects. Future workshop activities in Iraq and Syria will then be tailored to the evolving needs of the key district groups established as part of Objective 1 and, in particular, in the areas of seeder performance, seeding system research issues, machinery design solutions and technology awareness. Further, there is an opportunity to engage students at University of Mosul/University of Aleppo with manufacturers on projects addressing machinery design/performance issues. Example project areas may include seeding tine development and testing, seed/fertiliser metering system improvement, and press-wheel design solutions. A student project format may present significant value-adding potential to collaborating manufacturers, and should aim

to minimise constraints on them, under a no-risk/no-cost basis. UniSA staff would conduct regular visits to Syria (e.g. two per year) consisting of targeted topical workshops to key groups (1–2 days each, presentation & hands-on activities, as appropriate) and meetings with counterparts, consultations with key groups, field visits, machinery evaluation, training course development and student project mentoring. These training workshops will be based from ICARDA and be delivered to smaller (5–8 attendees) and specific industry groups (manufacturers, farmers, researchers), building on extensive training material and fact sheets developed during 2010-11 ZT seeder training courses delivered to Iraqi and Syrian manufacturers, farmers and researchers. Additional activities by UniSA staff will include following up and liaising between visits with the machinery counterparts/students about on-going ZT machinery issues and providing input to machinery research and development needs. A budget is provided to support development of local ZT seeder manufacturing capacity in involved Governorates in Iraq.

In Syria, interaction will continue with local manufacturers (now 8) to develop and supply better ZT seeders. Syrian manufacturers will join in appropriate ZT seeder training events at ICARDA.

Objective 3: Develop and promote efficient and sustainable farmer-based seed production and supply systems.

The seed production objective will be implemented in Nineveh and three adjacent Iraqi provinces, working with farmers and/or communities to encourage and facilitate development of profitable seed enterprises. These will provide quality seed of improved varieties to farmers to boost crop production and farmer income.

There are two components in the seed program. The first is to establish a functional seed unit for variety maintenance and early generation seed production for research, demonstration and further multiplication by providing training and equipment. The second is to ensure farmers' access to seed of improved adapted varieties by strengthening existing farmer seed producers into functional village-based seed enterprises (VBSEs) and linking them to formal seed sector institutions.

To implement these activities, a seed team will be established with representatives from SBAR, SBSTC, University of Mosul, DOA, Public Seed Companies and the ICARDA Seed Section. A consultant economist at ICARDA will assist in baseline and seed demand surveys in new provinces and analysis of profitability of VBSEs. The Iraqi team will implement the activities and meet regularly to monitor and evaluate work plan implementation and provide information for progress reports.

Activity 3.1: Provide promising new crop varieties/lines from ICARDA in Iraq for research, extension and seed production

ICARDA will continue to multiply and provide seed of elite materials/new crop varieties based on availability and requirements and requests from partners. SBAR and Mosul University will identify the need for, and endeavour to produce locally, foundation seed of new varieties/lines of wheat, barley, chickpea, lentil, pea, vetch, oats and safflower for research, demonstration and seed multiplication.

Activity 3.2: Develop a functional seed unit within the agricultural research system at Rashidiya RS and Mosul University to provide seed for research, demonstration and further multiplication

Two nucleus seed units established within SBAR in Rashidya Research Station and at Mosul University will provide variety maintenance and breeder and foundation seed production of new crop varieties for trials, demonstrations and further seed multiplication by Village-based seed enterprises (VBSEs). This will be linked to the registration and release process for promising varieties described under Activity 2.1. An assessment will be made to identify and address equipment needs for these functioning seed units.

A train-the-trainer approach will be used at ICARDA to train subject matter specialists from Mosul University and SBAR research stations from Ninevah and adjacent provinces on variety maintenance and breeder and foundation seed production. They will be responsible for variety maintenance and early generation seed production and be trainers for in-country courses in target provinces.

Activity 3.3: Develop sustainable farmer/village-based seed production systems

Seed systems and factors affecting farmers' access to new varieties in target provinces will be evaluated by an MSc or PhD student attached to Mosul University and co-supervised by the seed section of ICARDA. This will include in-depth analysis of factors affecting availability and access to new crop varieties, farmers' perception and awareness of new crop varieties, farmers' seed sources and seed management practices.

Eighteen farmers (individual village-based seed enterprises) currently involved in local seed production and marketing in Nineveh province will be organised under an umbrella of a provincial seed producer's association recognised and licensed by the Ministry of Agriculture and supervised by the UniMosul.

In adjacent provinces (Anbar, Salahahdin, Kirkuk), a multi-institutional and multi-stakeholders consultative process will be employed to target communities to initiate three new VBSEs. A group of progressive volunteer farmers willing to invest time and resources will be identified and organised to establish VBSEs under provincial seed producers' associations. VBSEs will be provided with technical support by relevant stakeholders (research, seed agencies, extension services, credit agencies) to: source foundation and registered seed of new crop varieties, inputs and credit to initiate quality seed production; receive training in technical aspects of seed production and financial and enterprise management; and promote varieties and seed through field days, etc.

The VBSEs will manage all seed production operations and receive assistance with marketing through local farmers or seed companies with support from a seed congress of seed specialists from local government institutions.

Through a train-the-trainer-approach, subject matter specialists from relevant stakeholders will be trained on seed production technology and financial and enterprise management at ICARDA. They will be responsible for implementing the project and providing in-country courses in target provinces.

Seed demand surveys will be conducted to guide VBSEs in business plan development. The VBSEs will be monitored and evaluated annually under the coordination of UniMosul and the seed congress for technical and economic performance to assess and encourage business profitability and enterprise sustainability. Data will be collected on area planted, amount of seed produced and marketed, quality of seed produced and cost of production to analyse profitability of the enterprises. These seed enterprises will be assisted to expand and diversify operations and develop into small private seed companies.

Objective 4: Monitor and evaluate adoption and impact of conservation cropping and identify constraints and enabling policy options for uptake by farmers.

The project has generated data on adoption through household surveys both in Syria and in the Ninevah governorate. These data will be analysed, synthesized and gaps identified before additional data collection. The socio-economic component in Iraq requires the dedication of three key staff with at least MSc level in agricultural economics or equivalent with 'good' English language skills, who can work immediately with Dr. Saad, ICARDA and The University of Western Australia economists. This team of researchers will be supported by local field staff, trained enumerators and extension agents to collect information. The three researchers will dedicate at least 50% of their time to the project and will participate in all the training workshops for the socio-economic component and work plan meetings and possibly undertake study visits to ICARDA and Australia. The selection of these key researchers, their commitment and consistency to contribute to the

project outputs and to learn during the course of project implementation will be critical. ICARDA Senior Economist and UWA economist (Dr Amin Mugera) will support the socio-economic component. The implementation of this component will be launched with a methodology training workshop where the analytical framework will be discussed followed with successive workshops and interactions through visits and face-to-face and virtual meetings between the Iraqi team, ICARDA and UWA economists.

The data sources for this research are long-term conservation cropping field trials conducted at ICARDA, and also on-farm demonstrations, farm surveys, monitoring of ZT seeder manufacture, distribution and use, and statistical data from national archives in both Iraq and Syria. The main methods applied will include descriptive statistics, partial budget analysis, production function analysis using multiple regression models and frontier production function, binary adoption (logit and probit) models, and economic surplus models.

The project will endeavour to address gender issues in the surveys and socio-economic evaluations. However, as mentioned under 4.3.2, it needs to be recognised that gender issues in Iraq are complex and gender equity needs to be considered sensitively with respect to cultural and religious norms. It should also be understood that sensitivities to gender in relation to employment in Iraq are significant and gender equality is neither easily analysed nor addressed. Where possible, survey information will be disaggregated by gender and evaluated to understand and identify ways of benefiting males and females equitably and appropriately.

Activity 4.1: Analyse improved technology option performance, profitability, WUE, and acceptance by farmers

Benefit cost analysis of improved conservation cropping (including zero till and improved management practices) will be applied using enterprise budget analysis for different crops and production systems using data already generated in Ninevah governorate and Syria and additional data that will be generated from the new demonstrations in new governorates in Iraq.

Different performance indicators including productivity, profitability (net returns), cost saving, average unit cost of production and breakeven conditions will be used to compare ZT and CC systems in governorates where the technology has spread in Iraq and Syria. Data from farm surveys and demonstrations will be used for this analysis.

The effects of conservation cropping on production efficiency and resource use in Ninevah governorate (and possibly the three new governorates) and in Syria will be analysed using frontier production analysis and other quantitative techniques.

Activity 4.2: Assess effectiveness of improved management options on adaptive capacity of local communities to climatic variability

Conservation cropping reduces costs, often gives higher yields and increased net returns, and can also reduce yield and income variability which is particularly important in dry areas. The risk mitigating effects of conservation cropping will be analysed with production function and risk analysis methods including stochastic dominance methods using multi-year yield data, costs and returns of farmers using conservation and conventional cropping systems in Syria.

