



project proposal

proposal phase Full Proposal

project **Development of conservation cropping systems in the drylands of northern Iraq**

project no. CIM/2008/027

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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 & Management
proposal stage	Full proposal
commissioned organisation	International Center for Agricultural Research in the Dry Areas (ICARDA)
project type	Large
geographic region(s)	Middle East
country(s)	Iraq
project duration	Three years
proposed start date	1 July 2008
proposed finish date	30 June 2011
time to impact	Category 1

1.1 Funding request

		amounts	totals
Year 1 (F/Y)	Pay1	1,345,864	1,773,398
	Pay2	427,534	
Year 2 (F/Y)	Pay3	1,047,859	1,483,583
	Pay4	435,724	
Year 3 (F/Y)	Pay5	1,051,508	1,453,444
	Pay6	401,936	
TOTAL		4,710,425	4,710,425

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1.3 Project summary

The project builds upon CIM/2004/024: *Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq*, implemented from July 2005 to June 2008 in Ninevah Governorate in northern Iraq and funded by ACIAR and AusAID. The new project will be led by the International Center for Agricultural Research in the Dry Areas (ICARDA) and implemented by the Iraqi Ministry of Agriculture (MOA) through its State Board of Agricultural Research in Baghdad and Directorate of Agriculture in Ninevah, the University of Mosul and Australian partner institutions (University of Adelaide, University of Western Australia and Western Australia Department of Agriculture and Food).

The new project aims to increase productivity, profitability and sustainability of crops in the drylands of northern Iraq through the development, evaluation and promotion of conservation cropping technologies involving zero-tillage (ZT), stubble mulching, improved crop cultivars and better crop management. It aligns with the priorities of the MOA national strategy detailed in 2.1.1. The key outcomes in Ninevah and northern Iraq will be:

1. wide adoption of conservation cropping systems by farmers
2. development of local village capacities to produce and market seed and ZT machinery
3. improved technical capacity by agricultural agencies to plan, implement and monitor research and development programs.

Key outcomes will be achieved through training Iraqi research and extension scientists and farmers while focusing on seven objectives structured around development and extension of conservation cropping technologies, development of seed production systems, improved planning and development through Geographic Information Systems and remote sensing and socio-economic analysis to monitor and promote adoption and impact.

Given common production systems and constraints, the new project will facilitate spillovers into the neighbouring governorates of Dohuk, Sulaymaniyah and Erbil, as well as the more southerly governorate of Najaf, by inviting agricultural researchers, extension officers and leading farmers to engage with and discuss the improved varieties and crop management technologies in the demonstration and research program.

2 Justification

2.1 Partner country and Australian research and development issues and priorities

2.1.1 Background

Agriculture currently provides 8% of Iraq's GDP, 20% of its employment, and supports a rural population of 7 million. The total population of Iraq is approximately 26 million. Arable land is estimated at 11.5 million hectares (M ha) comprising approximately 25 % of total area. FAO estimates that only 8 M ha are used for agriculture and less than half is cultivated annually. In general, the proportion of total farm cropped decreases with diminishing rainfall. Seventy-five percent of the cultivated area is located in central and southern regions. However, 70% of the production of wheat, the staple food crop, and barley, an important livestock fodder crop, is concentrated in the north, where the Ninevah Governorate accounts for 25% of total cereal production. Agriculture in the north is largely rainfed (100-400+ mm) with some supplemental irrigation and is based on mixed crop and small ruminant production. The project baseline survey in Ninevah in 2005/06 showed that average rural families had 12 persons. Average farm sizes are quite large – from 64 ha in high rainfall areas (HRA) to 316ha in low rainfall areas (LRA), with land mostly owned in HRA and rented in LRA. Many farmers plough twice before planting, use fertilisers, save their own seed and use contract sowing and harvesting services. Average sheep flocks ranged from 50 head in HRA to 220 head in LRA. Crops generate from 60 to 80% of income with 5-25% from livestock and the remainder from off-farm sources. These characteristics of the farming systems are important in developing appropriate technologies for different groups and agro-climatic situations.

Redevelopment of the agricultural sector was identified as a high priority by the Iraqi National Development Strategy (2005-2007). Agricultural production suffers from past mismanagement caused by civil instability with associated loss of capacity and the effects of periodic droughts. Despite considerable investment and extensive government subsidies in the 1980s and 90s, rainfed crop yields, and particularly cereal yields, have stagnated. Following the Gulf war and the imposition of economic sanctions, government incentives encouraged farmers to increase cereal areas by abandoning traditional cereal/fallow rotations, which exacerbated soil degradation and nutrient depletion. Iraq's cereal production has dropped sharply over the past decade due to importation of wheat, a lack of quality seed of improved varieties, the absence of improved management practices and the declining infrastructure for cereal marketing and processing. In irrigated areas, inappropriate water management practices have led to major salinity problems. Scientific enquiry and development to address these issues are severely constrained by ongoing violence and insecurity, destruction of infrastructure, dysfunctional government and commercial services and international isolation.

The proposed project contributes to the priorities of the Ministry of Agriculture (MOA) national strategy to:

- increase crop production and productivity through the development and dissemination of new crops and improved varieties, seed and production practices,
- combat drought and salinity, and
- support research and extension activities, all within the broader context of the government policy to phase out agricultural input subsidies.

In the context of growing concerns about global food security AusAID supports increased Australian development assistance to address the root causes of food insecurity in developing countries. This support includes programs to enhance productivity and market

development. The overall aim and objectives of the proposed project are consistent with and will contribute to the priorities outlined in AusAID’s humanitarian and development assistance program in Iraq. AusAID’s assistance to Iraq supports the development objectives and reconstruction efforts of the Iraqi Government which has actively participated in the design of the project. Iraq’s national development strategy lists four reconstruction priorities:

- strengthening the foundations of economic growth;
- revitalising the private sector;
- improving the quality of life for Iraqi people; and
- strengthening good governance and security.

Australia and ICARDA will make an effective and practical contribution to the wellbeing of the Iraqi rural sector through transferring expertise in crucial dryland cereal production. Assistance in the agriculture sector aims to improve food security and facilitate Iraq’s transition to an open, market-based economy through helping to restore agricultural services and boosting Iraqi agricultural production. The focus on agricultural systems will underpin general economic health and profitability of the cereal sector and the farming families involved while other specific initiatives will target small commercial enterprises including village based seed production and local agricultural machinery businesses. Human health will gain from reduced dust pollution associated with zero tillage. Training and professional development programs in Australia, Iraq and Syria for Iraqi scientists, students and researchers are designed to strengthen participating Iraqi institutions.

The major issues and constraints for agriculture, and particularly cropping, are declining production, low crop yields, highly variable and low rainfall, poor research and extension services, lack of availability and increasing prices of inputs, and low prices and marketing difficulties for outputs. This was confirmed in the early baseline survey of 260 farmers conducted by the project in Ninevah in 2005/06 (Table 2.1.1).

Table 2.1.1 Farmer constraints in Ninevah Governorate (from the baseline survey of 260 farmers 2005/06)

Constraints	% farmers
Unavailability of electricity	98
High price of fertilizer	98
Unavailability of fuel and oil	69
Poor market conditions	69
Unavailability of fertiliser	62
Unavailability of spare parts	60
Susceptibility of crops to pests	42
Variable rainfall distribution	34
Unavailability of extension services	32
Poor marketing processes	27
Low product prices	27
Unavailability and expense of herbicides	22
Long distance between farms and markets	18
Lack of skilled labour	13
Unavailability of sprayers	13
Lack of market information	10
Cost of machinery rental	5

From 1990 to 2003, production of wheat declined 33% from 1.2 to 0.8 million tonnes, and barley declined 67% from 1.8 to 0.6 million tonnes (Figure 2.1.1)

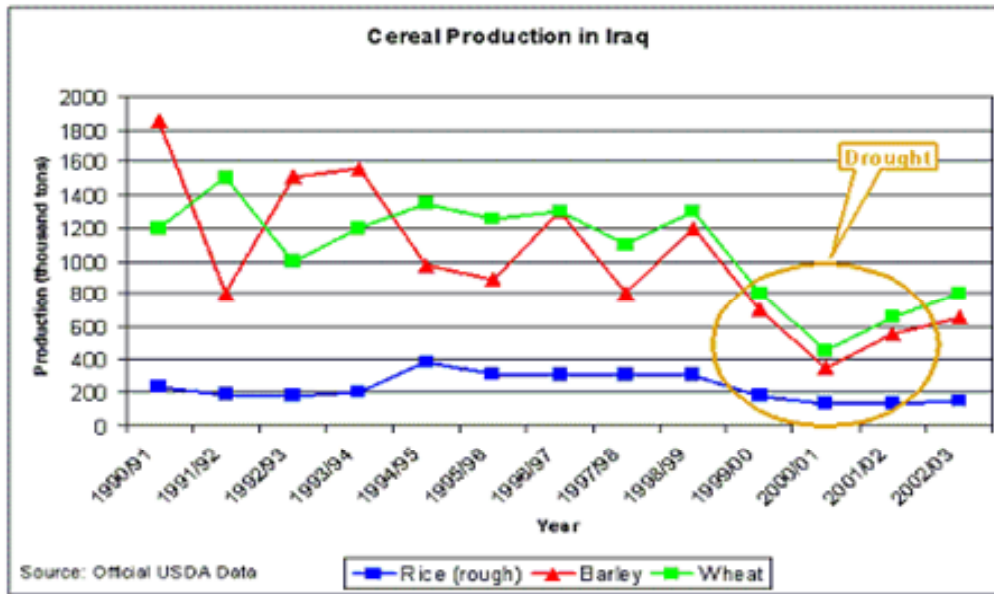


Figure 2.1.1 Cereal production trends in Iraq 1990 to 2003

Much of this decline was related to crop area, with wheat areas falling by 27% from 1.8 to 1.3 million hectares and barley areas by 37% from 1.9 to 1.2 m ha (Figure 2.1.2).

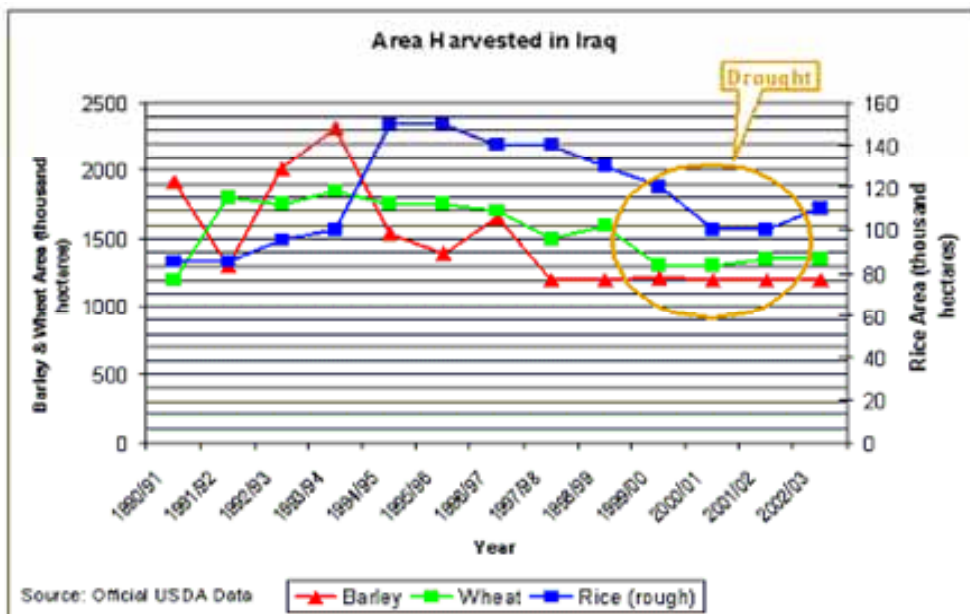


Figure 2.1.2 Cereal area trends in Iraq 1990 to 2003

Average yields of wheat (0.73 t/ha) and barley (0.62 t/ha) in 2002/03 were less than a quarter of those which could be expected using reasonable potential water use efficiencies (French and Schulz 1984, Sadras and Angus 2006). The 2005/06 baseline survey confirmed low yields have continued for bread wheat in Ninevah with 60% of farmers reporting yields less than 1 t/ha and 90% less than 2 t/ha (Figure 2.1.3).

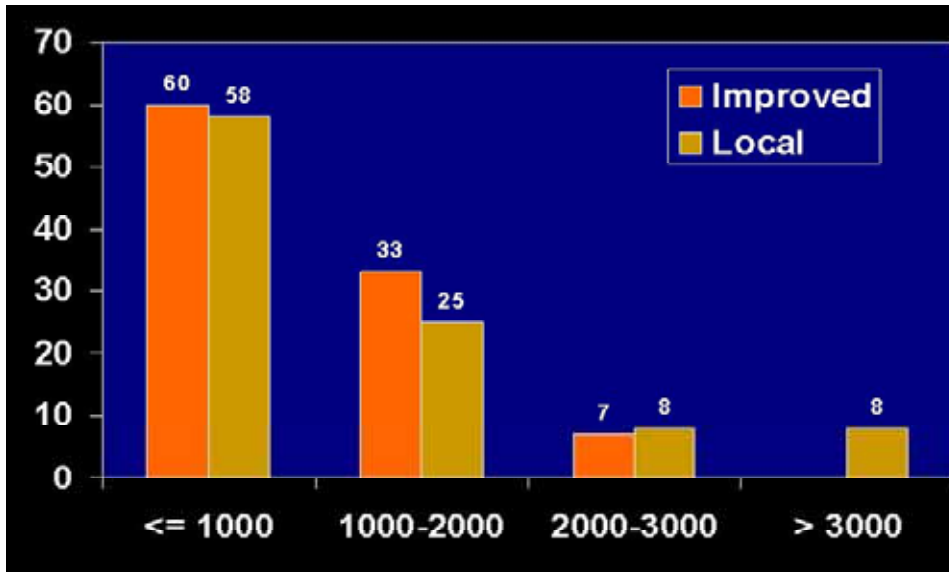


Figure 2.1.3 Intervals (%) of yield (kg/ha) for bread wheat in Ninevah Governorate (from the baseline survey of 260 farmers 2005/06)

Twenty-five % of Iraq's wheat and barley production comes from Ninevah, with a similar amount coming collectively from the northern governorates of Dohuk, Erbil and Sulaymaniyah. In a study of these Governorates, Anderson (2000, 2002) reported that annual wheat areas and production from 1981, well before sanctions, to 1999, fluctuated widely from 102,000 to 813,000 ha and 113,000 to 511,000 tonnes. The lowest figures were in the worst drought year of 1998. Annual consumer demand for wheat was around 630,000 t, equivalent to around 185 kg/person for the 3.4 million people. In a typical year, production of around 300,000 t would satisfy about 50% of demand. The additional requirement of 300,000 would require a doubling of yields. Much of this requirement in the past has been provided from the UN Food Basket, which commenced in April 1997 under UN Security Council Resolution 986. It is likely that a similar situation exists in Ninevah, which generally grows around the same amount of wheat. Because figures vary widely depending on year and information source, it is assumed in this proposal that crop areas and production in Ninevah are about 400,000 ha and 250,000 t for both wheat and barley.

Yield trends in Iraq contrast with those in Australia, where wheat yields have been increasing by around 3% per year for the last 100 years. These increases have been due to better varieties and a range of improved crop management technologies (Figure 2.1.4).