Activity 4.3: Monitor adoption of improved technologies and identify constraints and provide possible solutions

Existing household surveys in Ninevah governorate and Syria will be analysed and synthesized and additional baseline surveys conducted in districts surrounding the demonstration trials in the three new governorates in Iraq. Updated surveys covering main socio-economic variables may also be conducted in Ninevah and Syria. These baseline surveys will provide information on household characteristics, farm characteristics,

production practices, cropping patterns and farmer awareness and knowledge of different tillage options and other management practices.

The adoption patterns of conservation cropping and improved management technologies will be monitored through multi-year adoption surveys in Iraq and Syria. This will allow long-term projections of technology diffusion, essential for aggregate impact assessment.

The determining characteristics of adoption in Iraq and Syria will be identified by applying logistic and multiple regression methods to data generated from the adoption surveys and will allow identification of perceived benefits of conservation cropping and the significant drivers (determinants) or factors associated with the adoption particularly among autonomous adopters who do not receive direct support from the project.

Land tenure could be an important determining factor of adoption, as large land owners and investors make the decisions on tillage practices, based on share-cropping and contract farming arrangements. But as small-scale farmers realise the substantial benefits and cost reductions, this technology may also change sharecropping arrangements so small-scale farmers can access and benefit from the technology. This dual role of land tenure in conservation cropping adoption and impacts on the institutional arrangements of contract or share cropping will be analysed.

Constraints to adoption will be determined from adoption monitoring surveys and interviews with machinery service providers, seeding contractors, farmers who purchased ZT seeders or modified their own seeders and machinery manufacturers. Understanding this chain of stakeholders (or impact pathway) in technology diffusion is critical in making institutional and policy recommendations.

The project will endeavour to identify other projects and NGOs involved in developing and promoting ZT, and evaluate their roles in assisting with beneficiary advocacy in lease and contract agreements and improving local credit availability for seeder purchase.

Activity 4.4: Assess the impacts of conservation cropping

The data collected in activities 4.1 through 4.3, projections of future technology adoption based on farm surveys, and crop production data from national statistics will be used to assess economic impacts of conservation cropping at the national level using practical equilibrium models in Iraq and Syria.

Using per unit cost reduction of conservation cropping, prices, and research and development costs, as well as projected technology adoption patterns, the economic surplus model will allow estimation of gross and net returns to research investment. The impact of the technology on food security in terms of increased food production (downward shift of the supply curve) and on household income (livelihood improvement and poverty reduction) will also be quantified. These aggregate estimates will show the potential impacts of the technological change and provide information to justify national policies that support wide adoption in Iraq and Syria.

Activity 4.5: Identify enabling policy and institutional options

A review of agricultural policies will be conducted from available reports from other projects, Ministry of Agriculture and international organisations such as FAO, covering Iraq and Syria. Personal interviews will be conducted with key officials in relevant departments in the Ministry of Agriculture to understand how different policies are implemented.

The effects of current policies in Iraq and Syria on the adoption of conservation cropping and related technologies will be described from interviews of research and extension staff, farming communities, input traders and machinery manufacturers. This will include the role of high wheat prices in encouraging cereal monocultures and discouraging farmers from growing legumes and other break crops, which have lower, more volatile unsubsidized prices, and any implications for sustainability of cropping systems.

New policies or policy changes that can positively affect the uptake of conservation cropping and other improved crop management will be identified for Iraq and Syria. These policies may include price policies, access to credit for machinery acquisition, mechanisms for supporting farmer interest groups and policies that govern seed systems.

The role of NGOs (such as Aga Khan Foundation) and other organisations in both Iraq and Syria will be documented and lessons learned will be synthesized and disseminated for promoting alternative institutional support of technology dissemination through non-government and civil society organisations.

Policy impact briefs targeting relevant policy-decision makers in Iraq and Syria will be developed showing the role of policy in technology uptake and benefits of policy changes.

Objective 5: Enhance capacity of Iraqi research and extension institutions to develop and promote conservation cropping.

The training emphasis will be on skills and technologies related to better understanding, issues and constraints related to development and extension of conservation cropping in relation to agronomy, germplasm evaluation, participatory extension, ZT seeder development, statistical analysis, socio-economics and seed production.

Trainees will be nominated/selected according to the following criteria and qualifications:

- active and qualified in topic of training
- supported and keen to use what is learnt on return (implement and train)
- diversity (age, gender)
- mix of scientists, technicians and farmers (Iraq/Syrian)

Activity 5.1: Raise awareness and provide training in Ninevah for Iraqis (managers, scientists, extension officers, farmers)

Awareness, understanding and expertise in ZT cropping systems will be developed in the 10 new Ninevah districts and three new governorates through study and discussion visits to Ninevah, hosted by project partners under the Mosul Center for Agricultural Research in Dry Areas, at the University of Mosul. Each visit will involve 15 persons for 7 days in the following areas:

- ZT agronomy (3 visits Yr 1, 3 visit Yr 2)
- ZT seeders (2 visits Yr 1, 2 visit Yr 2)
- farmer seed production (2 visits Yr 1, 2 visit Yr 2)
- field day (1 visit Yr 1, 1 visit Yr 2)
- media visit (1 visit Yr 1, 1 visit Yr 2)

Activity 5.2: Provide short- and medium-term training and joint data analysis at ICARDA presented by Australian and ICARDA scientists

Undertake selected short-term (1–4 weeks) on-the-job and coursework training relevant to project activities related to conservation cropping development in the following areas:

- scientific and report writing (10 persons x 14 days x 2 visits, Yr 1, 2)
- participatory extension (15 persons x 14 days x 2 visits, Yr 1, 2)
- ZT seeder fabrication-operation (8 persons x 14 days x 4 visits, Yr 1, 2)
- statistical analysis (10 persons x 14 days x 2 visits, Yr 1, 2)
- ZT agronomy research (2 persons x 28 days x 4 visits, Yr 1, 2)
- farmer visit (20 farmers x 7 days x 3 visits, Yr 1, 2, 3)

- seed variety maintenance and production (10 persons x 14 days x 2 visits, Yr 1, 2)
- seed enterprise management (10 persons x 14 days x 3 visits, Yr 1, 2, 3)
- socio-economic evaluations (10 persons x 14 days x 3 visits, Yr 1, 2, 3)
- socio-economic students (3 persons x 2 months x 3 visits, Yr 1, 2, 3)

Activity 5.3: Continue long-term training/joint research and MSc/PhD graduate research at Australian partner Universities

Five Iraqi scientists will undertake 2–6 month study visits to Australia as follows:

- three study visits to the University of Western Australia: one socio-economist, 2 months, already budgeted for in previous project; plus one agronomist, 6 months and one socio-economist, 6 months, on current budget;
- two study visits to the University of South Australia/UniAdelaide (ZT design and operations counterparts, 3 weeks April–May 12)

Five Iraqi researchers from MOA, who arrived in Australia in January 2011, are undertaking English language training in preparation for postgraduate studies at the University of Adelaide (two MSc in salinity and socio-economics, one PhD in plant breeding) and The University of Western Australia (two MSc in agronomy and geographic information systems), and these studies will continue during the project. A further MSc candidate from the University of Mosul (replacing a PhD trainee terminated in 2010) will be selected to undertake a MSc in agronomy at The University of Western Australia.

Activity 5.4: Support participation of Iraqi collaborators in relevant workshops and conferences

Some support will be given to selected Iraqi scientists to attend regional or international conferences. Support for participation will be determined by the following factors:

- whether the request is supported by Iraqi institutions
- the relevance of the workshop to project activities
- approval by project management.

5.2 Activities and outputs/milestones

The aim, outcomes and component objectives of the project will be achieved by implementing the activities listed under each objective in Sections 3 and 5. The verifiable indicators, means of verification and risks related to the higher-order project logic are listed below.

Project logic	Verifiable indicators	Means of verification	Key assumptions/risks
Aim: Promote adoption of conservation cropping practices and increase crop productivity, profitability and sustainability in the drylands of northern Iraq	Production, profitability and sustainability of conservation cropping systems	Baseline studies Adoption/impact surveys Follow-up case studies of randomly-selected farmers and households Cost-benefit analysis	Security situation allows scientists, machinery manufacturers, contractors and farmers to operate effectively in Iraq and Syria
Outcomes			
1: wide adoption of conservation cropping systems by farmers in Ninevah and surrounding governorates	# farmers and contractors using ZT Areas adopted # seeder manufacturers and ZT seeders sold	Adoption/impact surveys Follow-up case studies of randomly-selected households Cost-benefit analysis	Security situation allows scientists, machinery manufacturers, contractors and farmers to operate effectively in Iraq and Syria

2: active R&D program on continued development, monitoring and adaptation of conservation cropping in northern Iraq	Conservation cropping technology advance: - improved crop management and varieties - improved ZT seeders	Project presentations, reports, workplans Surveys of village seed production Surveys/interviews and field inspections of farmers and contractors	Security situation allows scientists, machinery manufacturers, contractors and farmers to operate effectively in Iraq and Syria
3: improved technical capacity of Iraqi scientists and extension officers in conservation agriculture, and improved capacity by agricultural institutions/projects to plan and implement development programs	# staff trained Use of project-provided enhancements in R&D	Training reports Observations, discussions, institution records	Security situation and institutional support allows scientists to operate effectively in Iraq and Syria
Objectives			
1. Promote wide adoption of conservation cropping (zero tillage, stubble retention) in Ninevah and surrounding governorates where dryland crops are prominent (Kirkuk, Salahahdin, Anbar)	# demonstrations # field days # farmers using conservation cropping technologies	Annual workplans and technical reports Adoption/impact evaluation	Security situation in villages allows demonstrations and field visits/days to proceed in Iraq and Syria
2. Evaluate and adapt technologies to optimise production and sustainability of cropping systems through research across collaborator sites in Ninevah, ICARDA, South Australia and Western Australia on better crop establishment and management and improved germplasm	# research trials # 'new' crop management technologies and varieties identified/verified # 'new' crop management technologies and varieties moving into demonstration testing	Annual workplans and technical reports	Security situation allows research program in Iraq and Syria to proceed
3. Develop and promote efficient and sustainable farmer-based seed production and supply systems	# operational village-based seed enterprises Amount of local seed traded	Annual workplans and technical reports Surveys Discussions, inspections, institution records	Security situation allows Iraq program to proceed SBAR and UM capacity to implement activities and provide facilities (equipment, storage) Farmer involvement in local seed production and marketing business Availability of qualified staff dedicated to seed units
4. Monitor and evaluate adoption and impact of conservation cropping and identify constraints and enabling policy options for uptake by farmers	# M & E surveys New/revised operations and policies to enhance adoption/impact	Annual workplans and technical reports Technical position papers MOA and Uni Mosul strategies and policies	Available data from demos/trials Security situation allows socio-economists to operate effectively in Iraq and Syria

5. Enhance capacity of Iraqi research and extension institutions to develop and promote conservation cropping	# ICARDA training courses # training/study visits to Australia Use of project-provided enhancements in R&D	Annual workplans and technical reports Training reports Annual reporting	Availability/nomination of trainees with required criteria Iraqis able to travel to training Institutional support for returning trainees to implement programs in Iraq

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

Objective 1: Promote wide adoption of conservation cropping (zero tillage, stubble retention) in Ninevah and surrounding Governorates where dryland crops are prominent (Kirkuk, Salahahdin, Anbar).

No.	Activity	Outputs/ milestones	Due date of output/ milestone	Risks / assumptions	Applications of outputs
1.1	Demonstrate and promote uptake of ZT cropping widely in Ninevah districts	ZT interest groups functional in 10 new districts as well as 11 existing districts Established demos and information generated in10 new districts Field walks/field days with interest groups conducted during season Targeted trials conducted to fine-tune ZT technologies in demonstrations within existing districts and information available to new growers	Yr 1, 2	Commitment and staff available in new locations and governorates	Demonstrated practices and technologies adopted by participating farmers
1.2	Develop awareness and experience and encourage evaluation and uptake of ZT cropping in surrounding governorates	Established linkages and working relationship with key players such as DoA, relevant universities, relevant Departments of MoA, SBAR, seed industry, machinery manufactures and farming community Study tour of key stakeholders to Ninevah Province and ICARDA Establishment of two ZT interest groups in each new governorate Establishment of ZT demonstrations in 3 new governorates (each having 2 districts with demos in Yr 1 and 4 districts with demos in Yr2 and Yr3) Field walks and field days conducted during growing season involving the interest groups	Yr 1, 2, 3	Commitment and staff available in new locations and governorates	Improved awareness among stakeholders and effective participation in program at local level Demonstrated practices and technologies adopted by participating farmers
1.3	Facilitate farmer access to locally fabricated or modified ZT seeders for testing and evaluation	Technical and financial support for ZT modification of conventional seeders and fabrication of ZT seeders Increased availability of ZT machinery to all interest groups Increased local expertise and capacity to manufacture ZT machinery Wide testing and uptake of ZT by Iraqi (PC) and Syrian farmers (ICARDA)	Yr 1, 2, 3	Availability and cost of fabrication material locally Post-manufacture technical support for smooth operation of ZT machinery	ZT machinery accessible to farmers in the region and CA technologies widely adopted

PC = partner country, A = Australia, ICARDA

Objective 2: Evaluate and adapt technologies to optimise production and sustainability of cropping systems through research across collaborator sites in Ninevah, ICARDA, South Australia and Western Australia on better crop establishment and management and improved germplasm.

No.	Activity	Outputs/milestones	Due date of output/ milestone	Risks/ assumptions	Applications of outputs
2.1	Investigate, verify and adapt conservation cropping technologies including agronomic practices, rotations, residues, crop-livestock interaction, pest-disease-weed dynamics, soil fertility-structure-biology dynamics and germplasm adaptation	*Iraq* Experiments established/maintained; information provided by UniMosul on crop management under conservation cropping with a specific focus on drought tolerance For wheat, barley, lentils and chickpeas, one variety of each nominated for release and certification Application made for approval for release of nominated varieties Multi-site evaluation information to support release provided by SBAR (Mosul) of a small number (1–3) of identified priority lines using ZT technology, addressing criteria specified by the Variety Release Committee *ICARDA* Continuation of long-term sites with a range of agronomic options such as rotations and crop sequencing, residue dynamics and crop management *Australia* Appointment of Research Associate associated with the UWA experiments Experimental sites established by UWA to determine effects of weed management and crop residues on disease and pests, and impacts of livestock grazing on soil and water dynamics and farm profitability Appointment of postdoctoral position associated with UA experiments Field surveys conducted by UA on long-term ZT fields at a range of sites (e.g. south-east Australia, Iraq, Syria) to provide background understanding of key soil biological processes Existing conservation tillage sites in SA where residues can be managed used to investigate N and C cycling, soil moisture retention, and soil biology	July 12-June 15 July 12 - June 13 July 12 - June 13 July 12 - June 13 July 12–June 15 July 12 July 12–Dec 15 July 12 July 12–Dec 13 July 12–Dec 14	Sufficient seed availability Seasonal constraints Suitable applicants available Timely initiation Suitable applicants available Timely initiation	Knowledge to reduce yield gaps used to develop and promote conservation cropping in Iraq Final field testing info supporting approval for variety release Release of varieties Seed to move into seed prodn system Improved understanding of the roles of agronomy, weeds, crop residues and grazing on soils, soil H_2O, soil biological processes, N and C cycling, pests and diseases, etc., used to optimise production, profitability and sustainability and support development, promotion and adoption of conservation cropping
2.2	Fabricate, modify, evaluate and improve locally-made ZT seeders in conjunction with manufacturers and farmers	Appointment of two machinery counterparts as in-country leaders Orientation visit by counterparts to UniSA to coincide with seeding time Identification of key issues for improvement of performance and durability of ZT seeders Improved functional and adaptive performance of ZT machinery and involvement of key farmer groups in Iraq and Syria	July–Aug 12 Mar–Jun 13 Jul 12–Jun 15 July 12–Jun 15	Appropriate applicants available and appointed for training	Established process for on-going ZT machinery improvement through involvement of in-country machinery counterparts in the activities of farmer groups

2.3	Select appropriate technologies for promotion in the extension program under Objective 1	Outputs from 2.1 and 2.2 reviewed to evaluate and modify approaches and appropriate technologies selected to improve ZT seeder performance and promotion	At each planning meeting		

PC = partner country, A = Australia, ICARDA

Objective 3: Develop and promote efficient and sustainable farmer-based seed production and supply systems.

No.	Activity	Outputs/ milestones	Due date of output/ milestone	Risks/ assumptions	Applications of outputs
3.1	Provide promising new crop varieties-lines from ICARDA for Iraqi research, extension and seed production	Foundation seed of elite lines/varieties of wheat, barley, oats, chickpea, lentil, field pea, safflower, vetch supplied (10–100 kg)	Yr 1, 2, 3	No perceived risk	Breeder seed transferred to Nineveh for further multiplication, registration and potential release
3.2	Develop a functional seed unit within the agricultural research system at Rashidiya RS and Mosul University to provide seed for research, demos and multiplication	Identification and supply of small equipment needs for two seed units	Yr 1, 2	No perceived risk	Equipment purchased and provided to two seed units
		Provision of training on breeder and foundation seed production at ICARDA (linked to Objective 5)	Yr 1, 2		Trainees identified and training provided at ICARDA
		Provision of sufficient seed of germplasm and varieties for trials and demos in Ninevah and adjacent provinces	Yr 1, 2, 3		Relevant germplasm included in further evaluation and demonstration trials on station and farmer fields

3.3	Develop sustainable farmer/village -based seed production systems	Consolidation of existing individual seed producers (18) involved in local seed production and marketing under provincial seed producers association and identification of common issues such as technical (production, equipment, storage) and business operation (planning, management, marketing, etc) for improvement Three additional seed production and marketing networks established based on needs assessment in the new governorates and linked to the Nineveh network (MU and SBSTC) Group training undertaken for farmers, extension services and other stakeholders on seed production technology and financial and enterprise management (linked to Objective 5) Monitoring and evaluation of technical and economic performance of VBSEs (seed demand survey, business plans, profitability assessment) completed and used to improve performance (linked to Objective 4)	Yr 1, 2 Yr 2, 3 Yr 1, 2, 3 Yr 1, 2, 3	Farmer willingness to enter local seed production and marketing business Availability of new crop varieties adapted to northern Iraq environments Government policy in relation to seed price	Availability and accessibility of quality seed to farmers Profitable and sustainable local seed businesses

PC = partner country, A = Australia, ICARDA

Objective 4: Monitor and evaluate adoption and impact of conservation cropping and identify constraints and enabling policy options for uptake by farmers.