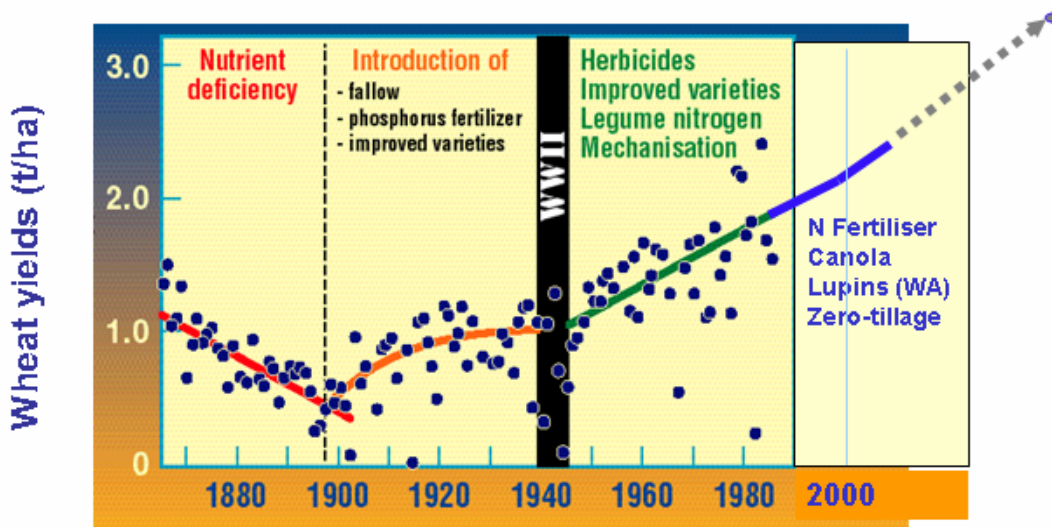


Figure 2.1.4 Yield trends for wheat in Australia

Anderson et al. (2005) have shown in a review of many studies around the world that 70% of such improvements have come from better crop management and 30% from better crop varieties. This is illustrated in Table 2.1.2 from Anderson and Impiglia (2002) where the average increase attributed to management was 0.68t/ha and to cultivars was 0.32t/ha.

Table 2.1.2 Responses to semi-dwarf wheat cultivars to management

Management	Yield (t/ha)		
	Tall Cultivar	Semi-dwarf Cultivar	Cultivar Increase
Old management [late sowing, 0N, low seed rate]	2.62	2.69	0.07
New management [early sowing, 50kg/ha N, high seed rate]	3.05	3.62	0.57
Management increase	0.43	0.93	1.00

(Data from 7 experiments in WA - Anderson & Impiglia 2002)

The dominance of crop management in yield increases, together with the initial results from the original project, have led us to build this project around conservation cropping through the use of zero tillage (ZT), which minimizes soil disturbance and promotes stubble retention. This technology has been developed and refined over the last 50 years and adopted on more than 100 million hectares worldwide, although it is little known or used in the Middle East, including in Iraq. The strong benefits it brings come from the opportunity for early sowing; savings in time, machinery and fuel; better soil structure (Organic Matter); better soil-water dynamics (porosity); better nutrient recycling (NPK); improved trafficability; higher yield potential; less erosion; and higher carbon

sequestration. The project will also focus on continuing evaluation and promotion of improved varieties, possibilities for wider cereal-legume-oilseed rotations and crop-livestock integration, and improved crop agronomy through better weed control, matching PK with crop demand, application of post-emergence N, increased plant populations, management of foliar/root pests/diseases, and deep ripping with the application of gypsum or lime on compact or acid soils.

It is emphasised the project is not developing or promoting fixed integrated crop variety/management packages. Experience since the early Green Revolution days in the 1970s has shown that this is not how resource poor farmers adopt technologies. Rather they tend to adopt in a stepwise fashion, usually adopting the cheapest factor first, rather than the most limiting factor. While agronomic research may strive to identify THE most limiting factor, this may be relevant only in the academic sense, since farmers do not necessarily have the resources to correct the most limiting factor, or everything at once, or any but the cheapest first. Instead, we are developing a range of options that can all contribute to yield advance, which can be considered and applied in various combinations depending on the farm environment and circumstances. Costs and benefits will be clearly demonstrated to the farming community through participatory on-farm agronomic research. This is discussed further in relation to conservation cropping under 2.1.4 Project continuity.

In the review and proposal planning, the importance of stubble retention and the amounts necessary for sustainability of the conservation cropping system were discussed. Given these are mixed crop-sheep enterprises with shepherds but without fences, some grazing of stubbles is inevitable. Information from the baseline survey suggests that 20-33% of the sheep feed is grazed stubble, 31-35% is barley, 16-25% is natural pasture and 9-27% is wheat bran. This suggests some substitution is possible and alternative feed sources can be enhanced, although farmer willingness to put effort into growing forages is uncertain. It is evident from research in the original project that more forage can be provided from ZT systems, which often have higher biomass as well as higher grain yields. It is unlikely to be an 'all or nothing' issue, but rather that some stubble utilisation is acceptable but the more retained the better. This issue will be further researched within the new project.

2.1.2 Original project progress

Despite the difficulties in Iraq, the original project made good progress against all objectives, which were to:

- identify, promote and widely disseminate amongst farmers in the rainfed cropping regions of northern Iraq “best-bet” improved varieties and crop management systems for wheat, barley and pulse and forage legumes.
- introduce, evaluate and select improved germplasm of wheat, barley and pulse and forage legumes for adaptation to rainfed farming systems in northern Iraq.
- identify, evaluate and select improved cropping system management options suited to rainfed farming systems in northern Iraq.
- enhance the capacity of Iraqi research and extension program to identify and evaluate potentially valuable germplasm and better crop/soil management technologies and promote their adoption by farmers

'Best bet' varieties and crop management technologies were demonstrated and promoted in 12 locations across the three rainfall areas of Ninevah (see Figure 5.1.2). Research was conducted on Rashidiya Research Station in Mosul and some demonstration locations to identify new adapted lines, to bulk up seed for subsequent inclusion in demonstrations and to evaluate improved crop management. Researchers worked with local machinery manufacturers and farmers to modify local seeders for ZT crop establishment. In ICARDA, linked research evaluated and refined ZT technology and local ZT seeder manufacture and investigated the potential of oats, peas and oilseeds to

diversify crop rotation options for Iraq. There were some spill-overs of this work into Syria, where local farmers and machinery manufacturers were keen to develop and adopt ZT. Iraqi scientists received training in 14 courses at ICARDA and four senior scientists went on study tour/training visits to Australia. Capital equipment supplied included ZT seeders, chisel ploughs, deep tillage subsoilers, and mobile seed cleaners.

The major achievements and outputs have been:

- evaluation of current cropping systems and identification of constraints through a major baseline survey and economic analysis to direct research efforts and evaluate project outcomes and impacts
- identification and uptake of more productive wheat and barley varieties
- demonstrations showing that crop establishment with chisel ploughing and drill seeding gave better yields than farmer methods involving several cultivations and broadcast seeding
- introduction of ZT technology into Iraq, reportedly for the first time, with evaluations showing comparable or better yields than crops sown with conventional cultivation
- development of strong interest by farmers in ZT technology, which has been related to good yields and less cost at a time when fuel prices are rising alarmingly (from 1 cent to 1 dollar per litre in 2006-2008) due to the lifting of input subsidies
- identification and seed multiplication of some promising lines of alternative crops (oats, peas) to diversify rotations
- improved seed production capacity through training and the procurement of 10 Syrian-made mobile seed cleaners
- improved capacity of 150 Iraqi staff from MOA, DOA and University of Mosul through training delivered by ICARDA and Australian institutions in crop improvement, crop management, research methodology and socio-economic analysis
- production of annual progress and technical reports and the establishment of a project website to document and disseminate project results
- strengthening of MOA and Ninevah links with ICARDA and Australia
- opening access to new information and approaches through interaction and exchanges
- spillovers of ZT technology and alternative crops (oats, peas) into Syria stimulating strong interest by farmers, machinery manufacturers and processors.

2.1.3 Project review

An external review of the predecessor project was conducted in April 2008 by Dr David Connor, Emeritus Professor, University of Melbourne. The review was positive, recommending a project extension to consolidate initial achievements and promote uptake of technologies with farmers and users (Connor 2008). Dr Connor's recommendations were:

"1. The project team be reminded to include the missing cereal cultivar evaluations in the technical report for the third year of the project.

This recommendation is to correct a limitation of previous reporting. The purpose is to ensure that adequate analysis of germplasm evaluations can be included in the Final Project Report and be available to guide planning of subsequent work.

2. ACIAR classify the project as highly successful and favourably consider a proposed extension.

This recommendation is based on the substantial progress that the project has made in all areas of the project and the determination of the Project Team to continue. While impact has been greatest in capacity building (Obj. 4), the results of the demonstrations are already reaching farmers and machinery manufacturers (Obj. 1). Given the response in comparable areas worldwide, a significant impact of ZT can be anticipated provided the adaptive research is carried out, and its value clearly presented through demonstrations and socio economic analyses. The value of the long-term trials that have been established will be obtained by continuation into the future (Obj. 3).

3. ACIAR ensure that a continuing project focuses on the gains that have been achieved in the first phase. Overall, this implies a concentration of all aspects of work on the adaptability of ZT to production systems that include rotational crops and also alternative forage sources for sheep.

Nutrient management and IPM were identified as important areas in the project document but little progress was made. With the new focus on ZT these activities become clearly linked to the goal of water limited productivity and the required experimental program more narrowly defined and better related to rotational cropping systems. The advantage of stubble retention to soil conservation and improvement of soil quality, possible in ZT systems, impacts greatly on fodder supply for grazing animals. That issue, too, becomes more clearly a part of considerations of optional cropping systems.

(The section below) discusses follow-up activities in more detail, providing a wider range of suggestions for consideration during planning to extend the project.

4. ACIAR ensures that a continuing project provides a dedicated leader based at ICARDA.

The success of the project to date reflects the attention given to it by the initial project leader (Dr Piggin) who was previously involved in planning the project. Given that the problems of insecurity and communication will continue at least into the immediate future, continuing success will depend upon comparable, skilled and dedicated leadership.”

In recommending a continuation of the project, Dr Connor provided the following comments and guidance:

- “The project has made remarkable progress considering the impediments which are likely to continue in the short term but even so, the project merits continuation for its importance, evident potential for success, and abilities that the team have developed to support it. It is important, however, to see an extension as an opportunity to capitalize on the major theme that has so far, viz. an evaluation of the potential of conservation cropping (ZT with components of stubble retention, diverse rotations, good crop management, etc) in the rainfed areas of northern Iraq and use the experience gained so far to focus the work clearly to that end. The following suggests features for consideration in developing the extension.
- Restrict demonstration and research tillage comparisons to ZT v. conventional tillage (CT). Chisel ploughing never was a true annual alternative but the response to it in the original project suggests serious compaction from past management.
- Any new sites for demonstrations, research, or farmer adoption must be checked for compaction before ZT is applied.
- The demonstrations must be kept simple. One strategy is to manage the two tillage systems in their optimum way. For example early sowing is an advantage of ZT that should be included. In research trials it can be dealt with differently with early- and late-planted treatments to distinguish between responses to ZT and sowing time.
- The yield gains from ZT in the first phase were achieved at yield levels below the water-limited potential. That must be the target benchmark for research and development in these water-limited areas.

- Monitoring of soil physical, chemical and biological properties will be needed in future work to develop nutrient and weed and disease control management. Simple measurements of soil water at sowing, flowering, and maturity can add a great deal to experiments and demonstrations.
- Long-term trials on ZT rotations should be established in Iraq as soon as possible.
- Emphasis should be given to direction and training on sound research methodology, paying particular attention to such things as replication, randomisation and statistical analysis. A manageable set of germplasm adaptation and crop management trials should be planned. Speculative technologies should be investigated first through small-plot trials rather than replicated demonstrations. Capacity should increase with increased involvement of the University of Mosul, especially through students.
- Given the importance of stubble to soil conservation and improvement of soil properties that improve workability, water-use efficiency, crop yield, and provide environmental benefits, a strong focus is also needed on stubble utilization and alternative fodder supply for ruminants. An important question will be the extent to which useful tillage/rotation experiments can be done without including grazing animals or stubble removal treatments.
- Germplasm evaluation must be focused on the tillage/rotation/fodder supply comparisons. New cultivar options can be included in the demonstrations as they become available. Just how much to do, how and where are critical questions. What benefit, for example, can be gained from collaboration with Syrian research stations close to the Iraqi border?
- Short and long term training as run and coordinated by ICARDA and Australian collaborators to continue.
- Work with farmer groups and machinery manufacturers should be reviewed and be provided with adequate resources to ensure maximum adoption.
- Impact and adoption analyses should be formalized and methodology tested so that impact can be used to support the project outcomes as soon as possible during the next phase.
- The contribution of ICARDA is critical to the success of the project. To capture that expertise and to gain access the resources, the project needs a committed leader from ICARDA with adequate time to devote to the project.”

These recommendations and comments have been addressed in this proposal.

2.1.4 Project continuity

Project activities, the work plan and implementation strategy were developed after the final review of the predecessor project at a workshop attended by representatives of all project participants at ICARDA on 13-17 April 2008.

The new project aims to increase productivity, profitability and sustainability of crops in the drylands of northern Iraq through the development, evaluation and promotion of conservation cropping technologies involving zero-tillage, stubble mulching, improved crop cultivars and better crop management. It will also have a small component on initial introduction and testing of salinity-tolerant lines of the target crops in Baghdad and Wasit Governorates, managed and implemented by the MOA State Board for Agricultural Research in Baghdad.

Within the project, conservation cropping is defined as the combination of practices that optimizes both short-term and long-term crop production, protects soil structure and encourages water and nutrient cycle efficiencies. Usually a suite of practices are combined in conservation cropping, such as tillage and residue management, livestock and grazing management, crop choice, rotation of crops and forages and integrated pest

and disease management. However specific practices that can be used to define conservation cropping, such as ZT, are not prescriptive, and usually have to be developed to match specific requirements of a particular agro-climatic zone and farming situation. Practices in a conservation cropping system vary according to rainfall (amount and distribution), soil type and topography, farm scale and tenure system, and socio-economic factors associated with the farmers involved.

Whatever the background to a conservation-based system, the practices all focus on the establishment, growth and yield of crops and forages with minimal soil disturbance and maximum retention of organic matter to maximize infiltration and soil moisture storage. The absence of cultivation means soils are more trafficable and timelier sowing is possible. The retention of residues means the soil surface and crop seedlings are better protected from wind and water damage. These conservation practices change soil biota dynamics and weed distribution and incidence and management of pests and weeds often has to be adjusted to match the changed dynamics of the conservation based system.

Usually the introduction of conservation cropping in the short-term does not negatively affect grain yield, and often positive yield responses are obtained. Economic benefits through fewer tillage operations (and less fuel use) are usually evident from the outset. This is particularly relevant in Iraq where input subsidies are being lifted and the price of diesel fuel has risen from about US\$0.01 to \$1.10 per litre between 2005 and 2008; resulting in a high farmer interest and willingness to adopt ZT technologies. As conservation cropping is usually undertaken as a long-term practice, when the whole system (soil-nutrients-rotations) equilibrates, the overall crop productivity is assured. Conservation cropping has a whole system, locality and socio-economic emphasis and involves an understanding and integration of the component practices and complexity. In dealing with this complexity, the involvement of the farmer in the development of the component practices and their integration into a workable and adapted system is essential.

To initiate the overall development of conservation cropping, and to focus farmer attention on this system of crop production, emphasis is usually placed on the practice of ZT. This is a sowing system where the seed is introduced to the soil at the required depth and with appropriate soil-seed contact, in a single passage of a crop seeder, and with minimal soil disturbance. ZT can be successful across all rainfall zones and soil types and, importantly, catches the interest of farmers. ZT also is a practice that farmers, whilst possibly still doubting its efficacy, can trial on their own farms. This process of involving farmers in a primary operation of conservation cropping is essential to their understanding of the system, its wide adoption and the realization of its potential.

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

2.2.1 Research and development strategy

In the original project (2005-08), the grain yields of bread wheat, durum wheat and barley in the demonstration trials were almost always greater for the 'demonstration' or 'best bet' plots than for the 'conventional' or 'farmer' plots in both 2005/6 and 2006/7. Economic evaluations of the trials showed these gains often translated into slightly higher returns per unit of land. However, if seasonal rainfall is taken as a reasonable estimate of crop water use, a significant yield gap remained between the theoretical attainable yield (French and Schulz 1984; Sadras and Angus 2006) and the grain yields achieved in most demonstration sites (using a WUE of 20 kg/ha/mm and water loss of 100 mm). The agreement between actual and potential yields was greatest when the seasonal rainfall was less than 200 mm and least when the seasonal rainfall exceeded 250 mm.