No.	Activity	Outputs/ milestones	Due date of output/ milestone	Risks/ assumptions	Applications of outputs
4.1	Analyse improved technology option performance, profitability, WUE and acceptance by farmers	Farm level analysis of: • benefit & costs of ZT technology in different production systems in Iraq and Syria • conservation cropping effects on production and resource use efficiency in Iraq and Syria	Yr 1 Yr 3	Effective socio-economic team (see methodology) in place	Enhanced awareness of benefits of conservation cropping among stakeholders
4.2	Assess effectiveness of improved management options on adaptive capacity of local communities to climatic variability	Better understanding of conservation cropping effects on farmers' resilience to risks in Iraq and Syria	Yr 3	Effective socio-economic team (see methodology) in place	Science-based support generated for conservation cropping adoption at local and national levels
4.3	Monitor adoption of improved technologies and identify and provide solutions to constraints	Understanding and documentation of diffusion of ZT technology and farmers' perceptions in Iraq and Syria Determinants of ZT technology adoption established, constraints identified and recommendation provided in Iraq and Syria	Yr 1, 2, 3 Yr 3	Slow progress in the supply of technology to farmers may limit observed adoption	Strategies for alleviating constraints to technology adoption developed and used

4.4	Assess the impacts of conservation cropping	Understanding, quantification and documentation of economic impacts of ZT technology in Iraq and Syria	Yr 3	Slow progress in the supply of technology to farmers may limit observed adoption	Increased awareness of and investment in conservation cropping R&D
4.5	Identify enabling policy and institutional options	Policies and strategies for the enhancement and promotion of ZT technologies developed and communicated to policy-decision makers in Iraq and Syria	Yr 2, 3	Effective socio-economic team Slow supply of technology to farmers may limit observed adoption	Policies that support development and adoption of conservation cropping technology implemented

PC = partner country, A = Australia, ICARDA

Objective 5: Enhance capacity of Iraqi research and extension institutions to develop and promote conservation cropping.

No.	Activity	Outputs/ milestones	Due date of output/ milestone	Risks/ assumptions	Applications of outputs
5.1	Raise awareness and provide training in Ninevah for Iraqis (managers, scientists, extension officers, farmers)	Increased awareness and expertise in 10 new Ninevah districts and three new governorates (15 persons x 7 days per visit) of: • ZT systems (3 visits Yr 1, 1 visit Yr 2) • ZT seeders (2 visits Yr 1, 1 visit Yr 2) • seed prodn (2 visits Yr 1, 1 visit Yr 2) • field day (1 visit Yr 2) • media visit (1 visit Yr 2)	Yr 1, 2	Selection and involvement of suitable trainees and capacity to travel	Expertise in developing and promoting ZT systems and seed production in new districts and governorates
5.2	Provide short- and medium-term training and joint data analysis at ICARDA presented by Australian and ICARDA scientists	Increased expertise in: • scientific and report writing (10 persons x 14 days x 2 visits, Yr 1, 2) • participatory extension (15 persons x 14 days x 2 visits, Yr 1, 2) • ZT seeder fabrication (8 persons x 14 days x 4 visits, Yr 1, 2) • statistical analysis (10 persons x 14 days x 2 visits, Yr 1, 2) • ZT agronomy research (2 persons x 28 days x 4 visits, Yr 1, 2) • farmer visit (20 farmers x 7 days x 3 visits, Yr 1, 2, 3) • seed production (10 persons x 14 days x 2 visits, Yr 1, 2) • seed enterprise management (10 persons x 14 days x 3 visits, Yr 1, 2, 3) • socio-economic evaluations (10 persons x 14 days x 3 visits, Yr 1, 2, 3) • socio-economic students (3 persons x 2 months x 3 visits, Yr 1, 2, 3)	Yr 1, 2, 3	Selection and involvement of suitable trainees and capacity to travel	Expertise in developing and promoting ZT systems and seed production in new districts and governorates

5.3	Continue long-term training/joint research and MSc/PhD graduate research at Australian partner universities	Increased expertise in conservation cropping-related technologies 3 study visits to UWA (agronomist, 6 months; socio-economist, 6 months; socio-economist, 2 months) 2 study visits to UniSA/UniAdelaide (ZT design and operations counterparts, 3 months Mar–May 12) 4 MSc and one PhD graduate (commenced Jan 2011) 1MSc graduate UWA (to commence 2012)	Yr 1, 2 Yr 1 Yr 3 Yr 3	Selection and involvement of suitable trainees and capacity to travel	Expertise in developing ZT systems for Iraq
5.4	Support participation of Iraqi collaborators in relevant workshops and conferences	Conference attendance and report	For relevant events and selected scientists	Selection and involvement of suitable trainees and capacity to travel	Exposure to international research generating new partnerships and research opportunities

PC = partner country, A = Australia, ICARDA

5.3 Project personnel

5.3.1 List of participants involved in the project

Australian commissioned and collaborating organisations (or IARC)

Name	Sex M/F	Agency and position	Discipline and role in project	Time input (%)	Funding
Dr Kamel Shideed	M	ICARDA	Chairman, Project Steering Committee	10	ICARDA
Dr Nasri Haddad	M	ICARDA	West Asia Regional Coordinator	10	ICARDA
Project leader	M	ICARDA	Project management	100	ACIAR
Dr Colin Piggin	M	ICARDA	Agronomy and project management	25	ACIAR
Dr David Feindel	M	ICARDA	Cropping Systems Agronomist	20	ACIAR
Dr Rolf Sommer	M	ICARDA	Soil scientist/modelling	10	ACIAR
Dr Aden Aw-Hassan	M	ICARDA	Socio-economist	10	ACIAR
Dr Seid A Kemal	M	ICARDA	Pulse pathologist	10	ACIAR
Mr Atef Haddad	M	ICARDA	Agronomist	100	ACIAR
Mr Yaseen Khalil	M	ICARDA	Agronomist	100	ACIAR
Dr Zewdie Bishaw	M	ICARDA	Seed Production	10	ACIAR
Mr Abdul Aziz Niane	M	ICARDA	Seed production	10	ACIAR
Socio-economist (consultant)		ICARDA	Seed and business economist	15	ACIAR
Prof. Kadambot Siddique	M	UWA	Crop physiologist-agronomist	10	UWA
Assistant Prof. Ken Flower	M	UWA	Agronomist	10	ACIAR
Assistant Prof. Amin Mugera	M	UWA	Socio-economist	10	ACIAR

Dr Jens Berger	M	UWA/CSIRO	Plant eco-physiologist-statistics specialist	10	ACIAR
Adjunct Prof.Wal Anderson	M	UWA	Agronomist	10	ACIAR
Prof. David Coventry	M	UniAdelaide	Crop-soil agronomist	10	ACIAR
Dr Matthew Denton	M	UniAdelaide	Agronomist	10	UA
Dr Jim Fortune	M	Rural Solution - UniAdelaide	Participatory extension specialist	10	ACIAR
Dr Jack Desbiolles	M	Ag Machinery Centre, UniSA - UniAdelaide	On-farm machinery engineer	10	ACIAR

Partner country institution(s) or collaborating IARC

Name	**Sex M/F**	**Agency and position**	**Discipline and role in project**	**Time input (%)**	**Funding**
Dr Kasim Ahmed Saliem	M	Deputy Director General, SBAR, MOA Baghdad	Project coordinator	20	MOA
Dr Abdulsattar A. Alrijabo	M	Assistant Professor, UniMosul	Project leader and agronomist	50	Uni Mosul
Mr Muhanna AlTak		Manager, DOA, Ninevah	Technology extension	20	DOA
Dr Saad Hatem Mohamed	M	Head, Training Center, SBAR-Baghdad	Agricultural economist	20	SBAR
Mr Ali Jasm	M	Director, SBAR-Ninevah	Agricultural economist	20	SBAR
Dr Kasim Khalil Kasim	M	SBAR-Ninevah	Forage agronomist	50	SBAR
Mr Raad Ahmed Hameed	M	SBAR-Ninevah	Barley breeder	20	SBAR
Dr Maan M. Salih	M	SBAR-Ninevah	Legume breeder	20	SBAR
Mr Younis Hamdoun Kassem	M	SBAR-Ninevah	Seed production	20	SBAR
Dr Saad Al Malk	M	SBAR-Ninevah	Soil management	20	SBAR
Mr Mehanna Abdulrahman	M	SBAR-Ninevah	Seed production	20	SBAR
Dr Thiab Ahmad Qasim	M	SBAR-Ninevah	Weed control	20	SBAR
Mr Jamal Abdul Fatah Yousif	M	SBAR-Ninevah	Wheat breeder	20	SBAR
Mr Anmar Tarik Ahmad	M	SBAR-Ninevah	Seed production	20	SBAR
Mr Khalil Ibrahim Dabo	M	SBAR-Ninevah	Agronomist	20	SBAR
Mr Zeyad Abdul Raza Majeed	M	SBAR-Ninevah	Extension	20	SBAR
Dr. Nahil Mohammed Ali	M	Dean College of Agriculture and Forestry, UniMosul	Research management	10	Uni Mosul
Dr Ahmad M Sultan	M	UniMosul	Weed control scientist	20	Uni Mosul
Dr Hesham M Hassan	M	UniMosul	Soil physics scientist	20	Uni Mosul
Dr Salim H Antar	M	UniMosul	Weed control scientist	20	Uni Mosul
Dr Khalid H Taha	M	UniMosul	Plant protection	20	Uni Mosul