Seasonal rainfall and grain yield - Ninevah 2005/6 and 2006/7

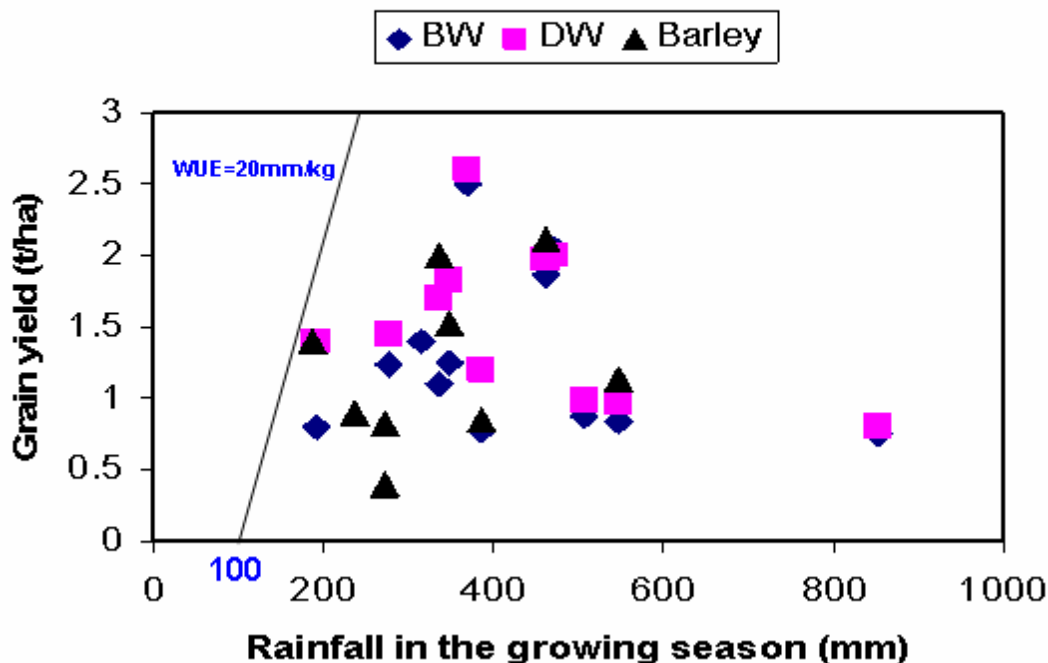


Figure 2.2.1 Grain yield of cereal crops achieved by the ‘demonstration’ treatments in Ninevah Governorate in 2005/6 and 2006/7 compared to the seasonal rainfall.

The gap between actual and potential grain yield for all three cereal crops exceeded 1 t/ha when the seasonal rainfall exceeded 250 mm. This suggests there were some unidentified factors limiting yield in addition to the cultivar and tillage treatments that were used in the demonstrations. These factors could include frost, unfavourable distribution of rainfall, late sowing, disease and insect damage, weed competition, nutrient deficiency (major or minor elements) and soil constraints (compaction, acidity, alkalinity, etc.). These limiting factors must be investigated and, where possible, treated to assess their impact on grain yield improvement and the economic value of treating them. This approach is outlined in Anderson et al. (2005).

Yields and WUE from some research trials at ICARDA are presented in Table 2.2.1 using evaporation losses of 60mm for cereals (French and Schulz 1984; Sadras and Angus 2006), 125mm for chickpea, 115 for lentil, 100mm for faba bean and 100mm for field pea (Siddique et.al 2001). These generally were higher for ZT than conventional cultivation but still well below attainable WUEs of 20kg/mm/ha for cereals and 15kg/mm/ha for pulses. Dry periods and severe frosts contributed to yield gaps but these trials also suggest better yields are possible with better management of crops. Siddique et al. (2001) reported WUEs of 11 kg/mm/ha for faba bean, 10kg/mm/ha for field pea, 6kg/mm/ha for chickpea and 4kg/mm/ha for lentil in trials conducted at two sites in two years in Western Australia, illustrating the difficulties of achieving potential WUEs in the field.

Table 2.2.1 Yields (kg/ha) and WUE (kg/mm/ha) of crops in ZT trials at ICARDA in 2005/6 and 2006/7

Crop	Treatment	Yield	WUE	Sowing
2005-06 Rainfall 290mm				
Chickpea	ZT	1354	8.2	12 Dec 05
	CT	757	4.6	12 Dec 05
Wheat	ZT	1483	6.5	Late Nov 05
	CT	1032	4.5	Late Nov 05
Peas (Dunwa)	CT	1005	5.2	30 Nov 05
2006-07 Rainfall 315mm				
Chickpea	ZT	620	3.3	27 Nov 06
	CT	385	2.0	27 Nov 06
Wheat	ZT	1420	5.6	10 Nov 06
	CT	1370	5.4	10 Nov 06
Oats	ZT	1470	5.8	10 Nov 06
	CT	1032	4.1	10 Nov 06
Wheat	ZT	570	2.2	13 Nov 06
	CT	545	2.1	13 Nov 06
Barley	ZT	1130	4.4	11 Nov 06
	CT	1095	4.3	11 Nov 06
Lentil	ZT	430	2.2	25 Nov 06
	CT	350	1.8	25 Nov 06
Chickpea	ZT	660	3.5	26 Nov 06
	CT	555	2.9	26 Nov 06

The project will involve development, evaluation and promotion of conservation cropping technologies which increase productivity, reduce costs and increase resource sustainability through:

1. reduced soil disturbance (ZT)
2. increased carbon conservation (stubble mulching)
3. better adapted crop and forage varieties (variety adaptation)
4. improved fertilizer practices (nutrient use efficiency)
5. improved integrated weed, pest and disease management (IPDM)
6. better crop and forage seeds (seed availability/quality)
7. more diverse rotations (alternative crops)
8. better integration of crops, forages and livestock

It will involve associated supporting R&D in the areas of:

1. seed production, particularly in the commercial or farmer system, which makes up some 90% of the seed exchange in Iraq
2. GIS and remote sensing to locate and evaluate recommendation domains for project technologies

3. socio-economic analysis, including *ex ante* and *ex post* evaluations of constraints, technologies, adoption and impact

The project will train Iraqi research and extension scientists in areas such as:

1. conservation cropping (including ZT, stubble management, agronomy, IPM, weed management)
2. ZT seeder development
3. new approaches to breeding (multi-site, multi-variate analysis)
4. modern extension approaches
5. socio-economic evaluation and adoption and impact analysis
6. seed production
7. GIS and crop modelling
8. statistical analysis, report writing and media presentations

Finally, it will involve training of Iraqi farmers in the areas of:

1. conservation cropping
2. seed production
3. identification of and solutions for major cropping constraints.

In this project, the objectives of the predecessor project which focussed on demonstrations, research and capacity building will remain. Several additional components will promote adoption of project outputs, develop strategies to overcome constraints to adoption, and ensure the sustainability of the research and development activities beyond the end of the project. Specifically, these include:

i) A component on seed production: Seed remains a major constraint for adoption and diffusion of new crop varieties. Seed delivery by the formal public sector is less than 10%, particularly in the drier areas of northern Iraq where farmers use their own seed of local varieties. The three main seed producing companies use the services of about 2,000 seed growers who grow seed under contract. The State Board for Seed Testing and Certification (SBSTC) is responsible for seed quality control including field inspection and seed testing, monitoring of seed in trade and facilitating variety release, but its operations are limited.

Following the workshops and policy forum organized in 2007 by the FAO Project OSRO/IRQ/502/UDG on *Rehabilitation and Development of the National Seed Industry in Iraq*, the MOA is currently developing a national seed program. Within this program, it is envisaged that certified seed production will be carried out by seed growers, and the Government will encourage high performing seed growers to develop self-sustaining private-sector seed operations.

During the first phase of the project, ten seed cleaning and treatment machines were procured and delivered to the MOA. There is a strong desire by MOA to make use of these facilities to facilitate development of farmer-based production and marketing of certified seed in at least eight/nine districts where the project is operational.

ii) A component on Geographic Information Systems (GIS): The Department of Agriculture of Ninevah Governorate has established a GIS Unit in order to centralize, analyze and visualize spatial information of relevance to agricultural development in the Governorate. Their interests in agricultural data collection include establishing a geodatabase as a repository for cadastral, ecological and other base maps, as well as developing analytical skills for application development, particularly in the field of land suitability assessment for different crops, varieties and land uses. The project will strengthen capacities in, and

facilitate agricultural planning and development through utilisation of, GIS and crop modelling.

iii) A component on monitoring and evaluating of adoption and impact of project technologies and identifying enabling institutional and policy options to enhance uptake by farmers: A new technology may change the optimal levels of inputs and its profitability depends on how demand for inputs changes and the extent of productivity improvement. Demand and reallocation of inputs could also affect technical efficiency in production. Farmers in northern Iraq face diverse and substantial levels of risk in agricultural production and an understanding of the effect of new technologies on productivity and efficiency is crucial in determining its potential diffusion among farmers. The lack of functioning institutions and enabling economic and policy environments could lead to low availability, access, and use of seed of new varieties. Similarly, the recent decision by the government to move away from input subsidy towards an output support program has implications for the adoption and impacts of new technologies. These policy changes need to be evaluated to determine the best options to encourage wide technology adoption and impacts. Widespread adoption of a new production technology may also be expected to have important market-level effects and economic influences beyond agricultural production systems. Thus, an integrated economic model incorporating both production and marketing systems is required to assess impacts.

The socio-economic component of this project will focus on: (i) assessing productivity, efficiency, economic viability and risk mitigation potential of the new technologies; (ii) monitoring and evaluating adoption and impacts at the farm level and potential (*ex ante*) impacts at market level; (iii) identifying institutional and policy options that would facilitate uptake of new technologies and development of village-based seed enterprises.

Although the project is focussed on Ninevah, production systems and constraints are similar in many of the surrounding governorates. The project will encourage spillovers by inviting agricultural researchers, extension officers and leading farmers from Dohuk, Sulaymaniyah, Erbil and Najaf Governorates to view and discuss the improved varieties and crop management technologies in the demonstration and research program. This may extend to provision of some seed and advice for ZT research and demonstrations.

2.2.2 Relationship to other ACIAR investments and other donor activities

According to MOA and University of Mosul collaborators, there are no other donor activities related to agriculture in Ninevah, and certainly none evaluating and promoting improved dryland cropping technologies through research and demonstration together with farmers in farmer fields. In fact, there is reportedly no other such work going on in Iraq.

The project has benefited from research findings and information from many studies on rainfed cropping, especially from southern Australia, where the climate and crops are so similar to northern Iraq. There is a direct link with previous CIMMYT and ACIAR projects in northern India which have developed small, robust ZT seeders. The initial Iraqi evaluations of ZT in the project were made possible by the importation of several Indian ZT seeders from National Agro Industries in Ludhiana, Punjab State, a collaborator in earlier ACIAR projects.

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3 Objectives

Aim: The project aims to increase crop productivity, profitability and sustainability in the drylands of northern Iraq through the development, evaluation and promotion of conservation cropping technologies involving zero-tillage, stubble mulching, improved crop cultivars and better crop management.

The key outcomes in Ninevah and northern Iraq will be:

1. wide adoption of conservation cropping systems by farmers
2. development of local village capacities to produce and market seed and ZT machinery
3. improved technical capacity by agricultural agencies to plan, implement and monitor research and development programs

This will be achieved through seven objectives, structured to separate major work areas and institute mandates to facilitate understanding of institution roles and component implementation:

Component objectives:

1. To demonstrate and promote uptake of “best-bet” improved varieties and crop management systems for wheat, barley and pulse and forage legumes
2. To evaluate and select new, improved germplasm of wheat, barley and pulse and forage legumes for promotion in demonstration programs
3. To evaluate and select new, improved crop management technologies for promotion in demonstration programs
4. To facilitate agricultural planning and development through utilisation of GIS and crop modelling
5. To develop, evaluate and promote efficient and sustainable local seed production and supply systems
6. To monitor and evaluate adoption and impacts of project technologies, and identify enabling policy options to enhance uptake by farmers
7. To enhance capacity of Iraqi research and extension programs to develop and promote improved conservation cropping technologies.

Activities

Objective 1: To demonstrate and promote uptake of “best-bet” improved varieties and crop management systems for wheat, barley and pulse and forage legumes

Activities

- Compile, review and analyse existing information on potential available technology options
- Demonstrate and evaluate alternative conservation tillage management in Ninevah governorates.
- Identify, promote and widely disseminate ‘best bet’ improved crop varieties among farmers in the rainfed cropping regions of Ninevah.

Objective 2: To evaluate and select new, improved germplasm of wheat, barley and pulse and forage legumes for promotion in demonstration programs

Activities

- Identify potential lines from the original project experience, other Iraq information, ICARDA’s international testing program, Australian experience, and other sources.
- Screening, evaluation and selection of improved germplasm in Ninevah.

- Screening, evaluation and selection of improved germplasm of wheat, barley, and forage legumes and grasses for adaptation to salinity in Iraq.

Undertake some germplasm adaptation trials at the Syrian GCSAR Research stations at Kamishley/Hassake, close to the Iraq border near Mosul, where conditions are similar. This risk management strategy will provide insurance of data collection in the event that some Ninevah trials cannot be established or fail due to an adverse security situation

Objective 3: To evaluate and select new, improved crop management technologies for promotion in demonstration programs

Activities

- Conduct research on conservation cropping technologies including ZT, stubble mulching, time of sowing, stubble removal/retention, crop rotation, improved fertilizer practices, improved weed, pest and disease management in Iraq and in ICARDA
- Include crop soil simulation modelling into the conceptualization of research on conservation cropping, i.e. setup additional sub-plots and consider additional, model-relevant, measurements
- Simulate the effect of conservation cropping on crop yield; quantify the benefits of this cropping system over conventional cropping practices; carry out scenario analyses on the effect of reduced residue retention (determine the "turning point") and on the effect of a changing climate
- In conjunction with local manufacturers, modify and adapt locally produced seeders and evaluate their performance under zero-tillage
- Conduct research on adaptation and seed production of alternative crops including oats, peas and oilseeds in ICARDA and, when seed is available, in Iraq
- Evaluate systems for the integration of crops, forages and livestock
- Undertake initial demonstrations with farmers in Iraq and ICARDA/Syria and identify options for wider promotion in the extension program under Objective 1.

Objective 4: To facilitate agricultural planning and development through utilisation of GIS and crop modelling

Activities

- Conduct annual training session on advanced GIS skills
- Initiate training sessions in crop-soil simulation modelling using either the CropSyst, APSIM or DSSAT crop modelling suite
- Develop land suitability maps using locally compiled and globally available data.
- Integrate GIS into project development activities and develop and utilize geospatial services to assist with the interpretation and promotion of project technologies.

Objective 5: To develop, evaluate and promote efficient and sustainable local seed production and supply systems

Activities

- Multiply and provide new crop germplasm or crop varieties from ICARDA for research and demonstration in Iraq based on request
- Continue development of a functional seed unit within the agricultural research system to provide seed for research trials and demonstrations at Rabiaa RS
- Establish sustainable farmer/village-based seed production systems

Objective 6: To monitor and evaluate adoption and impacts of the project technologies, and identify enabling policy options to enhance uptake by farmers.

Activities

- Characterization of improved technology options in terms of their performance, profitability, risk reduction, and acceptance by farmers
- Analysis of water productivity and WUE in each zone with attention to factors explaining low WUE in supplemental irrigation areas and farmer's demand for water.
- Identification of sources of inefficiency in crop production under different rainfall zones, and assess the impact of improved options on increasing the efficiency.
- Assessment of the effectiveness of improved management options on the adaptive capacity of local communities to climatic variability and change
- Monitoring and evaluation of the rate of adoption of improved technologies and identify constraints to provide feedback to technical, socio-economic and policy research.
- Evaluation of economic and environmental impacts of improved technologies promoted by the project at both farm and community levels
- Assessment of the impact of land tenure, input and output pricing policies (input price subsidy, output price supports) on the uptake of new technologies and their implications on rural livelihoods.
- Identify enabling policy and institutional options

Objective 7: To enhance capacity of Iraq research and extension programs to develop and promote improved conservation cropping technologies

Over the life of the project, the on-the-job and formal training program through the activities listed below is expected to deliver:

- enhanced capabilities of Iraqi research program through joint research and specialized training programs.
- research and extension staff better able to promote and disseminate new technologies in partnership with farmers.
- enhanced capabilities in evaluating adoption and impact of improved technologies.
- effective international collaborative networks between Iraqi, ICARDA and Australian institutions and scientists.