Dr Mohammed Yousif Al-Fahady	M	UniMosul	Crop breeder	20	Uni Mosul
Dr Mohammed S. Al-Taweel	M	UniMosul	Crop breeder	20	Uni Mosul
Dr Suaad Irdeny Abdullah	F	UniMosul	Plant protection	20	Uni Mosul
Dr Saad Abdul Jabbar Sameer	M	UniMosul	Agricultural mechanisation	20	Uni Mosul
Dr Salim Younis Al Niaamy	M	UniMosul	Economics	20	Uni Mosul
Dr Emad Yousif Ismael Abdullah	M	UniMosul	Economics	20	Uni Mosul
Mr. Jaafar Sedeeq Saeed	M	DOA Ninevah	Technology extension	20	DOA
	M	DOA Ninevah	Seed specialist	20	DOA
Mr Haydar Nasser Al-Sammak Bhajat	M	DOA Ninevah	Computer engineer, knowledge management and presentation	20	DOA
	M	Agricultural Engineer, DOA Ninevah	Responsible for LRA activities	50	DOA
Mr Hazem Aziz Saleh	M	Agricultural Engineer, DOA Ninevah	Responsible for MRA activities	50	DOA
Mr Abdul AlMoniem M. Mahmoud	M	Agricultural Engineer, DOA Ninevah	Responsible for HRA and SI activities	50	DOA
Mr Mohana Fathel Al Taha	M	Director, Analytical Laboratory, DOA Ninevah	Plant and soil analysis	50	DOA
Mr Kofayl Burhan Al Ummary	M	Manager, Al Hatra District (LRA), DOA Ninevah	Management of demonstrations and extension	50	DOA
Mr Amir Hamdoun Shahab	M	Manager, Tell Abta District (LRA), DOA Ninevah	Management of demonstrations and extension	50	DOA
Mr Salim S. Esmael	M	Manager, Al Mahalabia District (LRA), DOA Ninevah	Management of demonstrations and extension	50	DOA
Mr Sabah Abd El-Ahad	M	Manager, Al Hamdania District (MRA), DOA Ninevah	Management of demonstrations and extension	50	DOA
Mr Emad Shakir Hermiz	M	Manager, Tell Kief District (MRA), DOA Ninevah	Management of demonstrations and extension	50	DOA
Mr Zuhair Salem Abou	M	Manager, Bashyqa District (MRA), DOA Ninevah	Management of demonstrations and extension	50	DOA
Mr Taha Ahmed Abd Al Azeez	M	Manager, Al Namroud District (MRA/SI), DOA Ninevah	Management of demonstrations and extension	50	DOA
Mr Sami Ibrahim Mustafa	M	Manager, Al Qush District (HRA), Ninevah DOA	Management of demonstrations and extension	50	DOA
Mr Haji Mohammad Yakub	M	Manager, Al Shykhan District (HRA), DOA Ninevah	Management of demonstrations and extension	50	DOA
Mr Mohamed Sadeq Hassan	M	Manager, Rabiaa District (HRA and HRA/SI), DOA Ninevah	Management of demonstrations and extension	50	DOA
Mr Qahtan S. Ibrahim	M	SBSTC - Ninevah	Seed inspection and registration	20	SBSTC

Mr Eesam Y. Saied	M	SBSTC - Ninevah	Seed inspection and registration	20	SBSTC
Director	M	DOA - Anbar	Governorate management of project		
Adel Murshed Mutlak	M	Team Manager, Monitoring Department DOA - Anbar	District management of project	50	DOA
Ammar Waees Aqool	M	Agronomist, Monitoring Department, DOA - Anbar	Planning and monitoring	50	DOA
Nader Yousef Ahmed	M	Agronomist, Monitoring Department, DOA - Anbar	Planning and monitoring	50	DOA
Salam Ismaeel Ibraheem	M	Soil Lab. Manager, DOA - Anbar	Plant and soil analysis	50	DOA
Arkan Ali Mohammed	M	Soil Lab. Technician, DOA - Anbar	Plant and soil analysis	50	DOA
Qusay Kammash Mutlak	M	Soil scientist, Lands Department, DOA - Anbar	Soil management	50	DOA
Mohammed Khalaf Hamad	M	Extension Officer, DOA - Anbar	Extension	50	DOA
Naeem Abdullah Mutlak	M	Agronomist, Falloja District, DOA - Anbar	Management of demonstrations	50	DOA
Hisham Mohammed Ali	M	Agronomist, Kaeem District, DOA - Anbar	Management of demonstrations	50	DOA
Abdulghani Mustafa Abdulrazzaq	M	Agronomist, Anna District, DOA - Anbar	Management of demonstrations	50	DOA
District Manager	M	Rawa District, DOA - Anbar	Management of demonstrations	50	DOA
District Manager	M	AlBaghdadi District, DOA - Anbar	Management of demonstrations	50	DOA
Zead Abood Saeed	M	Director, DOA - Salah Aldin	Governorate management of project	50	DOA
Fadhel Ahmed Ameen	M	Manager, Statistics Dept, DOA - Salah Aldin	Planning, monitoring and evaluation	50	DOA
Ameer Saaod Alwan	M	Manager, Planning Dept, DOA - Salah Aldin	Planning and management	50	DOA
Naseem Abdulhameed Hassan	M	Manager, Plant Production Dept, DOA - Salah Aldin	Planning and implementation	50	DOA
Abdulkareem Shab Taresh	M	Extension officer, Extension Center, DOA - Salah Aldin	Planning and implementation	50	DOA
Omar Sarhan	M	Extension officer, Extension Dept, DOA - Salah Aldin	Planning and implementation	50	DOA
Abed Farhan Fadhel	M	Manager, Al Door District, DOA - Anbar	Management of demonstrations	50	DOA
Hadi Ahmed	M	Manager, Al Tooz District, DOA - Anbar	Management of demonstrations	50	DOA
Mahdi Mubarak Hameed	M	Director, DOA - Kirkuk	Governorate management of project	50	DOA
Mardan Hameed Mardan	M	Deputy Director, DOA - Kirkuk	Governorate management of project	50	DOA
Hassan Habeeb Hassan	M	Agronomist, Kirkuk University	Agronomy teaching and research	50	DOA
Sarmad Kareem Khalil	M	Manager, Dakook District, DOA - Kirkuk	Management of demonstrations	50	DOA

Abdullah Hamad Jrad	M	Manager, AlAbbasi District, DOA - Kirkuk	Management of demonstrations	50	DOA
Adel AbdulAziz Abdullah	M	Manager, Shwan District, DOA - Kirkuk	Management of demonstrations	50	DOA
Saleh Shahadha	M	Manager, Al Rashad District, DOA - Kirkuk	Management of demonstrations	50	DOA

5.3.2 Description of the comparative advantage of the institutions involved

ICARDA will lead and coordinate the project and staff will contribute technical expertise and assistance in cropping system management and germplasm improvement, including provision of seed and development of seed production capacity; participate in the planning, analysis and reporting of technical activities of the project; direct and assist in monitoring and evaluation of adoption and impact of project technologies; and implement ICARDA training and capacity building for Iraqi collaborators.

With over 30 years applied research experience in the region, ICARDA is uniquely placed to continue to manage, coordinate and provide technical assistance to the project. ICARDA is located in Syria on an experimental station with similar conditions to those in Iraq. Iraq lies within the eco-regional mandate of ICARDA and there has been collaboration with national programs since ICARDA was established in 1977. Over the years, ICARDA has shared lines from breeding programs with Iraq and improved varieties of wheat, barley, lentil and chickpea from ICARDA have been released to Iraqi farmers. For example, Rihane 3 barley is now grown by farmers on over 200,000 ha or 14% of the barley area in rainfed areas in northern Iraq. ICARDA's breeding programs continue to generate diverse material adapted to specific abiotic and biotic stresses, which will be used within the project.

ICARDA is the only CGIAR Center with a functional Seed Unit addressing seed system constraints to ensure impacts from research at farmer and community levels. The primary objective of the Seed Unit is to strengthen National Seed Systems, both formal and informal by: (i) supporting the public seed sector to become more effective and competitive, (ii) stimulating private seed sector participation through policy influence, (iii) designing alternative seed delivery systems for dry or marginal areas and resource poor farmers, and (iv) capacity development of human resources in the seed sector. The Seed Unit is involved in integrated and diverse activities both at headquarters and in the region executing a number of successful seed sector development projects. It will manage the seed production/distribution component in the project.

All implementation of the project in Iraq will be managed by Iraqi institutions. The Ministry of Agriculture (MOA) is responsible for agricultural research, development and regulation and will coordinate the project in Iraq through the Director General of the State Board for Seed Testing and Certification (SBSTC). This will provide access to Ministry management to facilitate implementation, especially for fund transfers and travel, and ensure project activities are consistent with Ministry priorities and mandate. Within the Ministry, SBAR is responsible for implementation of agricultural research in Iraq and has major research institutes in Baghdad and in all governorates. Within the project, SBAR-Baghdad has strong expertise in and will lead socio-economic research on evaluation of adoption and impact. SBAR-Ninevah will undertake crop improvement and management research at Rashidiya Research Station, which has land, facilities and staff to support the research program.

The University of Mosul (www.mosuluniversity.org/) was established in 1967 and is the second largest University in Iraq with 12 Colleges and seven Research Centres (including Remote Sensing), and a mandate for research and training of undergraduate and postgraduate (MSc and PhD) students. The College of Agriculture and Forestry has 11 Departments, including Departments of Field Crops, Agricultural Mechanisation, Plant Protection, Soil and Water, Agricultural Economics, Animal Resources, Agricultural Education. The College of Agriculture will lead the Project, and provide a major input into

research in crop improvement, crop management, machinery manufacture and socio-economic research and monitoring and evaluation. It has large research fields and will involve staff and students in project studies to provide both information and training. It has a strong agricultural engineering group and good links with farmers and machinery manufacturers and will have a major role in technology transfer and in development and promotion of ZT seeders.

The Directorate of Agriculture groups in Ninevah, Al Anbar, Salah Aldin and Kirkuk have the mandate to undertake agricultural extension, seed production and regulation activities within the governorate. The DOA Managers, together with the Project Leader (who was previously Manager DOA-Ninevah in the original project), will take a lead role in the extension component of the project, through the strong DOA network of District extension officers, facilities and machinery and close linkages with farmers and farm contractors. It will implement and manage demonstration sites, which are in farmer fields, and technology transfer through farmer involvement in demonstrations and field days. It has the mandate and good facilities for seed production/distribution and will help implement the seed production activities.

The UWA Institute of Agriculture at The University of Western Australia provides education, training and research in agriculture and resource management. It is involved with teaching, graduate and postgraduate training, research and agribusiness activities and integrates with other groups in the University with interests in agriculture, land and water management, rural economy, policy and development, food and health.

The Institute has access to highly qualified and internationally recognised researchers and teachers in a range of disciplines—especially in dryland agriculture—based in its various schools and Centres, with excellent contacts in and connections with industry. It has access to modern laboratory, glasshouse, lecture theatres and other field facilities.

Under consultancy with The University of Western Australia, Dr Jens Berger from CSIRO will run courses at ICARDA to strengthen the analytical capacity of Iraqi scientists and participate in project planning, especially in the design, analysis and interpretation of experiments. Jens will also assist with agronomy research.

The University of Adelaide provides specialist skills in crop agronomy, plant breeding, and system and extension development. The modern facilities and technologies at the Waite and Roseworthy campuses will provide excellent opportunities for the postgraduate training of Iraqi scientists.

PIRSA Rural Solutions will provide extensive experience in extension and rural sociology; gained through many participative projects with farmer groups and industry in South Australia and with ACIAR projects in China and India.

The Agricultural Machinery R&D Centre (AMRDC) at the University of South Australia conducts research and design activities over a wide range of engineering applications to agriculture. The AMRDC is a leader in tillage machinery research and development, particularly with no-till farming. The group has strong links with the agricultural machinery industry, collaborates actively on agricultural machinery research and development projects in Australia and overseas, conducts design and testing consultancies, offers postgraduate research training and carries out engineering teaching. The AMRDC will be a key partner providing engineering related input into the project.

5.3.3 Summary details of the role of each participant involved

Project leader will be a crop specialist with extensive Australian and international experience in leadership and research in agricultural research and development institutions and projects involving crops, pastures and livestock, including with AusAID and ACIAR. He will lead and coordinate the overall project and also have a key technical role in implementation of the conservation cropping component of the project.

Dr Kamel Shideed is an agricultural economist and Assistant Director of International Cooperation and Communication. Of Iraqi nationality, he was formerly Director of the IPA research institution in Baghdad. He will assist with project implementation and chairing the project steering Committee.

Dr Colin Piggin, an agronomist, was project leader during the first two phases of the project, and will provide assistance with project management and implementation and crop management R & D.

Dr Seid Kemal is a pathologist and will undertake research and assist with training in the monitoring and management of pests and diseases and in disease resistance, epidemiology and integrated pest management practices.

Dr Aden Aw-Hassan is a socio-economist and head of Socio Economic and Policy Research. He will lead the implementation of socio-economic surveys and in activities related to assessing the adoption and impact of improved agricultural technologies, with assistance from other socio-economists at ICARDA.

Dr Zewdie Bishaw is a seed production systems specialist and leads the Seed Unit in ICARDA. He will lead the component to develop an efficient and effective seed production capacity for farmer seed at a village level and for research seed at Rashidiya Research Station.

Mr Abdul Aziz Niane is a seed production specialist and will assist in the program to develop successful Village-Based Seed Enterprises in Ninevah. He will assist with transfer of experimental seed and procurement of capital equipment for the seed production component for Iraq.

Dr Rolf Sommer is a soil scientist and agrosystems modelling specialist. He will undertake research and training in soil, soil fertility and residue management.

Dr David Feindel is a cropping systems agronomist. He will take part in the agronomic ZT trials on station and on-farm and in-training activities of NARES partners.

Mr Atef Haddad and Mr Yaseen Khalil are research associates and agronomists. They will assist in all aspects of project coordination and interaction with partner institutions and especially with the linked agronomy research and extension program and agronomy training at ICARDA. They will also facilitate and manage project liaison with Syrian scientists, local machinery manufacturers and farmers.

Iraq

Ministry of Agriculture

Dr Kasim Ahmed Saliem (Project Coordinator) is the Deputy Director General, State Board for Agricultural Research (SBAR), MOA Baghdad. He will liaise with the management of MOA and facilitate project operations, selection of trainees, and financial management.

Mr. Sa'ad H. Mohamed is the Head of the Training Center, SBAR, Baghdad. He will lead the socio-economic monitoring and evaluation components of the project, with support from MOA, University of Mosul and ICARDA economists.

Dr Kasim Khalil Kasim is a forage specialist and Director of Research for the SBAR in Mosul. He has excellent linkages with the DOA District staff and will be involved in implementing the forage component of the project research and demonstration program.

Mr. Younis Hamdoun Kassem is an agricultural engineer in the SBAR at Rashidiya Experiment Station in Mosul. He will be involved in implementing the SBAR-Ninevah research component of the project.

Mr. Raad Ahmed Hameed is a barley breeder and Dr Maan Salih is a pulse breeder in the SBAR at Rashidiya Experiment Station in Mosul. They will be involved in implementation of the germplasm improvement component of the project in Ninevah.

University of Mosul

Dr Abdulsattar A. Al-Rijabo (Project leader) is an Assistant Professor and agronomist at the College of Agriculture College, University of Mosul. He has been the Iraqi Project Manager since the project started in 2005 and has excellent capability and experience in coordinating and integrating the components and institutions involved. He will coordinate the overall program in Ninevah and interact with other partner institutions through the Ninevah Implementation Committee. He will take a lead role in research and teaching in crop management/agronomy.

Dr. Salim Younis Al Niaamy is a Professor of Economics at the University of Mosul. He will be involved in implementing the socio-economic and monitoring and evaluation components in Ninevah.

Dr Emad Yousif Ismael Abdullah is an Assistant Professor of Economics at the University of Mosul. He will be involved in implementing the socio-economic and monitoring and evaluation components in Ninevah.

Dr Suaad Irdeny Abdullah is a Professor (Entomology) at Mosul University. She will provide IPM input into research and demonstration trials and student training.

Dr Abdul Jabbar Samir Saad is an Assistant Professor (Agricultural Mechanisation) at Mosul University. He will take a lead role in machinery development and promotion and training of students.

Dr. Nahil Mohammed Ali is the Dean of the College of Agriculture and Forestry. He will facilitate implementation, provision of facilities and involvement of staff and students.

Dr Ahmad M. Sultan is a Researcher at Mosul University. He will provide input into research and demonstration trials and student training.

Dr Hesham M. Hassan is a Researcher at Mosul University. He will provide input into soil and water science research and demonstration trials and student training.

Dr Salim H. Antar is a Researcher at Mosul University. He will provide input into weed research and demonstration trials and student training.

Dr Khalid H. Taha is a Researcher at Mosul University. He will provide input into IPM research and demonstration trials and student training.

Dr Mohammed Yousif Al-Fahady is a plant breeder at Mosul University. He will provide input into research and demonstration components of the project and into student training.

Dr Mohammed S. Al- Taweel is a plant breeder at Mosul University. He will provide input into research and demonstration trials and student training.