Activities

- Develop and agree on program of training
- Short-term and individual medium-term training and joint data analysis at ICARDA
- Thematic workshops
- Long-term training/joint research and MSc/PhD graduate research at Australian partner institutes and/or ICARDA
- Support participation of Iraqi personnel in regional or international workshops and conferences of relevance to the project.

4 Planned impacts and adoption pathways

4.1 Scientific impacts

The project will advance understanding of the determinants of WUE and the components of yield gaps in Iraq through crop-soil-simulation modelling. When combined with GIS, results will be applicable to similar agroecologies throughout the region.

The project builds on the history of experiences in other agroecologies (notably Australia) in the application and adoption of new crop management practices. It provides an opportunity to build on this accumulated experience and apply it in an integrated approach within a target area. The biophysical and socio-economic monitoring and modelling will quantify the contributions of each factor to overall productivity and are expected to provide lessons in how farmers adapt to and adopt improved technologies.

4.2 Capacity impacts

Capacity enhancement is a separate objective (Objective 7) and a major focus of the project. Iraqi scientists have been isolated over the last 30 years from free international interaction and collaboration. The project will enhance linkages with international crop science, especially in Australia, and provide training for over ninety Iraqi scientists during the project life. It is expected these staff will return to the project after completion of training, to utilise and reinforce the knowledge learned.

Seventy five Iraqi staff will receive short-term (3-4 weeks) training at ICARDA in topics relevant to project activities; selected Iraqi staff will attend thematic workshops in ICARDA with Australian and ICARDA scientists; ten Iraqi scientists will spend 6 months with Australian partner institutes undertaking relevant studies and undertaking a research project; and six Iraqi researchers will complete MSc (4) and PhD (2) graduate degrees at an Australian partner institute, with some field work possibly undertaken at ICARDA.

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, crop-livestock interactions, seed production, germplasm evaluation, economic and policy research, GIS, crop modelling, soil testing, IPM, statistical analysis, report writing and media presentations.

4.3 Community impacts

4.3.1 Economic impacts

Attainable yields with 300mm rainfall are around 4 t/ha for wheat, so it is expected to double yields where conservation cropping is adopted, through early sowing, better soil-water dynamics (porosity), better nutrient recycling (NPK), better soil structure (organic matter) and improved trafficability of machinery. Increased profits will come from increased yields as well as savings in time, machinery costs and fuel.

Uptake of new varieties depends on availability of seed, some 90% of which is provided through the informal, farm-to-farm sector. Seed availability will be promoted through utilisation of the 10 seed cleaners which were provided at the end of the first phase of the project under a specific objective on the development of village-based seed enterprises (Objective 5). It is expected that this will increase farmer access to and uptake of better seed.

The initial farmer interest in ZT is expected to grow with the increased project focus on conservation cropping which is more productive and profitable for farmers and will better

sustain the resource base through minimal soil disturbance, retention of stubble, and diverse rotations (cereals-legumes-oilseeds). Experience overseas where ZT has been widely adopted suggests strong adoption is also likely in Iraq once awareness grows and ZT machinery is available, especially given 100-fold diesel price increases over the last three years.

The total net benefit to farmers from adopting improved varieties of wheat, barley and lentil and the ZT technologies is estimated to be AUD 14.8 million over the three year project.

This estimate is based on previous experiences working in the security-constrained environment in Iraq. Average adoption rates of 20% for wheat, 10% for barley and 5% for lentil are assumed, over the total area of these crops in Ninevah Governorate. The estimate of increased net revenues from the use of improved varieties and ZT is taken from the results of trials in the 2006/07 season of the project, and is a combination of increased revenue from yield increase and a reduction in fuel and tillage costs associated with the adoption of ZT. For lentils, the benefit is the revenue from lentil adoption minus the opportunity cost (revenue from wheat) from diverting land initially used in wheat production to lentils.

Table 4.1 Estimate of total net revenue from adoption (Australian \$)

Factor	Wheat	Barley	Lentil	Total
Current Area (Ninevah Governorate)	430,000 ha	490,000 ha	2,260 ha	922,260 ha
Average adoption rates	20%	10%	5%	
Assuming lentil is adopted on 5% of current wheat land			21,500 ha	
Area using improved practices	86,000 ha	49,000 ha	21,500 ha	156,500 ha
Increase in net return (\$) using ZT	69.0	27.6		
Net benefit from adopting lentil (\$)*			348.7	
Total Net revenue from adoption (\$)	5,938,247	1,352,594	7,495,975	14,786,815

* For lentils, the benefit is the revenue from adoption minus the opportunity cost (revenue from wheat) from diverting land initially used in wheat production to lentils.

The full economic benefits of investment in the project are expected to be fully realized within 10-15 years after project termination. Full adoption on 100% of the area, at current value of net revenues, would total some \$ 43 million. However, such widespread adoption of a new production technology may also be expected to have important market-level impacts beyond agricultural production systems, which are not, as yet quantifiable. There may also be benefits from other crops being evaluated (e.g., chickpea, faba bean, oats, peas, canola) if adapted lines are identified, promoted and adopted, but it is too early for these to be estimated.

4.3.2 Social impacts

There are about 70,000 rural households with an average of 12 members per household, making a rural population of about 840,000, in Ninevah. With the potential of reaching about 7% to 10% 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.

More needs to be known about gender roles and the implications of adoption of project technologies on equity, and the project will endeavour to do this through including gender disaggregation in surveys and evaluations where appropriate, and using this information to enhance opportunities and benefits for women and children. 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, for example with a contribution by women of 18% in MRA, 11% in HRA, 15% in LRA and 6% in situations with supplementary irrigation.

In cereal and legume cropping, women and children 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, whilst children shepherd livestock (mainly sheep) whilst grazing and travelling to/from natural pasture areas.

There will be benefits to family nutrition, including women and children, through increasing local production of cereals and pulse legumes, with the latter especially important to increase protein intake and reduce cooking times. In fact, there may be serious social consequences if local production is not markedly increased. In northern Iraq, the dietary requirement for wheat is 185 kg per person per year with only half supplied by local production. Faced with the termination of food-for-oil importations to cover the shortfall, and alarming increases in the price of diesel fuel on which current cropping practices depends, efforts such as those being undertaken by the project to underpin a sustainable doubling of crop production are urgently required to keep the threat of starvation and major civil disturbance at bay.

Beyond agricultural production, large associated social benefits relating to health and other community issues can accrue from conservation agriculture. For example, from comparative studies worldwide and particularly from classic Mediterranean climates similar to those experienced in northern Iraq, Syria and southern Australia, dust pollution is reduced through the implementation of ZT, thereby reducing respiratory health problems.

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.

In relation to gender equity, Iraq is a state party to The Convention on the Elimination of All Forms of Discrimination against Women (CEDAW, ratified on 12 September 1986). 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, professional challenges faced by women are and will continue to be recognised by the project and appropriate mechanisms will be incorporated to support the increasing role of female scientists and support staff. Currently one of the collaborating research leaders is female and seven of the sixty three trainees in the recently concluded project were women. Project management will play specific attention to involving and supporting more women in project activities and training.

4.3.3 Environmental impacts

Major sustainability benefits will come from less erosion and increased carbon sequestration in the soil (1% increase in soil C = 33t/ha). Substantial gains in the conservation of soil and soil moisture are expected. It has been estimated that soil losses may range from 5 to 47% depending on the cultural practice; ZT could reduce this soil

loss by up to 75%.¹ There will be a substantial reduction in the emission of carbon dioxide and other pollutants from using less fossil fuel when ZT is adopted. For example, assuming ZT adoption rates of 10 % on about 800,000 hectares of cereal grown annually, the net reduction in carbon dioxide emission is estimated at 1,715 tons per year, based on an average emission of 2.68 kg per litre of diesel fuel, 4 litres per hour for running a tractor and two tractor hours required to prepare one ha of land. In addition, the project will promote cereal /legume rotations which will improve soil fertility and sustain yields and land productivity.

4.4 Communication and dissemination activities

The project has a specific extension component (Objective 1) to promote adoption of project technologies. Better adapted germplasm and crop management technologies identified in the research components of the project will feed directly into the extension component, where farmers are involved with extension officers from DOA and researchers from University of Mosul and the State Board for Agricultural Research in testing selected ('best bet') technologies across 12 demonstration sites in farmer fields. Field days and farmer group visits will be conducted at all demonstration locations. Farmers are already aware of and very interested in some of the improved varieties and crop management technologies, especially ZT, tested in the original project.

The extension component, and 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 Jay Cummins, an extension specialist 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. The No-till Farmers Association of Western Australia and member farmers, will provide opportunities for Iraqi trainees at University of WA to undertake small research projects and be involved in on-going conservation cropping research and extension activities within farming communities near Perth.

Development and promotion of ZT technology will be enhanced through working with local machinery manufacturers who operate in every town to fabricate, evaluate and market small, relatively cheap, locally modified or manufactured ZT seeders. Uptake of ZT will be facilitated because most of the ~800,000ha cereal (wheat + barley) crop in Ninevah is sown by contractors, with 70,000 cropping farmers/farm families serviced by around 100 contract sowing teams, each sowing the crops of around 700 farmers. Contractors will promote ZT as they become familiar with it and develop their sowing plant. This component will be enhanced by the involvement of the Agricultural Machinery Research and Development Centre at the University of South Australia in development and modification of locally made ZT seeders, with regular involvement of Dr Jack Desboilles in project meetings and training.

A GIS and crop modelling component (Objective 4) of the project is aimed to increase technology transfer through identification of recommendation domains and increasing understanding of the reasons behind yield gaps. This will enable technology development and promotion to be targeted on major constraints.

The socio-economic component (Objective 6) will also enhance uptake of technologies by evaluating adoption and impact and identifying constraints. This will help the project

¹ Ellies, 2000. Soil erosion and its control in Chile - An overview. *Acta Geologica Hispanica*, 35 No. 3-4; 279-284

research focus on major technical constraints and provide guidance on how technical and policy constraints can be overcome.

Although the project is focused on Ninevah, production systems and constraints are similar in many of the surrounding governorates. The project will encourage spillovers by inviting agricultural researchers, extension officers and leading farmers from Dohuk, Sulaymaniyah, Erbil and Najaf to view and discuss the improved varieties and crop management technologies in the demonstration and research program. This may extend to provision of some seed and advice with establishing some ZT research and demonstrations. A budget of \$10,000 per year is allocated to support these visits

Awareness and uptake of project technologies in Iraq, especially those associated with conservation cropping will be enhanced by Iraqi researcher and extension officer visits to ICARDA during project reporting/planning meetings. There will also be special visits by scientists and leading farmers around Aleppo and Kamishley/Hassake 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, as it was in the original project:

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

There will be valuable spillovers in Syria gained 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 and development will be undertaken by ICARDA in collaboration with the General Commission on Science and Agricultural Research (GSAR) Research Stations at Kamishley/Hassake, close to the Iraqi border in NE Syria, as recommended in the external project review in 2008. ICARDA already has some collaborative germplasm trials in Kamishley/Hassake. The Kamishley Station has a new, 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. ICARDA (represented by Dr Piggin, Dr Pala, Mr. Haddad) participated and gave presentations linked to a GTZ/FAO workshop on Conservation Agriculture entitled "Conservation Agriculture for Sustainable Land Management to Improve the Livelihood of People in Dry Areas" in May 2007 in Damascus. This collaboration will be furthered by the continuation of the ACIAR/AusAID Iraq project and encourage wider Middle East spillovers.

The project will interact with the International Centre for Advanced Mediterranean Agronomy Studies through its Mediterranean Agronomic Institute of Zaragoza (IAMZ) in Spain (<http://www.iamz.ciheam.org/>), which collaborates with countries around the Mediterranean Basin in research, development and training on Mediterranean agronomy. It would be an appropriate institution to send Iraqi collaborators for training and conferences, with its expertise and proximity. Dr Carlos Cantero from Leida University near Zaragoza, who is linked to training and development activities at IAMZ, would be a contact point for this interaction.

The project has established a Web page on the ICARDA web site. This will be enhanced during the project. Major project activities and findings will be recorded and made

available on the site, to increase awareness of and access to technology developments by researchers, extension officers and farmers.

5 Operations

5.1 Methodology

Project management and timetable

This project will be managed and implemented in a similar way to the original project, as this worked well in a very difficult environment.

Overall leadership and coordination will be by the Project Leader in the Commissioned Organisation ICARDA, with components in Iraq coordinated by the Iraq Coordinator and led by the Iraq Project Leader. Activities in each partner institution will be led by the designated Institution Project Leader. The roles and responsibilities of each institution are represented in Figure 5.1.1 Project Management and Implementation.

A Project Coordination Committee will be established, chaired by the Project Leader and composed of the project leaders from each institution, plus a representative from ACIAR and AusAID. This committee will meet annually at the end of the annual reporting/planning meeting, to review project progress and planning for the coming year and discuss and resolve major issues facing the project.

In Iraq, the Ninevah Implementation Committee will be reactivated, chaired by the Iraq Project Leader and composed of managers and key scientists from the University of Mosul, Directorate of Agriculture and State Board for Agricultural Research in Ninevah. Depending on the security situation, this committee will meet or interact monthly to plan, monitor, review and report on activities and achievements, and ensure that the agreed workplan is being implemented.

Given the security situation in Iraq, and the fact that ICARDA and Australian partners cannot travel to Iraq, it is important that there is flexibility in implementation of the workplan to ensure project objectives are achieved. Any major issues or changes will be discussed thoroughly with all collaborators/partners through email and telephone before taking action. This worked well in the original project.

There will be an annual cycle of events over the three years of the project, to accord with the annual cropping cycle in Iraq and Syria. The overall timetable of main events and activities is presented in Table 5.1.2. The annual technical and project management meeting will be held at the start of Autumn (September) to review results from the previous year and develop the detailed workplan for the next year, attended by project leaders and key scientists from all institutions. The Project Management Committee will meet at the end of each annual technical meeting. Information from the annual meeting will be collated into the Annual Project Report for ACIAR/AusAID, which is due each year at the end of May. Although this project is for three years, all parties envisage a longer term commitment.

Crops and field activities are undertaken from planting in mid-Autumn (October) to harvest in Spring-Summer (April-June). Activities in Iraq will be implemented as planned by each institution with inter-agency coordination and integration through the Ninevah Management Committee. Monitoring and evaluation, surveying, analysis, interpretation, and training will be ongoing as appropriate in Iraq, ICARDA and Australia.