Directorate of Agriculture Ninevah

The following staff in the Directorate will manage and implement the project demonstration program on 22 sites in 21 Districts in Ninevah. This involves designing and locating the demonstrations, planting, managing, and measuring the crops, and analysing and reporting results and achievements. It also involves liaison with the farmers who own the land and organising farmer inspections and field days. Information and achievements will be incorporated into GIS systems to assist with planning and expansion of technologies to similar areas. The group will also host farmer visits from surrounding governorates. DOA support staff and machinery in the headquarters and districts will be involved in the implementation and management of all demonstration and extension activities:

Mr Muhanna AlTak leads the DOA program and is the Director of DOA - Ninevah

Mr. Jaafar S. Saied is the Manager of DOA - Ninevah.

Yet to be identified: Follow up/First sector in DOA - Ninevah, and responsible for the first sector (LRA).

Mr. Hazem Aziz Saleh works in the Follow up/Second sector in DOA - Ninevah and is responsible for the second sector (MRA).

Mr. Abdul AlMoniem M. Mahmoud works in the Follow up/Third Sector DOA - Ninevah and is responsible for the third sector (HRA) and supplementary irrigation (SI).

Mr. Haydar Nasser Al-Sammak is a computer specialist and works in the Computer Department in DOA - Ninevah.

Mr. Mohana Fathel Al Tak is Director of the Analytical Laboratory in DOA - Ninevah

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Mr. Kofayl Burhan Al Ummary is an Agricultural Engineer in the DOA - Ninevah and Manager of the Al Hatra Agricultural District (LRA).

Mr. Amir Hamdoun Shahab is an Agricultural Engineer in the DOA - Ninevah and Manager of Tell Abta Agricultural District (LRA).

Mr. Salim S. Esmael is an Agricultural Engineer in the DOA - Ninevah and Manager of Al Mahalabia Agricultural District (LRA).

Mr. Sabah Abd El-Ahad is an Agricultural Engineer in the DOA - Ninevah and Manager of Al Hamdania Agricultural District (MRA).

Mr. Emad Shakir Hermiz is an Agricultural Engineer in the DOA - Ninevah and Manager of Tel Kief Agricultural District (MRA).

Mr. Zuhair Salem Abou is an Agricultural Engineer in the DOA - Ninevah and Manager of Bashyqa Agricultural District (MRA).

Mr. Taha Ahmed Abd Al Azeez is an Agricultural Engineer in the DOA - Ninevah and Manager of Al Namroud Agricultural District (MRA/SI).

Mr. Sami Ibrahim Mustafa is an Agricultural Engineer in the DOA - Ninevah and Manager of Al Qush Agricultural District (HRA).

Mr. Haji Mohammad Yakub is an Agriculture Extension Officer in the DOA - Ninevah and Manager of Al Shykhan Agricultural District (HRA).

Mr. Mohamed Sadeq Hassan is an Agricultural Engineer in the DOA - Ninevah and Manager of Rabiaa Agricultural District (HRA and HRA/SI).

State Board for Seed testing and Certification, Ninevah

Mr Qahtan S. Ibrahim is a Manager and seed specialist in the SBSTC in Ninevah and will provide input into the seed production program through seed testing and certification and assisting with variety release.

Mr Eesam Y. Saied is a seed specialist in the SBSTC in Ninevah and will provide input into the seed production program through seed testing and certification and assisting with variety release.

Governorates of Al Anbar, Salah Aldin, Kirkuk

The following staff will manage and implement the project demonstration program in the four districts in each of Al Anbar, Salah Aldin and Kirkuk. This involves designing and locating the demonstrations, planting, managing, and measuring the crops, and analysing and reporting results and achievements. It also involves liaison with the farmers who own the land and organising farmer inspections and field days. Other MOA support staff and machinery in the headquarters and districts will be involved in the implementation and management of demonstration and extension activities as required.

(To be named) is the Director DOA is the head of DOA Anbar.

Adel Murshed Mutlak is the Team Manager, Monitoring Department DOA - Anbar District.

Ammar Waees Aqool is an Agronomist, Monitoring Department, DOA - Anbar.

Nader Yousef Ahmed is an Agronomist, Monitoring Department, DOA - Anbar.

Salam Ismaeel Ibraheem is a Soil Lab. Manager, DOA - Anbar.

Arkan Ali Mohammed is a Soil Lab. Technician, DOA - Anbar.

Qusay Kammash Mutlak is a Soil scientist, Lands Department, DOA - Anbar.

Mohammed Khalaf Hamad is an Extension Officer, DOA - Anbar.

Naeem Abdullah Mutlak is an Agronomist, Falloja District, DOA - Anbar.

Hisham Mohammed Ali is an Agronomist, Kaeem District, DOA - Anbar.

Abdulghani Mustafa Abdulrazzaq is an Agronomist, Anna District, DOA - Anbar.

(To be named) is the District Manager is head of Rawa District, DOA - Anbar.

(To be named) is the District Manager of AlBaghdadi District, DOA - Anbar.

Zead Abood Saeed is Director, DOA - Salah Aldin.

Fadhel Ahmed Ameen is Manager, Statistics Dept, DOA - Salah Aldin.

Ameer Saaod Alwan is Manager, Planning Dept, DOA - Salah Aldin.

Naseem Abdulhameed Hassan is Manager, Plant Production Dept, DOA - Salah Aldin.

Abdulkareem Shab Taresh is an Extension officer, Extension Center, DOA - Salah Aldin.

Omar Sarhan is an Extension officer, Extension Dept, DOA - Salah Aldin.

Abed Farhan Fadhel is a Manager, Al Door District, DOA - Anbar.

Hadi Ahmed is a Manager, Al Tooz District, DOA - Anbar.

Mahdi Mubarak Hameed is Director, DOA - Kirkuk.

Mardan Hameed Mardan is Deputy Director, DOA - Kirkuk Governorate.

Hassan Habeeb Hassan is an Agronomist, Kirkuk University.

Sarmad Kareem Khalil is Manager, Dakook District, DOA - Kirkuk.

Abdullah Hamad Jrad is Manager, AlAbbasi District, DOA - Kirkuk.

Adel AbdulAziz Abdullah is Manager, Shwan District, DOA - Kirkuk.

Saleh Shahadha is Manager, Al Rashad District, DOA - Kirkuk.

Australia

The University of Western Australia (UWA)

The Director of the UWA Institute of Agriculture (IOA) and relevant staff at The University of Western Australia will participate in project planning and progress review meetings; provide postgraduate training in relevant research areas to Iraqi staff nominated by the project; and provide professional training for selected Iraqi staff in conservation cropping and germplasm evaluation.

Professor Kadambot Siddique is the Chair in Agriculture and Director of IOA at UWA. He has extensive experience in production agronomy, germplasm enhancement, farming system research and development of grain crops in Australia and overseas, with involvement in overseas projects in India, Bangladesh, China, Pakistan, Nepal, East Timor, Turkey, Iraq, ICRISAT and ICARDA. He was a major contributor to the two phases of the Iraq–ICARDA–Australia project. He has supervised more than 20 PhD and MSc students (domestic and overseas) and also mentored a number of short-term trainees

from various countries (including Iraqi scientists). Professor Siddique will contribute to planning, implementation and critically analysing and publishing the data as technical and scientific papers. Professor Siddique will coordinate the UWA component through the IOA, especially for training of postgraduate students and short-term (6 months) Iraqi trainees.

Dr Ken Flower is an Assistant Professor in the School of Plant Biology and IOA at UWA in Production Agronomy and Farming systems. Dr Flower has extensive experience with no-tillage technology while working with Western Australian No-Tillage Farmers Association (WANTFA). He will contribute to the no-tillage aspect of the project and will be a co-supervisor of postgraduate students and short-term trainees.

Dr Amin Mugera is an Assistant Professor in the School of Agricultural and Resource Economics and IOA at UWA. His areas of expertise include socio-economics, sensitivity analysis and economic modelling. In addition to attending project planning meetings, Dr Mugera will be a co-supervisor of postgraduate students and short-term trainees in agricultural economics.

Dr Wal Anderson is an agronomist and Adjunct Professor within UWA IOA who has experience over many years in similar projects in Syria, Iraq, Jordan, Pakistan, Iran, Morocco and Lebanon. He will provide agronomic input into UWA, ICARDA and Iraq crop management R & D.

Dr Jens Berger from CSIRO will consult through UWA. He has worked in international agriculture, with CGIAR centres and NARS, for more than 20 years with a principal interest in dryland crop adaptation to terminal drought and genetic resources. He has considerable expertise in the analysis and interpretation of complex datasets, including genotype by environment studies, and training in Modern PC-based Data Handling and Statistical Methods. He will run courses at ICARDA to strengthen the analytical capacity of Iraqi scientists, tailored to suit the existing skill level of participants. He will participate in project planning, especially in the design, analysis,interpretation and reporting of experiments.

In addition to the above individuals, UWA will provide part-time postgraduate supervisors for MSc students in the project. Supervisors' specific time allocation will depend upon the nature of thesis topics and other research requirements.

University of Adelaide (UA)

Dr Matthew Denton will coordinate the overall input of the University of Adelaide into the project. David is a lecturer in agronomy and soil biology in the School of Agriculture, Food and Wine, Faculty of Sciences. He will focus on the development of best-practice agronomy and soil biology management in the research and demonstration components of the project and the coordination of training activities at the University of Adelaide.

Dr David Coventry is an agronomist and will provide support in the research on crop, residue and soil management at the University of Adelaide. He will attend project meetings and provide support to visiting trainees including supervision and mentoring of the Iraqi postgraduate students.

Dr Jim Fortune is an extension specialist and Consultant in International Farming Systems Development, Rural Solutions SA, Primary Industries and Resources South Australia, funded through the University of Adelaide component of the project. He has worked for over 30 years in extension and education in Australia and many overseas countries, with experience in ACIAR, AusAID and DAFF projects in the Middle East, Asia and north Africa. Jim will coordinate the planning and delivery of specialist participatory extension training at ICARDA.

Dr Jack Desbiolles is an Agricultural Research and Development Engineer in On-Farm Machinery at the University of South Australia, funded through the University of Adelaide component of the project, with a farming background and 20 years research experience. He has developed wide practical skills in applied and adaptive machinery research and

development, in the areas of soil tillage, no-till crop seeding, spraying and harvesting machinery. He has developed engineering research components and linkages with the farming industry and machinery manufacturers, integrated into on-farm participatory farming system programs at both local and regional levels in Australia. Jack' current interest also includes the development of integrated engineering solutions for conservation agriculture and small-scale farm mechanisation. He actively disseminates research findings to support broad-scale adoption in the grain growing industry. Jack will provide support in ZT machinery development/modification, particularly by providing work experience opportunities in South Australia for two Iraqis, as well as coordinating ZT machinery-related training and workshops at ICARDA and facilitating ZT seeder development with researchers and farmers in Iraq and Syria.

In addition to the above individuals, Uni Adelaide will provide part-time postgraduate supervisors for MSc and PhD students in the project. Supervisors' specific time allocation will depend upon the nature of thesis topics and other research requirements.

5.4 Intellectual property and other regulatory compliance

ICARDA and the project partners will fulfil all relevant obligations under international treaties and arrangements with respect to intellectual property and biological resources. ICARDA is a signatory, through the CGIAR, to the International Treaty on Plant Genetic Resource for Food and Agriculture (ITPGRFA). All germplasm transferred to Iraq is accompanied by standardized Material Transfer Agreements (SMTAs) that conform to the requirements of the ITPGRFA.

The results of ICARDA's research are available as international public goods to the international research community for the benefit of poor farmers in developing countries.

While the project is providing a sound basis for rapid adoption of zero tillage cropping and manufacture and sale of zero till seeders by collaborating manufacturers and farmers, we are still aware of value arising from branding. As such, zero till seeders that have been produced for farmers and other institutions by cooperating manufacturers are marked with the ACIAR-AusAID and ICARDA logo/name. In this way we are providing a clear linkage to the origins of the work and an easy reference point to other information sources available in relation to the project activities.

5.5 Travel table

PART A Commissioned Organisation or IARC

Trip no.	Person or position	Estimated date of travel	From / to	Purpose	Duration (days)
1	Project leader	Year 1	Aleppo – Australia	Collaboration with Australian partners and MSc/PhD supervision	4-6 weeks
2	Project leader	Year 2	Aleppo – Australia	Collaboration with Australian partners and MSc/PhD supervision	4-6 weeks
3	Project leader	Year 3	Aleppo – Australia	Collaboration with Australian partners and MSc/PhD supervision	4-6 weeks
4	ICARDA researcher	Year 1	Aleppo – Australia	Collaboration with MSc/PhD supervision	21 days
5	ICARDA researcher	Year 2	Aleppo – Australia	Collaboration with MSc/PhD supervision	21 days

6	ICARDA researcher	Year 3	Aleppo – Australia	Collaboration with MSc/PhD supervision	21 days

4. PC = partner country, A = Australia

PART B Australian Collaborating Organisation/s

Trip no.	Person or position	Estimated date of travel	From / to	Purpose	Duration (days)
6	Australian partners, consultants and sub-contractors	Year 1	Australia-Aleppo	Annual review and planning meetings, training, thematic workshops	8 days
7	Australian partners, consultants and sub-contractors	Year 2	Australia-Aleppo	Annual review and planning meetings, training, thematic workshops	8 days
8	Australian partners, consultants and sub-contractors	Year 3	Australia-Aleppo	Annual review and planning meetings, training, thematic workshops	8 days

PC = partner country, A = Australia

PART C Overseas Partner Organisation/s

Trip no.	Person or position	Estimated date of travel	From / to	Purpose	Duration (days)
9	Iraqi project scientists x 30	Year 1	Iraq-Aleppo	Annual review and planning meetings, joint report preparation, etc	2 weeks
10	Iraqi project scientists x 30	Year 2	Iraq-Aleppo	Annual review and planning meetings, joint report preparation, etc	2 weeks
11	Iraqi project scientists x 30	Year 3	Iraq-Aleppo	Annual review and planning meetings, joint report preparation, etc	2 weeks
12	Iraqi project scientists & farmers x 108 *	Year 1	Iraq-Aleppo	Group and individual training, joint data analysis	2-3 weeks
13	Iraqi project scientists & farmers x 108 *	Year 2	Iraq-Aleppo	Group and individual training, joint data analysis	2-3 weeks
14	Iraqi project scientists & farmers x 43 *	Year 3	Iraq-Aleppo	Group and individual training, joint data analysis	2-3 weeks

** Travel for individual training courses is itemized in budget*

PC = partner country, A = Australia

6 Appendix A: Intellectual property register

Inquiries concerning completion of this form should be directed to **contracts@aciar.gov.au**

6.1 Administrative details

Project ID	CIM 2008 027
Project title	Development of conservation cropping systems in the drylands of northern Iraq
Assessment provider	Colin Piggin
If not Australian project leader, provide title	
Date of assessment	18 August 2011

6.2 Categories of intellectual property and brief description

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:

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**
Iraq	Germplasm of cereal (wheat, barley, oats) and pulse and forage legumes (chickpea, lentil, faba bean, pea) from ICARDA's crop improvement programs

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

If "yes" to any of the above, for each applicable country provide:

brief details of the materials or information, the organisation providing, and the organisation receiving the materials

a copy of any formal contract between the parties.

Country	Details of proprietary materials, techniques and information

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

If "yes" to any of the above, for each applicable country provide:

brief details of the agreements and conditions

a copy of any such agreement before project commencement.

Country	Details of other agreements

6.3 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
Iraq	Design for zero tillage equipment. Full rights in Iraq. Rights for Commissioned Organisation and Australian Organisations for research purposes only
Syria/Commissioned Organisation	Design of zero tillage equipment. Commissioned Organisation will have rights to use IP and share with others (under agreement)

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)?		

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

the source of the Third Party IP.

the applicable country/ies, the circumstances/agreement/arrangement under which the IP is to be obtained or used by the project partners (for example, material transfer agreement, germplasm acquisition agreement, confidentiality agreement, research agreement or other arrangements).

any conditions or restrictions on its use.

Country	**Details of third party IP**

Other contracts, licences or legal arrangements

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

If "yes", for each applicable country provide brief details.

Country	**Details of other contracts, licences or legal arrangements**

7 Appendix B: Budget

Use tables in PRELIMINARY PROPOSAL.

Use budget proforma spreadsheet for FULL PROPOSAL (attached)

Commissioned organisation / commissioned IARC: ICARDA

Item	FY1	FY2	FY3	FY	Total (AUD)
Salaries + on-costs	444,300	457,628	471,358		1,373,286
Operating expenses	363,563	358,160	357,212		1,078,935
Travel	327,156	508,853	271,801		1,107,810
Infrastructure	170,253	198,696	165,056		534,005
Capital items	363,799	0	0		363,799
Sub-total	1,669,069	1,523,337	1,265,427		4,457,833

Australian collaborating organisation: University Western Australia

Item	FY1	FY2	FY3	FY	Total (AUD)
Salaries + on-costs	85,410	86,255	88,790		260,455
Operating expenses	290,570	191,406	169,126		651,102
Travel	38,200	5,600	27,200		71,000
Infrastructure	20,710	14,163	14,255		49,128
Capital items					
Sub-total	434,890	297,424	299,371		1,031,685

Australian collaborating organisation: University Adelaide

Item	FY1	FY2	FY3	FY	Total (AUD)
Salaries + on-costs	98,800	98,150	100,100		297,050
Operating expenses	348,070	204,906	177,624		730,600
Travel	35,700	24,783	24,783		85,266
Infrastructure	24,129	16,392	15,125		55,646
Capital items					
Sub-total	506,699	344,231	317,632		1,168,562

Partner country: Iraq

Item	FY1	FY2	FY3	FY	Total (AUD)
Salaries + on-costs					
Operating expenses	543,069	538,329	487,796		1,569,194
Travel					
Infrastructure	27,154	26,917	24,390		78,461
Capital items	594,270	0	0		594,270
Sub-total	1,164,493	565,246	512,186		2,241,924

Total (AUD)	**3,775,150**	**2,730,238**	**2,394,615**		**8,900,003**

8 Appendix C: Supporting documentation

This section is only required for FULL PROPOSAL

Documents attached:

Letters of support

Letters of approval

Curricula vitae