Figure 5.1.1 Project Management & Implementation - Roles and responsibilities

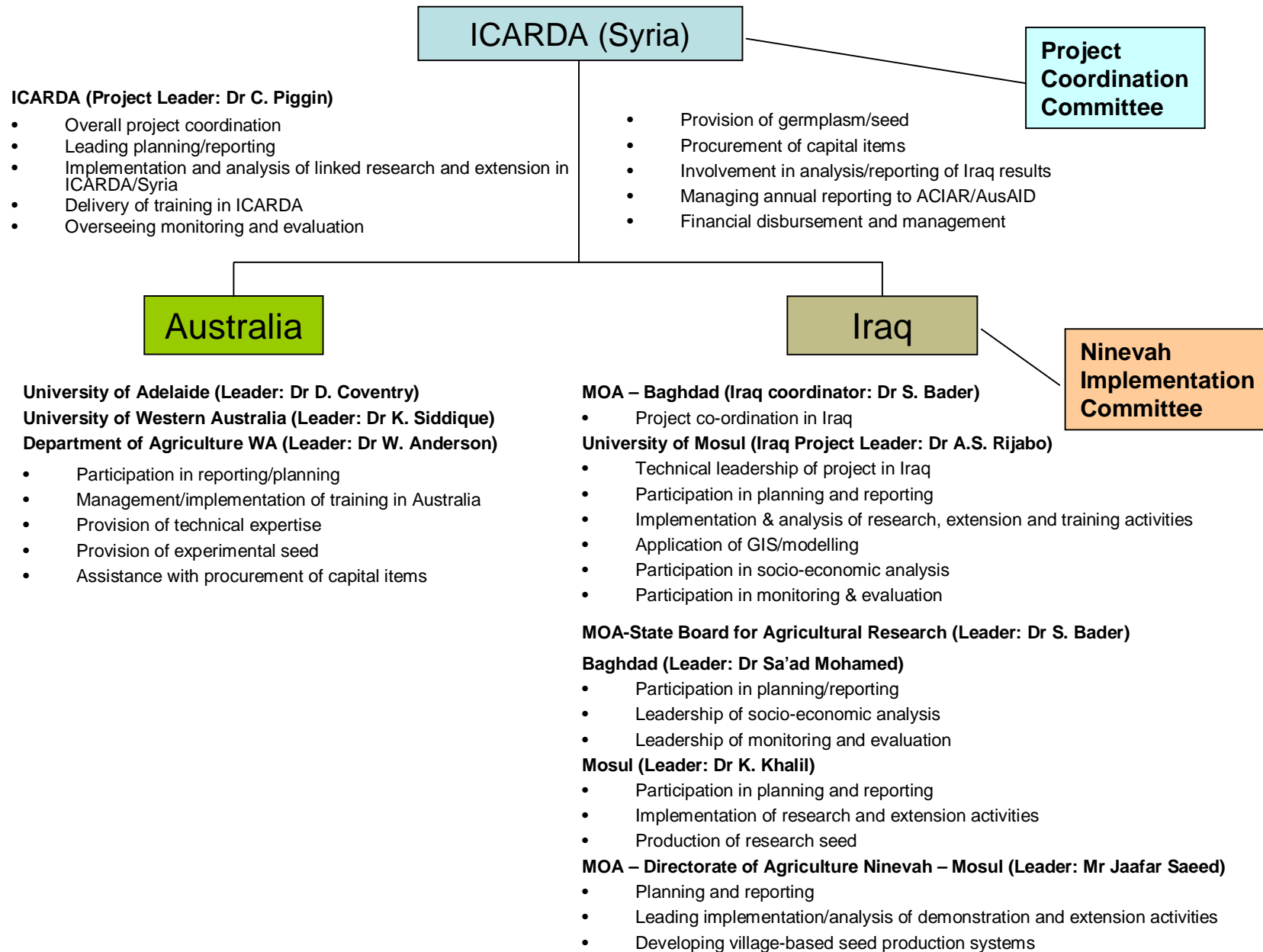


Table 5.1.2 Annual **Timetable of Main Events and Activities (July 2008-June 2011)**

Time	Activity
Monthly	Meeting of Ninevah Implementation Committee in Mosul Purpose: plan, monitor, review, report activities and achievements Participants: UniMosul, DOA Ninevah, SBAR-Ninevah chaired by Iraq Project Leader (~ 30 participants)
Early September	Annual technical meeting in ICARDA Purpose: report on previous year activity and achievements, plan next year program, Participants: all partners chaired by Project Leader (~ 40 participants)
Early September	Annual Project Management Committee meeting in ICARDA Purpose: review and agree on achievements, workplans, policies, directions and finances of the project Participants: leaders of all partner institutions
Oct (Autumn) – June (Summer)	Cropping season – implementation of demonstration, research and extension programs in Iraq and ICARDA
Ongoing	Monitoring & evaluation/surveying in Ninevah
Ongoing	Analysis & interpretation of data information in Iraq and ICARDA
Ongoing	ST and LT training in ICARDA & Australia
May	Annual report to ACIAR/AusAID

Risks and sustainability

The original project has operated effectively and made excellent progress over three years with the current partners, despite a very challenging working environment set against the political and security situation in Iraq. There has been severe violence and bombings in Mosul and Tel Afar, where much of the project activity is located, which has made it difficult and dangerous for project personnel in both the office and field. In-country field visits by ICARDA and Australian collaborators for planning, implementing and monitoring progress are not possible. There have been changes in MOA appointments of Minister and Coordinator, a referendum and election, and land disputes and security concerns which meant that Tel Afar and Al Rashidiya research stations could not be used as planned. Sadly, the MOA project co-ordinator, Dr Awad Abbas, DG of the State Board of Agricultural Extension was assassinated in Baghdad after returning from the September 2005 planning meeting at ICARDA, which was a severe setback, although his replacement, Dr Saleh Bader, DG of the State Board of Research, is providing excellent support. There have also been difficulties sending funds into Iraq and getting suitable nominees for training opportunities.

Despite these difficulties, the original project has performed remarkably well since commencement on 1 May 2005. All major project meetings were held as scheduled at ICARDA, funds were eventually transferred and the budget expended, agreed work was well undertaken in Iraq and Syria, planned training programs were undertaken in ICARDA and Australia, and agreed capital items were supplied. This has been for several reasons. Firstly, the Iraqi institutions have a strong mandate to develop and promote the technologies the project is addressing. Secondly, these institutions possess strong ownership of the project through their substantial involvement in deciding priorities and developing workplans. Thirdly, the project work is facilitated by the enthusiasm, flexibility and dedication of Iraqi collaborators, the proximity of ICARDA, and the shared interest and support of ICARDA and Australian scientists.

With this experience in mind, the activities and anticipated outcomes of the project are considered feasible and sustainable. Iraqi institutions will in the long-term, continue to benefit from the training and consequent capacity-building the project provides, while in the short-term the project will benefit from their mutual collaboration and leadership on the ground.

Specific risks and assumptions involved with activities are indicated under 5.2 Activities and outputs/milestones. These are mainly associated with the security situation in the area where the project is operating in Iraq, and it is considered that care and flexibility in the timing and location of activities can overcome the problems, as was the case in the original project. Other risks are safety issues concerning travel to ICARDA and Australia and availability of appropriate trainees who fill required criteria. Flexibility with timing of and persistence in selection should enable these meetings and training to proceed, as they did in the original project.

Technical implementation

The project will continue to operate in the sites established in the original project (Figure 5.1.2).

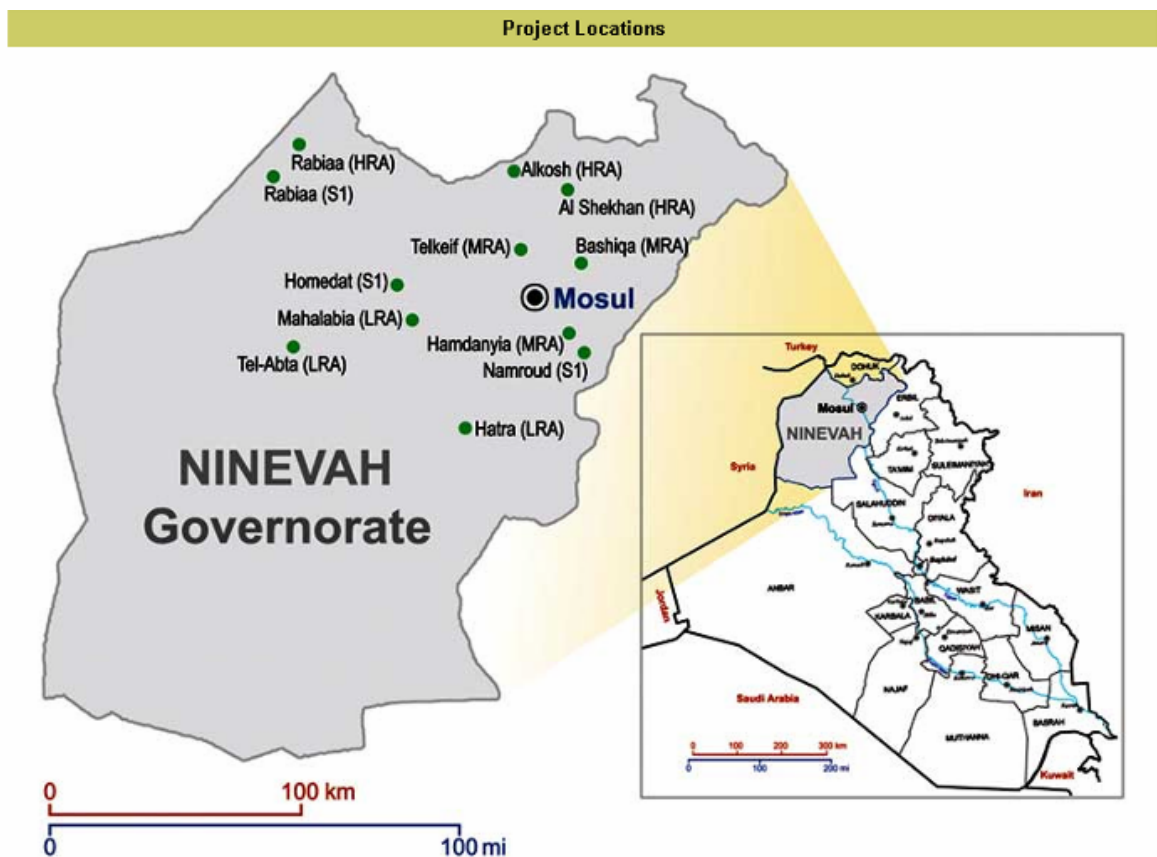


Figure 5.1.2: Locations of on-farm demonstrations:

HRA = high rainfall areas, >450mm; MRA = moderate rainfall areas, 350-450mm; LRA = low rainfall areas, <200-350mm; SI = areas with supplementary irrigation:

Objective 1: To demonstrate and promote uptake of 'best-bet' improved varieties and crop management systems for wheat, barley and pulse and forage legumes

The project will continue the program of demonstrations established in the original project. Based on the work plan agreed in the first planning workshop (September 2008), sites and participating host farmers and farmer groups will be selected for on-farm demonstrations in twelve sites: with four sites (three with natural rainfall, one with supplementary irrigation termed SI) in the high rainfall area (HRA), moderate rainfall area (MRA), and low rainfall area (LRA).

These demonstrations will be monitored throughout the season, providing data for the analysis of the various factors within the best-bet practices. Some of the same sites in farmers' fields also will be used for specific research trials under Objectives 2 and 3. Small plots (100 m²) will be used for the multiplication of seed of promising cultivars (20

cultivars), at the same time providing a venue for farmers to observe the performance of these lines.

Demonstrations and trials will be established in host farmers' fields under the supervision and management of project staff to ensure that the best-bet practices are correctly demonstrated. 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 germplasm and crop management technologies.

Within Activities 1.2 and 1.3, the project will develop innovative approaches to enhancing the extension outreach achieved through the project, led by Dr Jay Cummins of PIRSA Rural Solutions through Adelaide University. This will be achieved through the development of participatory driven research, development and extension methodologies, with the aim of complementing a range of project activities such as the field demonstration sites, training activities undertaken at ICARDA, and the short term scientists training conducted in Australia. The development of such methodologies will be guided through undertaking a range of case study examinations of current extension approaches associated with project participants, identifying specific constraints to the adoption of improved farming systems (from a socio-economic perspective). Specific themed workshop training sessions will be conducted annually at ICARDA, amongst Iraqi project partners. These activities will provide a focus on developing improved systems of adoption and change at the farmer level, supported through simple but effective evaluation tools and approaches.

Activity 1.1 Compile, review and analyse existing information on potential available technology options

Options will include those tested in the original project and more broadly within and outside Iraq, including registered Iraqi varieties of target crops and crop management options. Results from the original project will be compiled and analysed to identify and prioritize available "best bet" technologies to be demonstrated in the project. This will be an ongoing activity as new results become available each year and underpin adjustments to the demonstration program.

Activity 1.2 Demonstrate and evaluate alternative conservation tillage management in Ninevah governorate.

Alternative conservation tillage options, including ZT (at all locations), chisel plough (at some locations), and deep tillage/subsoiling (at some locations), chosen because of their promise (ZT), their use by some HRA/SI farmers (chisel plough), and the suspicion that soil hard pans can be a constraint (deep tillage), will be compared with the farmers' conventional tillage practices. Long-term trials will be established in three districts in each rainfall zone: HRA, MRA, LRA and at sites with SI. Factorial experiments will be established with two factors - tillage methods and cereal (wheat or barley) cultivar - with three replications and plot size of 1 *donum* (0.25 ha) using district rotations/crop management. Four trials will be conducted:

- HRA and SI: three tillage methods (ZT, chisel, and conventional tillage) x two cultivars of wheat.
- MRA and LRA: two tillage methods (ZT and conventional tillage) x two cultivars of barley
- In all four locations at sites where a hard pan has been identified: A simple experiment will be undertaken comparing deep tillage with conventional tillage, using one cultivar of wheat or barley.

Activity 1.3 Identify, promote and widely disseminate 'best bet' improved crop varieties among farmers in the rainfed cropping regions of Ninevah

Germplasm of wheat, barley, pulse and forage legumes identified as adapted to the HRA, MRA and LRA rainfed farming systems will be evaluated under ZT and conventional

cultivation with farmers in their fields. Factorial trials (3 reps) will be established in one location in each rainfall zone. The size of plots will be dependent on the seed available. For cereals (wheat and barley) and pulses (lentil and chickpea), seed is available from original project multiplication or from ICARDA.

Objective 2: To evaluate and select new, improved germplasm of wheat, barley and pulse and forage legumes for promotion in demonstration programs

For each activity, 10-12 adapted elite lines of each crop (bread wheat, durum wheat, barley, chickpea, lentil, faba bean) and vetches will be identified by ICARDA and Australian partners from international nurseries and other sources and seed dispatched to Iraq for screening for specified biotic and abiotic stresses. These will be evaluated in experiments using a randomized complete block design with three replications, and small plots of 10 m². In addition to yield measurements, the experiments will be monitored and scored throughout the growing season for desirable traits.

Activity 2.1: Identify potential lines from the original project experience, other Iraq information, ICARDA's international testing program, Australian experience, and other sources.

Evaluations will involve six crops (bread wheat, durum wheat, barley, chickpea, lentil, faba bean) and forages (vetch). ICARDA will source seed not available in Iraq for the targeted yield trials comprising up to 10 elite lines for different traits.

Activity 2.2: Screening, evaluation and selection of improved germplasm in Ninevah

Screening, evaluation and selection of improved germplasm of wheat, barley, pulses (chickpea, lentil, faba bean) and forage legumes for adaptation to moderate rainfall areas (MRA) will be conducted on the Mosul University farm and at Rashidiya research station. Oats and peas will also be evaluated when sufficient seed of the best adapted varieties is available from ICARDA/Australia.

Screening, evaluation and selection of improved germplasm of pulses (chickpea, lentil, faba bean) for drought tolerance in high rainfall areas (HRA) will be conducted at Al Khosh.

Screening, evaluation and selection of improved chickpea germplasm for resistance to diseases (*Ascochyta*, *Fusarium* spp.) will be carried out in controlled experiments at Mosul University farm, with artificial inoculation of *Ascochyta* and *Fusarium* spp. and with SI when necessary to simulate HRA conditions.

Activity 2.3: Screening, evaluation and selection of improved germplasm of wheat, barley, and forage legumes and grasses for adaptation to salinity in Iraq

This has been added to the project as a small pilot activity to respond to one of the priorities of the MOA and a request by the Director General of the State Board of Agricultural Research (SBAR) to initiate some testing for salt tolerance. 'Best bet' available varieties of bread wheat, barley and forage legumes and grasses identified as adapted to saline conditions will be evaluated by SBAR-Baghdad in replicated trials established in farmers' fields in irrigated sites at Wahdea in Baghdad Governorate and Sawaria in Wasit Governorate. ICARDA will assist with identification and seed provision of candidate varieties and cultivars from results of evaluations and experiences in irrigated salinity-affected sites by other international and NARS institutions. ACIAR will also consider the development of a separate project on salinity, with an appropriate broad and integrated approach addressing issues such as irrigation management, drainage, soil management in an integrated fashion.

Objective 3: To evaluate and select new, improved crop management technologies for promotion in demonstration programs

Activity 3.1: Conduct research on conservation cropping technologies including zero-tillage, stubble mulching, time of sowing, stubble removal/retention, crop rotation, improved fertilizer practices, improved weed, pest and disease management in Iraq and in ICARDA

Various short-term and long-term trials will be established in Ninevah and at ICARDA to evaluate the various components of conservation cropping listed above. Evaluation of trials under (1) will be supported by crop modelling activities. Trials will include:

1. Comparison of ZT and conventional tillage crop establishment with additional treatments of early/late sowing, \pm stubble removal and potential (stress-free) growth in long-term trials in ICARDA and Ninevah
 - In Ninevah, this will be done at the University of Mosul farm, where MSc students will undertake a range of specific studies on priority soil, crop, and weed, pest and foliar and soil-borne disease issues within the different tillage treatments in the long-term trial.
 - In ICARDA, it will involve the continuation of the two established long-term trials, which will have sowing time and stubble removal treatments, with monitoring of priority soil, water, crop and weed, pest, and disease parameters.
2. Evaluation of alternative crop and forage rotations under ZT in LRA and MRA in Ninevah.
 - Trials will be established to assess alternative rotations under ZT and their effects on soil fertility and physical properties and on the management of weeds, diseases and insects. 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 / barley+safflower / safflower, and wheat / wheat+flax / flax; and 2-course rotations of barley / medic, barley / common vetch & barley mix for hay-making; wheat / *Nigella sativa*; wheat / *Agropyron*, *Phalaris*, *Lolium*, *Festuca*, *Dactylis*.
 - In addition, there will be trials evaluating intercropping of barley with saltbush (*Atriplex* spp)
 - The trials will assess whether plant residues of safflower and flax enhance ZT; the effects of rotation on soil fertility and physical properties; the production of high quality forages for grazing animals; and the effects of rotation on weed, insect and diseases incidences.
 - These ideas will need to be thoroughly and realistically discussed at the first work planning meeting in September 2008, to ensure manageable set of trials on researchable priority issues is planned.
3. Evaluation of the effect of different tillage systems on weed control
 - A survey for all weed plants 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. Ecological and biological studies of the parasitic weeds, *Orobanch* (broom rape) and *Cuscuta* (dodder), will be conducted through PhD studentships at the University of Mosul.

4. Evaluation of adding polymer gel crystals to the soil to enhance water availability.
 - This exploratory research at the University of Mosul will assess a newly available technique of adding Polymer gel to soil. The technique is intended to increase the water-holding capacity of soils, reduce the frequency of irrigation in irrigated areas, limit the loss of nutrients due to leaching, reduce evaporation from the soil surface, improve soil physical properties, and enhance plant growth.
 - A trial on either wheat or barley will be established in each location (HRA, MRA, LRA and SI) under ZT, with three treatments: application of polymer gel + 50% or 100% of recommended rate of fertilizer; and control, without polymers gel + 100% of fertilizer. Regular measurements will be made of soil moisture and other properties.
 - These ideas will need to be thoroughly and realistically discussed at the first work planning meeting in September 2008, to ensure a manageable set of trials on researchable priority issues is planned.
5. Evaluate Integrated Pest Management (IPM) options for cereals (wheat, barley) and food legumes (chickpea, lentil) in Ninevah
 - One 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. One farmer field school, made of 30 farmers, will be established around each of the IPM plot sites to teach farmers how to manage these pests. Other specific IPM studies will be undertaken by MSc students from Mosul University.
6. Evaluate the biological control of covered smut and root rot diseases in wheat
 - Experiments will be established on University of Mosul farm to study the effects of allelopathic management as a means of reducing the incidence of covered smut. Experiments will include four treatments: wheat straw treated with bio-control spores; K fertilization at 40 kg/donum; application of both bio-control and K fertilizer; and untreated control. Specific studies will be undertaken by MSc students.

Activity 3.2 Cross-evaluation of alternative cropping systems by crop-soil-simulation modelling

In a small side-experiment linked to the experiments outlined under Activity 3.1 (1), the potential growth, i.e. the growth free of water and nutrient stress, of the chosen wheat and barley varieties will be determined for later crop model calibration (this is of special importance for any less-characterized landraces from Iraq)

Soil physical properties (texture, soil bulk density, field capacity and permanent wilting point) soil organic matter and nitrogen and plant-available P and K will be determined before the onset of the cropping season

Soil mineral N, soil moisture, crop growth (aboveground-biomass and leave-area development over time), root depth, yield and the fade of surface residue cover (if applicable) over time will be monitored regularly at crop establishment, four weeks before anthesis, at anthesis and maturity. Total N uptake of the crop will be determined at maturity. Phenological development (e.g., Fekes, Zadok) will be monitored.

Selected trials will be analysed by crop simulation modelling at a later stage, once the necessary expertise in crop-modelling has been established (see objective 4). The aim is to use crop models to highlight the effect of conservation cropping on crop yield and to quantify its benefits over conventional cropping practices. Additional scenario analyses will allow for quantification of critical levels of surface residue ("turning point") and shed light on the effect of a changing climate, where the focus will be laid on the foreseen increased year-to-year variability in rainfall amount and periods.

Activity 3.3 In conjunction with local manufacturers, modify and adapt locally produced seeders and evaluate their performance under ZT

The local unavailability of ZT seeders constrains the adoption by farmers of ZT practices. With a view to outscaling conservation tillage practices, the project will evaluate ZT seeders modified by local manufacturers. Imported Indian ZT seeders have been tested, but in the farmers' opinion they are unsuitable for the extensive production systems in Ninevah because their working width is too narrow, their frames and sowing arms are weak and susceptible to breakage, and they require 3-point linkage which is rare on Ninevah tractors.

This activity will continue from the initial start made in 2007/08. It will involve interaction and collaboration with small machinery manufacturers and farmers to modify existing seeders or design and build new seeders. There are several farmers and a PhD student involved in Ninevah and four manufacturers involved from Syria. Local modifications will be evaluated including:

1. the "RAMA" drill seeder, with a working width of 3.6 m. A prototype has already been developed by a local manufacturer and is being used for contract ZT planting in one village in the project area.
2. a modified disc seeder with a working width of 3.8m and upright discs and tubes delivering seed to disc slits in the soil

The project will purchase some modified seeders and use them in demonstrations and promote their uptake. There are some 70,000 farmers/farm families in Ninevah and most of the ~800,000ha wheat and barley crop is planted by around 100 contract sowing teams, each sowing the crops of perhaps 700 farmers. This should facilitate widespread adoption of ZT sowing. The machines may cost around \$3,500 and, with large contractors, a loan scheme is unlikely to be necessary. Contractors and leading farmers will be especially targeted and involved in developing and promoting ZT seeders.

The Agricultural Machinery Research and Design Centre (AMRDC), Institute of Sustainable Systems and Technologies, University of South Australia, will be engaged in a consultancy through the University of Adelaide to assist with this activity. This would involve Dr Jack Desbiolles, Research Fellow, On-Farm Machinery Area, in an annual visit to ICARDA each year and:

- participation in annual reporting/planning meetings
- assistance and advice on design, modification and evaluation of locally-made Iraqi and Syrian seeding machines, using the principles of the Indian and other ZT seeders
- training of contractors/farmers from Iraq in the use and maintenance of zero-till planters
- training and support of local seeder manufacturers from Iraq and Syria
- assistance with training/supervision of visiting Iraqi trainees

Activity 3.4 Conduct research on adaptation and seed production of alternative crops including oats, peas and oilseeds in ICARDA and, when seed is available, in Iraq

Experiments will continue at ICARDA evaluating adaptation of oats, peas and brassicas. Better-performing lines will be multiplied for wider testing, including in Iraq.

Activity 3.5 Evaluate systems for the integration of crops, forages and livestock

Some of the long-term trials comparing ZT and conventional tillage will have \pm stubble treatments to monitor soil properties and crop performance, with stubble removal simulating grazing. This and other published studies will be used to evaluate whether ZT benefits are reduced with grazing and the need and feasibility of restricting grazing of stubbles and providing alternative forages.

Activity 3.6 Undertake initial demonstrations with farmers in Iraq and ICARDA/Syria and identify options for wider promotion in the extension program under Objective 1.

Optimum conservation cropping technology packages will continue to be initially verified and demonstrated with selected farmers, especially involving ZT and stubble retention. This will be in selected demonstrations under Objective 1 in Iraq and with farmers near collaborating machinery manufacturers in Syria.

Objective 4: To facilitate agricultural planning and development through utilisation of GIS and crop modelling

Activity 4.1 Conduct annual training session on advanced GIS skills.

Training will be provided in techniques required for the harmonization of project datasets to a common geodatabase structure, using global datasets of relevance (particularly remote sensing archives); and methods for analysing and developing ecological maps and datasets, for interpretation of satellite images and for developing land suitability maps using locally compiled and globally available data

The training will have a mixture of lectures, practicals and assignments using the participants own data. In between the training events they will also be required to undertake tasks in the office, which will be evaluated during the next course and will be backstopped through e-mail correspondence.

Activity 4.2 Develop land suitability maps using locally compiled and globally available data.

Soil maps, climatic data, satellite imagery, land use and farm type data covering the Ninevah Governorate will be compiled and interpreted. Crop requirement tables and simple land suitability models will be developed for the main field crops and land suitability maps prepared and validated using local knowledge and data from the demonstration and research trials.

Activity 4.3 Integrate GIS into project development activities and develop and utilize geospatial services to assist with the interpretation and promotion of project technologies.

The experience in land suitability modelling developed in the course of Activity 4.2. will be used for creating the required databases and refining these models for identification of the potential recommendation domains of the new crops, varieties or technologies promoted by the project.

Activity 4.4 Initiate training sessions in crop-soil simulation modelling using either the CropSyst, APSIM or DSSAT crop modelling suite

Two to four key-scientists will be identified and selected (based on willingness, background and skills) for two to three training sessions at ICARDA in crop modelling. The four to seven day training sessions will in the beginning this training in year one be basic (familiarizing with the concept of crop modelling) and, at a later stage in years 2/3, participants will work with their own data, generated within Activity 3.1 (1) and 3.2. The proximity of ICARDA will underpin post-project sustainability.

Objective 5: To develop, evaluate and promote efficient and sustainable local seed production and supply systems

Activity 5.1 Multiply and provide new crop germplasm and/or crop varieties from ICARDA for research and demonstration in Iraq based on request

Each year produce around 1-2 tonnes of seed of lines and varieties of cereals, legumes and forages at ICARDA and despatch for research and demonstrations in Iraq

Activity 5.2 Continue development of a functional seed unit within the agricultural research system to provide seed for research trials and demonstrations at Rabiaa research station

Review existing breeder and basic seed production procedures and facilities (equipment, storage) made during the first year at ARC-Rabiaa

Appropriate procedures and facilities (equipment, storage) developed for breeder and basic seed production during the second year at ARC-Rabiaa

Training for variety maintenance, breeder and foundation seed production organized in Yrs 1 and 2

Activity 5.3 Establish sustainable farmer/village-based seed production systems

A multi-institutional and multi-stakeholders consultative process will be employed in targeting the communities to initiate local village-based seed enterprises (VBSEs). In-depth group discussions will be organized with farmers and local leadership in target communities to explain project objectives and solicit their interest to enter the seed business. A group of progressive, volunteer farmers from the community willing to invest time and resources will be identified and organized to establish local VBSEs and form a seed producers association. An average number of 10 to 20 farmers per VBSE working mainly on target crops will be selected and provided with seed of the best available varieties and trained in technical and financial aspects to become entrepreneurs and produce and market quality seed.

The enterprises will be organized around the seed cleaning and treatment equipment already made available to the MOA and will be assisted in sourcing foundation seed and inputs and credit to start production of commercial seed. They will receive technical backstopping and training in technical aspects of seed production technology and financial/enterprise management and assistance in promoting the varieties and seeds through field days. The project will arrange for field inspections by SBSTC to ensure high standards of seed quality. The groups will manage all seed production operations and marketing directly through local contacts or networks including extension services.

Seed demand surveys will be conducted and business plans developed annually to assist in seed production and marketing in target areas. The amount of seed produced and marketed would be monitored and a profitability analysis conducted to measure the profitability and ensure the sustainability of the enterprises. These rural enterprises will be assisted in expanding their operation and business diversification and eventually developing into private seed companies. The amount of seed distributed, number of farmers accessing quality seed, incremental yield achieved and area planted with new crop varieties will be used as indicators of the performance of VBSEs.

Objective 6: To monitor and evaluate adoption and impacts of project technologies, and identify enabling policy options to enhance uptake by farmers.

Several methodological approaches will be used to address this objective. The methodologies relating to specific activities are described below.

Activity 6.1 Characterization of improved technology options in terms of their performance, profitability, risk reduction, and acceptance by farmers

Characterization of new technology options (crop varieties, cropping system management) will be conducted using simple activity (enterprise) budgets and partial budgets. Returns to investment will be estimated to establish their profitability compared to farmers' conventional practices. Formal risk analysis using stochastic dominance and Mean-Variance (E-V) analyses will be used to assess risk-reducing features of interventions. Farmer adoption surveys will be conducted to evaluate acceptance of improved technologies.

The socio-economists will work closely with other scientists to collect field data from farmers involved in demonstration trials and those who have adopted the new

technologies. Farmers' perceptions about these technologies will be documented through a structured formal survey of users. Additional data will be collected on input and output prices at farm or market level.

Activity 6.2 Analyse water productivity and water use efficiency in each zone with attention to factors explaining low WUE in supplemental irrigation areas and farmer's demand for water

To measure technical efficiency in the use of farm inputs (including water), simple physical output per unit of input will be measured. Fixed allocatable input model and stochastic production frontier functions will be identified and estimated to assess technical efficiency in different zones and to identify factors explaining inefficiency. Stochastic frontier analysis is a standard method which has been widely applied in agricultural economics literature.

Activity 6.3 Identify sources of inefficiency in crop production under different rainfall zones, and assess the impact of improved options on increasing the efficiency

The same methodology of stochastic frontier analysis used in activity 6.2 will be applied for this activity with the difference of including variables that represent improved technology options being introduced in the different rainfall zones. Typically, input use and crop production data will be collected as well as farm household and community characteristics. Two samples of farmers who use or do not use the improved technology options will be interviewed to assemble the data.

Activity 6.4 Assess the effectiveness of improved management options on the adaptive capacity of local communities to climatic variability and change

Household vulnerability to climate change will be assessed among those using and not using conservation agriculture. The approach will consist of comparing livelihood outcomes in terms of household food security, income, and poverty status to evaluate resilience to climate and climatic variability following adoption of the new technologies.

Activity 6.5 Monitor the rate of adoption of improved technologies and identify constraints to provide feedback to technical, socio-economic and policy research.

Adoption of improved technologies will be monitored to document technology diffusion within and outside locations where they were promoted. In the third year, after a sufficiently large number have been exposed to and adopted these technologies, an adoption survey will be conducted to identify the rates and intensity of adoption and identify main constraints, which will be tabulated using descriptive statistics. Adoption will be assessed under different typologies of farming communities (e.g., farm size, type of enterprise, vulnerability status, production system). Estimating the probability of adoption and analysing factors affecting adoption requires econometric modelling. Probit or Logit model specifications will be used where the probability of adoption depends on the characteristics of the farmers as well as the technologies. The intensity of adoption will be analysed using a limited dependent variable model (e.g., Tobit). The number and type of variables to be included in the three models will depend on the technology under consideration and data availability.

Activity 6.6 Evaluate economic and environmental impacts of improved technologies promoted by the project at both farm and community levels

Net returns per unit of major inputs such as land, water and labour will be calculated and compared between adopters and non-adopters of improved technologies. In addition, household income will be estimated to determine the extent to which single crop-based technologies contribute to overall household food security and poverty reduction. Extrapolation to community level impacts will be conducted using the economic surplus model and based on actual and expected adoption levels. This will require collection of information on yield gain, quantities produced and consumed, price received and paid, price elasticities of supply and demand and planted area.

The impacts of conservation agriculture (ZT) on water productivity and WUE will be evaluated. It is expected that the use of conservation agriculture will expand farm-level impact through increases or no reductions in yield and a reduction in the use of fossil fuel for land preparation and planting, which will translate into cost savings, increased profitability and a downward shift in the supply curve. The aggregate effect of a supply shift will be estimated through the economic surplus approach and used to estimate the returns to investment (with and without conservation agriculture). This requires estimating the adoption path. Sensitivity analysis will investigate the viability /feasibility of conservation agriculture with a change in economic factors. Reduction in CO₂ emissions through reductions in fossil fuel consumption will be estimated using appropriate conversion factors. The research team will explore the use of the MIDAS (Model of Integrated Dryland Agricultural Systems) model in collaboration with Australian scientists (e.g. Dr David J. Pannell, UWA). It is planned to interview 500 households using structured questionnaires to collect data for adoption and impact assessment.

Activity 6.7 Assess the impact of land tenure, input and output pricing policies (input price subsidy, output price supports) on the uptake of new technologies and their implications on rural livelihoods.

The effect of land and pricing policies on uptake of new technologies will be examined through an analysis of incentives or disincentives these policies bring from an economic point of view for farmers. The methodology will be based on econometric analysis of factors affecting technology adoption (probit, logit models) including land tenure systems and policy variables (input and output prices) as independent variables. Adoption rates with alternative levels of these variables will be compared.

Activity 6.8 Identify enabling policy and institutional options

Stakeholder consultations will identify constraints and feasible policy options that could encourage the uptake of new technologies. Welfare analysis will be conducted using an economic surplus model to estimate changes in consumer and producer surpluses, costs and social gains or losses. These outcomes will be compared across policy options to determine the best options.

Objective 7: To enhance the capacity of Iraqi research and extension programs to develop and promote improved conservation cropping technologies

Activity 7.1: Develop and agree on program of training:

MOA, ICARDA and Australian partners to jointly nominate and select suitable staff.

Activity 7.2: Short-term and individual medium-term training and joint data analysis at ICARDA

Undertake selected short-term (3-4 weeks) on-the-job and coursework training relevant to project activities including conservation cropping, crop-livestock interactions, seed production, germplasm evaluation, economic and policy research, GIS, crop modelling, soil testing, IPM, statistical analysis, report writing and media presentations (20 Iraqi staff per year)

Activity 7.3: Thematic workshops

Thematic workshops on particular topics of interest will be held between Iraqi project scientists, Australian partners and ICARDA to discuss and analyse on-going work, identify new research needed and transfer new approaches and methods of analysis. The workshops will be scheduled immediately prior to or following the annual planning and reporting meetings.

Activity 7.4: Long-term training/joint research and MSc/PhD graduate research at Australian partner institutes

10 Iraqi scientists will spend up to 6 months each at one of the Australian partner institutes over the 3 year project. They will undertake a program of independent studies and conduct a 6 month research project under the supervision of Australian scientists.

Selected Iraqi researchers will complete MSc (4) and PhD (2) graduate degrees at an Australian partner institute and/or ICARDA, under the joint supervision of Australian and ICARDA partners. At least one UWA postgraduate student may be located in Albany (DAFWA) to undertake field based research under the supervision of Dr Wal Anderson and one University of Adelaide student may be located at the Agricultural Machinery R & D Centre under Dr Jack Desbiolles.

Possible topics for Australian training include socio-economics, GIS, conservation cropping, crop agronomy/management, modern breeding/selection, multivariate and G x E analysis, ZT seeder development, modern extension approaches, insect, disease and weed management.

For trainees to interact well and benefit from their training in Australia, they will need to meet the following criteria determining their selection:

- have completed a undergraduate university degree;
- been active as a scientist in their chosen field;
- be reasonably young (<35 yo);
- be fluent and able to pass the University entrance test in English;
- be able to adapt to Australian culture/life;
- be active and able to use the training in their chosen field on return to Iraq.

Activity 7.5: Support participation of Iraqi personnel in regional or international workshops and conferences of relevance to the project.

Some limited support will be given to selected Iraqi scientists to attend regional and/or international workshops. Project support for such 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 Section 3. 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: to 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
Outcomes			

1: wide adoption of conservation cropping systems by farmers	# adopting farmers Areas adopted	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
2: development of local village capacities to produce and market seed and ZT machinery	# of village-based seed enterprises amount of R & D seed produced # farmers and contractors using ZT	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
3: improved technical capacity by agricultural agencies to plan, implement and monitor research and development programs	# of staff trained Use of project –provided enhancements in R & D	Training reports Observations, discussions, institution records	Security situation and institutional support allows scientists from MOA and Uni Mosul to operate effectively
Objectives			
1. To demonstrate and promote uptake of “best-bet” improved varieties and crop management systems for wheat, barley and pulse and forage legumes	# of demonstrations # of 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
2. To evaluate and select new, improved germplasm of wheat, barley and pulse and forage legumes for promotion in demonstration programs	# of research trials # of improved lines identified/characterised # of ‘new’ lines moving into demonstration testing	Annual workplans and technical reports	Availability of new crop varieties adapted to Iraq conditions
3. To evaluate and select new, improved crop management technologies for promotion in demonstration programs	# of research trials # of new technologies identified/verified # of ‘new’ crop management technologies moving into demonstration testing	Annual workplans and technical reports	Availability of new crop management technologies adapted to Iraq conditions
4. To facilitate agricultural planning and development through utilisation of GIS and crop modelling	Increased capacity of Ninevah GIS unit Use of GIS in planning/promotion Use of modelling in R & D	Discussions, inspections, institution records	Availability of and access to facilities and data in Iraq and user support from ICARDA
5. To develop, evaluate and promote efficient and sustainable local seed production and supply systems	# of operational village-based seed enterprises Amount of local seed traded	Surveys Discussions, inspections, institution records	SBAR capacity and willingness in implementing suggested procedures and operating facilities (equipment, storage) Farmer willingness to enter local seed production and marketing business Availability of qualified staff dedicated to seed units

6. To monitor and evaluate adoption and impacts of project technologies, and identify enabling policy options to enhance uptake by farmers	# of 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 Ninevah and Baghdad
7. To enhance capacity of Iraqi research and extension programs to develop and promote improved conservation cropping technologies	# ICARDA training courses # training/study visits to Australia Use of project –provided enhancements in R & D	Workplans Training reports Annual reporting	Availability/nomination of trainees with required criteria Iraqis can 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: To demonstrate and promote uptake of “best-bet” improved varieties and crop management systems for wheat, barley and pulse and forage legumes

no.	activity	outputs/ milestones	due date of output/ milestone	risks / assumptions	applications of outputs
1.1	Compile, review and analyse existing information on potential available technology options, (options already tested in the original project and more broadly within and outside Iraq, including registered Iraqi varieties of target crops and crop management options) in all agro-climatic zones of Ninevah governorate (All)	Annual Project meeting project partners to discuss and determine work plan Constraints/limitations in rainfed crop production identified through evaluation of Phase 1 results/ experiences and on-going diagnostic study of farmers' existing practices Available “best bet” technologies identified and prioritized based on Phase 1 results/ experiences in farmer demonstrations and research trials	Yr 1, 2, 3 m3	Iraqis can travel and annual meetings can proceed	Identified “best bet” technologies used in subsequent activities
1.2	Demonstrate and evaluate alternative conservation tillage management in Ninevah governorate, including zero-tillage, chisel plough, and deep tillage, compared with conventional tillage (PC)	Annual Project meeting of all project partners to discuss and determine work plan Demonstration trials established Field days and visits to promote farmer awareness/adoption Evaluation of results and reporting	Yr 1, 2, 3 m3 Yr 1, 2, 3 m5 Yr 1, 2, 3 on-going Yr 1, 2, 3 m3	Iraqis can travel and annual meetings can proceed Security situation allows demonstrations and field visits/days to proceed	Conservation cropping practices are adopted by participating farmers

1.3	Identify, promote and widely disseminate among farmers in the rainfed cropping regions of Ninevah 'best bet' improved crop varieties identified in Phase 1 of the project (PC)	Annual meeting of all project partners to discuss and determine work plan	Yr 1, 2, 3 m3	Iraqis can travel and annual meetings can proceed	Improved varieties are adopted by participating farmers
		Demonstration trials established	Yr 1, 2, 3 m5	Security situation allows field work and visits/days to proceed	
		Field days and visits to promote farmer awareness/adoption	Yr 1, 2, 3 on-going		
		Evaluation of results and reporting	Yr 1, 2, 3 m3		

PC = partner country, A = Australia

Objective 2: To evaluate and select new, improved germplasm of wheat, barley and pulse and forage legumes for promotion in demonstration programs

no.	activity	outputs/ milestones	due date of output/ milestone	risks / assumptions	applications of outputs
2.1	Identify potential lines from the original project experience, other Iraq information, ICARDA's international testing program, Australian experience, and other sources (All)	ICARDA activity: identifying 10-12 elite lines of drought, disease and salinity tolerance ICARDA activity: incorporating abiotic/biotic stress tolerance/resistance into adapted lines	Yr 1, 2, 3 m3 On-going	No perceived risk as this ICARDA mandate activity	Adapted lines transferred to Ninevah for further testing and evaluation
2.2	Screening, evaluation and selection of improved germplasm in Ninevah (PC)	Screening trials established Evaluation of results and reporting Field days and visits to promote farmer awareness/adoption Selected improved lines moved into activity 1.3 in demonstration program	Yr 1, 2, 3 m 5 Yr 2, 3 m 3 Yr 1, 2, 3 on-going Yr 1,2,3 m4	Security situation allows research trials and field visits/days to proceed	Selected germplasm included in further testing and demonstration trials
2.3	Screening, evaluation and selection of improved germplasm of wheat, barley, and forage legumes and grasses for adaptation to salinity in Iraq (PC)	Screening trials established Evaluation of results and reporting Field days and visits to promote farmer awareness/adoption	Yr 1, 2, 3 m 5 Yr 2, 3 m 3 Yr 1, 2, 3 on-going	Security situation allows trials and field visits/days to proceed MOA in Baghdad has expertise and resources to implement trials	Selected germplasm included in further testing and demonstration trials

Objective 3: To evaluate and select new, improved crop management technologies for promotion in demonstration programs

no.	activity	outputs/ milestones	due date of output/ milestone	risks / assumptions	applications of outputs
3.1	Conduct research on conservation cropping technologies including ZT, stubble mulching, time of sowing, ± stubble, improved fertilizer practices, crop rotation, improved weed, pest and disease management in Iraq and ICARDA (PC and ICARDA)	Annual meeting to discuss and determine work plan Trials established Field days and visits to promote farmer awareness/adoption Evaluation and reporting at annual meetings Selected improved technologies moved into activity 1.2 in demonstration program	Yr 1, 2, 3 m3 Yr 1, 2, 3 m5 Yr 1, 2, 3 on-going Yr 2, 3 m3 Yr 1,2,3 m4	No perceived risk in ICARDA Iraqis can travel and annual meetings can proceed Security situation allows research trials and field visits/days to proceed	Tested practices recommended for wider demonstration and dissemination
3.2	Cross-evaluation of alternative cropping systems by crop-soil-simulation modelling (PC and ICARDA)	Small experiments conducted for later crop model calibration Selected trials analysed by crop simulation modelling to evaluate benefits of conservation cropping	Yr 1, 2, 3 m5 Yr 3 m3	No perceived risk in ICARDA Security situation allows research trials and field visits/days to proceed in Iraq	Results from simulation modelling used in identifying key factors and promoting best practices
3.3	In conjunction with local manufacturers, modify and adapt locally produced seeders and evaluate their performance under ZT (PC and ICARDA)	Annual Project Reporting and Planning meeting to discuss and determine work plan Prototype ZT seeders produced, evaluated and promoted Evaluation of results and reporting at annual meetings	Yr 1, 2, 3 m3 On-going Yr 2, 3 m3	Security situation allows small village-based machinery manufacturers to collaborate and field visits/days to proceed	Successful prototype seeders manufactured on wider scale for dissemination to farmers through demonstrations
3.4	Conduct research on adaptation and seed production of alternative crops including oats, peas and oilseeds in ICARDA and, when seed is available, in Iraq (PC and ICARDA)	Annual Reporting and Planning meeting to discuss and determine work plan Trials established Evaluation and reporting at annual meetings Field days and visits to promote farmer awareness/adoption Selected crops/ lines moved into activity 1.3 in demonstration program	Yr 1, 2, 3 m3 Yr 1, 2, 3 m4 Yr 1, 2, 3 m3 Yr 1, 2, 3 on-going Yr 1,2,3 m4	No perceived risk in ICARDA Iraqis can travel and annual meetings can proceed Security situation allows research trials and field visits/days to proceed in Iraq	Recommended alternative crops/rotations for demonstration in Iraq
3.5	Evaluate systems for the integration of crops, forages and livestock (All)	Evaluation of literature and trials Reports and recommendations to annual meetings	On-going Yr 2, 3 m3	No perceived risk Iraqis can travel and annual meetings can proceed	Recommended forage crop rotations for demonstration in Iraq

3.6	Undertake initial demonstrations with farmers in Iraq and ICARDA/Syria and identify options for wider promotion under Objective 1 (PC and ICARDA)	Establishment of demonstrations with farmers in Iraq and around ICARDA	Yr 1, 2, 3 m4	No perceived risk in Syria Security situation allows demonstrations and field visits/days to proceed in Iraq	Recommendations for wider dissemination
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Objective 4: To facilitate agricultural planning and development through utilisation of GIS and crop modelling

no.	activity	outputs/ milestones	due date of output/ milestone	risks / assumptions	applications of outputs
4.1	Conduct annual training session on advanced GIS skills (ICARDA)	2-3 trained GIS scientists	Yr 1,2,3 m12	Availability of trainees with required criteria	Training used in building GIS capacity in Iraq
4.2	Develop land suitability maps using locally compiled and globally available data (PC and ICARDA)	Land suitability maps developed and used in planning and technology dissemination	Yr 3, m12	No perceived risk in ICARDA Availability of and access to data in Iraq	Maps used in targeting project activities
4.3	Integrate GIS into project development activities and develop and utilize geospatial services to assist with the interpretation and promotion of project technologies (PC)	New GIS skills being applied in DOA Ninevah GIS Unit	On-going	Security situation allows scientists to operate effectively	Information used in interpreting project results
4.4	Initiate training sessions in crop-soil simulation modelling using either the CropSyst, APSIM or DSSAT crop modelling suite (ICARDA)	2-3 scientists trained in modelling Crop models increasingly used in evaluation of conservation cropping	Yr 1 m12 Yr 2 m12 On-going	Availability of trainees with required criteria	Information used in interpreting project results

Objective 5: To develop, evaluate and promote efficient and sustainable local seed production and supply systems

no.	activity	outputs/ milestones	due date of output/ milestone	risks / assumptions	applications of outputs
5.1	Multiply and provide seed of new crop germplasm and crop varieties for research and demonstration in Iraq (ICARDA)	1-2 tonnes of seed of new germplasm and varieties of cereals, legumes and forages produced at ICARDA and made available for research and demonstration in Iraq	Yr 1,2,3 m4	Availability of new germplasm and new crop varieties targeted for Iraq conditions	Seed transferred to Iraq for use in selection trials

5.2	Develop a functional seed unit for breeder and foundation seed production at Rabiaa research station in Ninevah using the seed cleaners purchased in the original project (PC)	Appropriate procedures and facilities for breeder and basic seed production reviewed during first year and established during the second year At least 10 participants trained each year in variety maintenance and breeder/foundation seed production	Yr 1, 2 m12 Yr 1, 2 m12	Security situation allows functioning of research station SBAR capacity and willingness in implementing suggested procedures and operating facilities (equipment, storage) Availability of qualified staff dedicated to seed units	Seed used in demonstrations and as starter seed for VBSEs
5.3	Establish sustainable farm/village-based seed production enterprises (VBSEs) (PC)	Four VBSEs operational during Yr1 each producing 100 t seed An additional 4/5 VBSEs operational during Yr2 each producing 100 t seed Group training for farmers, extension services and other stakeholders organized each yr on technical and management aspects Seed demand survey conducted and business plans developed each yr Analysis of profitability of VBSEs conducted each yr to ensure sustainability and options for diversification A network/association of local seed production and marketing enterprises established at provincial level during Yr3	Yr 1 m12 Yr 2 m12 Yr 1,2,3 m12 Yr 1,2,3 m12 Yr 1,2,3 m12 Yr 3 m12	Security situation in villages allows technicians and farmers to undertake program Availability of new crop varieties adapted to Iraq conditions Farmer willingness to enter local seed production and marketing business	Seed produced by VBSEs available for dissemination to other farmers

Objective 6: To monitor and evaluate adoption and impacts of project technologies, and identify enabling policy options to enhance uptake by farmers

no.	activity	outputs/ milestones	due date of output/ milestone	risks / assumptions	applications of outputs
6.1	Characterization of improved technology options in terms of their performance, profitability, risk reduction, and acceptance by farmers (PC)	Yields and agronomic performance estimates, budgets and results of sensitivity analysis, farmer perceptions documented and used in evaluation and planning	Yr 2 m12	Available data from demos/trials Security situation allows socio-economists to operate effectively in Ninevah and Baghdad	Results assist in identifying best practices to be promoted by project
6.2	Analysis of water productivity and factors explaining low WUE in SI areas and farmer's demand for water (PC)	Water-related productivity and demand indicators	Yr 2 m12	Available data from demos/trials Security situation allows socio-economists to operate effectively in Ninevah and Baghdad	Results assist in identifying best practices to be promoted by project
6.3	Identify sources of inefficiency and assess the impacts of improved options on increasing efficiency (PC)	Options for improving production inefficiency identified	Yr 2 m12	Available data from demos/trials Security situation allows socio-economists to operate effectively and conduct surveys in Ninevah and Baghdad	Results assist in identifying best practices to be promoted by project
6.4	Assess the effectiveness of improved management options on the adaptive capacity of local communities to climatic variability and change (PC)	Best-bet technology options for adaptation to climatic risk identified	Yr 3 m6	Available data from demos/trials Security situation allows socio-economists to operate effectively and conduct surveys in Ninevah and Baghdad	Results assist in identifying best practices to be promoted by project
6.5	Monitoring rate of adoption of improved technologies and identifying constraints to provide feedback to technical, socio-economic and policy research (PC)	Adoption indicators, constraints identified and shared with others	Yr 2 m12	Available data from demos/trials Security situation allows socio-economists to operate effectively and conduct surveys in Ninevah and Baghdad	Results used in recommending policies or other actions needed to remove constraints to wider adoption
6.6	Evaluation of economic and environmental impacts of improved technologies promoted by the project at both farm and community levels (PC)	Estimates of impact documented	Yr 2 m6	Available data from demos/trials Security situation allows socio-economists to operate effectively and conduct surveys in Ninevah and Baghdad	Results used in promoting the recommended technologies

6.7	Assess the impact of land tenure, input and output pricing policies (input price subsidy, output price supports) on the uptake of new technologies and their implications on rural livelihoods (PC)	Land tenure and pricing policy options developed	Yr 2 m12	Available data from demos/trials Security situation allows socio-economists to operate effectively and conduct surveys in Ninevah and Baghdad	Results used in recommending policies or other actions needed to support widespread uptake of new technologies
6.8	Identify enabling policy and institutional options (PC and ICARDA)	Enabling institutional arrangements and policy incentives and options identified	Yr 3 m6	Available data from demos/trials Security situation allows socio-economists to operate effectively and conduct surveys in Ninevah and Baghdad	Identified options communicated to policy makers

Objective 7: To enhance capacity of Iraqi research and extension programs to develop and promote improved conservation cropping technologies

no.	activity	outputs/ milestones	due date of output/ milestone	risks / assumptions	applications of outputs
7.1	Develop and agree on program of training (All)	Annual training program	Yr 1,2,3 m3	No perceived risk in ICARDA Iraqis can travel and annual meetings can proceed	
7.2	Short term and individual medium-term training and joint data analysis (ICARDA)	Training conducted (25 trainees per year)	Yr 1,2,3 m12	No perceived risk in ICARDA Availability of trainees with required criteria Iraqis can travel to training	Training used by Iraq scientists in project activities
7.3	Thematic workshops (ICARDA)	New research areas identified, or work plans adjusted; new methodologies adopted	Yr 1,2,3 m3	No perceived risk in ICARDA Availability of trainees with required criteria Iraqis can travel to training	Better targeting of research and greater efficiency in analysis
7.4	Long term training/joint research and English/MSc/PhD graduate research at Australian partner institutes (A)	10 Iraqi scientists trained over 3 years 4 MSc graduates 2 PhD graduates	Yr 1,2,3 m12 Yr 3 m12 Yr 5 (2013) m12	No perceived risk in Australia Availability of trainees with required criteria Iraqis can travel to training	Strengthened capacity of Iraqi research program
7.5	Support participation of Iraqi personnel in regional or international workshops and conferences of relevance to the project (All)	Conference attendance and report	Occasional for appropriate events and selected scientists	Availability of appropriate events Availability of trainees with required criteria Iraqis can travel to training	Exposure to international research generates new partnerships and research opportunities for Iraqi scientists

PC = partner country, A = Australia, ICARDA = International Center for Research in Dry Areas

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 Colin Piggin	M	ICARDA	Agronomist/Project Manager	100	ACIAR
<i>Under recruitment</i>		ICARDA	Agronomist	10	ICARDA
Dr Osman Abdalla	M	ICARDA	Wheat Breeder	10	ICARDA
Dr Stefania Grando	F	ICARDA	Barley Breeder	10	ICARDA
Dr Mohammed Imtiaz	M	ICARDA	Pulse Breeder	10	ICARDA
Dr Fouad Maalouf	M	ICARDA	Faba Bean Breeder	5	ICARDA
Dr Seid Kemal	M	ICARDA	IPM/pathology specialist	10	ICARDA
Dr Safaa Kumari	F	ICARDA	Plant virologist	5	ICARDA
Dr Mustafa Bohssini	M	ICARDA	Entomologist	5	ICARDA
Dr Kamel Shideed	M	ICARDA	Economist - Impact assessment	10	ICARDA
Dr Zewdie Bishaw	M	ICARDA	Seed Production Systems	10	ICARDA
Dr Koffi Amegbeto	M	ICARDA	Seed Systems Economist	10	ICARDA
Mr. Abdul Aziz Niane	M	ICARDA	Seed production specialist	10	ICARDA
Dr Juergen Diekmann	M	ICARDA	Farm Manager/Agronomist	10	ICARDA
Dr Eddy De-Pauw	M	ICARDA	GIS specialist	10	ICARDA
Dr Rolf Sommer	M	ICARDA	Agro-ecosystem modelling specialist	10	ACIAR
Dr Andrea Pape-Christiansen	F	ICARDA	Knowledge Management Specialist	10	ICARDA
Mr. Atef Haddad	M	ICARDA	Research Associate, Agronomist	75/10	ACIAR /ICARDA
Research Technician		ICARDA	Agronomy	100	ACIAR
Prof. Kadambot Siddique	M	University of Western Australia	Crop physiologist and agronomist	10	UWA
Dr Ken Flower	M	University of Western Australia	Agronomist	10	UWA
Dr Atakelty Hailu	M	University of Western Australia	Socio-economist	10	UWA
Dr Jens Berger	M	University of Western Australia	Plant eco-physiologist and statistics specialist	10	ACIAR
Dr Don Cummings	M	No-till Farmers Association of Western Australia, through UWA	ZT farming/agronomy	10	ACIAR
Dr Wal Anderson	M	Department of Agriculture and Food, Western Australia	Agronomist	10	DAFWA
Mr. Robin Wilson	M	Department of Agriculture and Food, Western Australia	Wheat breeder	10	DAFWA
Dr Reg Lance	M	Department of Agriculture and Food, Western Australia	Barley breeder	10	DAFWA

Dr Glen Riethmuller	M	Department of Agriculture and Food, Western Australia	Agricultural engineer	10	DAFWA
Prof. David Coventry	M	University of Adelaide	Crop and soil agronomist	10	UA
Associate Professor Jason Eglinton	M	University of Adelaide	Barley breeder	10	UA
Dr Jay Cummins	M	Contracted through University of Adelaide from SARDI Rural Solutions	Participatory extension specialist	10	ACIAR
Dr Jack Desbiolles	M	Contracted through University of Adelaide from the Agricultural Machinery Research and Design Centre, University of South Australia	Research Fellow, On-Farm Machinery	8	ACIAR

5.3.2 Partner country institution(s) or collaborating IARC

Name	Sex (M/F)	Agency and Position	Discipline and Role in Project	Time input (%)	Funding
Dr Saleh Bader	M	Director General, State Board for Agricultural Research (SBAR), Ministry of Agriculture (MOA)	Project Coordinator	20	MOA
Dr Abdulsattar A. Alrijabo	M	Assistant Professor, University of Mosul	Project Leader and agronomist, seed production	50	Uni Mosul
Mr. Jaafar Sedeeq Saeed	M	Manager, Directorate of Agriculture (DOA), Ninevah	Technology extension	50	DOA
Dr Saad Hatem Mohamed	M	Head, Socio-economics Dept., SBAR-Baghdad	Agricultural Economist	50	MOA
Mr. Watheq Abdul Kahar Al-Rawi	M	Researcher, Socio-economics Department, SBAR-Baghdad	Agricultural economist	20	MOA
Mr Kefah Tawfiq Saleh	M	Researcher, SBAR-Baghdad	Agronomist	20	MOA
Dr Kasim Khalil Kasim	M	Forage researcher, SBAR-Ninevah	Forage agronomist	50	MOA
Mr. Raad Ahmed Hameed	M	Researcher, SBAR-Ninevah	Barley breeder	50	MOA
Mr. Mahdi Salh Kheder	M	Agricultural Engineer, SBAR-Ninevah	Researcher	50	MOA
Mr. Younis Hamdoun Kassem	M	Seed specialist, SBAR-Ninevah	Seed production	50	MOA
Dr Moafak M. Ahmad	M	Dean College of Agriculture and Forestry	Research management	10	Uni Mosul
Dr Abbas M. Al-Hasan	M	Head, College of Agriculture, Department of Field Crops	Forage and range management	20	Uni Mosul
Dr Ahmad M. Sultan	M	Researcher, College of Agriculture and Forestry	Weed control	20	Uni Mosul
Dr Saad A. Samier	M	Researcher, College of Agriculture and Forestry	Agriculture Mechanization	20	Uni Mosul

Dr Hesham M. Hassan	M	Researcher, Department of Soil Science and Water, College of Agriculture and Forestry	Soil physics	20	Uni Mosul
Dr Salim H. Antar	M	Researcher, College of Agriculture and Forestry	Weed control	20	Uni Mosul
Dr Khalid H. Taha	M	Researcher, College of Agriculture and Forestry	Plant protection	20	Uni Mosul
Dr Mohammed Yousif Al-Fahady	M	Crop breeder, College of Agriculture and Forestry	Crop breeder	20	Uni Mosul
Mr. Mohammed S. Al-Taweel	M	PhD student, College of Agriculture and Forestry	Crop breeder	20	Uni Mosul
Mr. Moayaser Mohammed, MSc	M	Agronomist, College of Agriculture and Forestry	Agronomist	20	Uni Mosul
Mr. Mohammed A. Hajy, MSc.	M	Agronomist, College of Agriculture and Forestry	Agronomist	20	Uni Mosul
Dr Suaad Irdeny Abdullah	F	Professor, College of Agriculture	Plant protection	20	Uni Mosul
Dr Saad Abdul Jabbar Sameer	M	Assistant Professor, University of Mosul	Agricultural mechanization	20	Uni Mosul
Dr Emad Yousif Ismael Abdullah	M	Assistant Professor, University of Mosul	Economics	20	Uni Mosul
Mr. Abd Al- Monem Mohamed Mahmood	M	Ninevah DOA	Agricultural Engineer	50	DOA
Seed specialist	M	Ninevah DOA	Seed specialist	50	DOA
Mr. Haydar Nasser Al-Sammak Bhajat	M	Computer Engineer, Ninevah DOA	Knowledge management and presentation	50	DOA
Mr. Bassam Yahya Kassim	M	Agricultural Engineer, Ninevah DOA	Responsible for LRA activities	50	DOA
Mr. Hazem Aziz Saleh	M	Agricultural Engineer, Ninevah DOA	Responsible for MRA activities	50	DOA
Mr. Abdul AlMoniem M. Mahmoud	M	Agricultural Engineer, Ninevah DOA	Responsible for HRA and SI activities	50	DOA
Mr. Manhal Mati Yousif	M	Head, Department of Planning, Ninevah DOA	Planning, monitoring and evaluation	50	DOA
Mr. Azem Mohamed Yahya	M	Head of Department of Plant Protection, Ninevah DOA	IPM monitoring and evaluation of demonstrations	50	DOA
Mr. Mohana Fathel Al Tak	M	Director, Analytical Laboratory, Ninevah DOA	Plant and soil analysis	50	DOA
Mr. Kofayl Burhan Al Ummayy	M	Manager, Al Hatra District (LRA), Ninevah DOA	Management of demonstrations and extension	50	DOA
Mr. Amir Hamdoun Shahab	M	Manager, Tell Abta District (LRA), Ninevah DOA	Management of demonstrations and extension	50	DOA
Mr. Salim S. Esmael	M	Manager, Al Mahalabia District (LRA), Ninevah DOA	Management of demonstrations and extension	50	DOA
Mr. Sabah Abd El-Ahad	M	Manager, Al Hamdania District (MRA), Ninevah DOA	Management of demonstrations and extension	50	DOA
Mr. Emad Shakir Hermiz	M	Manager, Tell Kief District (MRA), Ninevah DOA	Management of demonstrations and extension	50	DOA

Mr. Zuhair Salem Abou	M	Manager, Bashyqa District (MRA), Ninevah DOA	Management of demonstrations and extension	50	DOA
Mr. Taha Ahmed Abd Al Azeez	M	Manager, Al Namroud District (MRA/SI), Ninevah DOA	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), Ninevah DOA	Management of demonstrations and extension	50	DOA
Mr. Mohamed Sadeq Hassan	M	Manager, Rabiaa District (HRA and HRA/SI), Ninevah DOA	Management of demonstrations and extension	50	DOA

5.3.3 Description of the comparative advantage of the institutions involved

With over 30 years applied research experience in the region, ICARDA is uniquely placed to manage, coordinate and provide technical assistance to the project. ICARDA is located in Syria, on an experimental station with very 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 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 utilized within the project.

ICARDA also holds a large collection of Iraqi germplasm, sent by the national program in 1996 to conserve its genetic resources collections. The number of accessions of Iraqi origin held in major gene banks outside Iraq is limited; the largest collection is at USDA (1,113 accessions) while ICARDA holds 1,003 accessions of mandated crops. These are available at Iraqi request for repatriation to Iraq and for targeted breeding in 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 Agricultural Research (SBAR). 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 and monitoring and evaluation of adoption and impact. SBAR-Ninevah will co-implement 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/index_e.htm) was established in 1967 and is the second largest University in Iraq with 12 Colleges and 7 Research Centres (including on Remote Sensing), and a mandate for research and training of undergraduate and post-graduate (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, GIS development and modelling, 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 in Ninevah has the mandate to undertake agricultural extension, seed production and regulation activities within the Governorate. The DOA Manager, 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 fact in farmer fields, and technology transfer through farmer involvement in demonstrations and field days. It has the mandate and good facilities for seed production and distribution and for development planning in agriculture, and will take the lead in the seed production and GIS development/utilisation components of the project.

The Institute of Agriculture is in the Faculty of Natural and Agricultural Sciences at the University of Western Australia and provides education, training and research in agriculture and resource management. It is involved with teaching, graduate and post-graduate training, research and agri-business 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 recognized 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 a consultancy with the University of Western Australia, Dr Jens Berger from CSIRO will run a series of 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.

Under a similar consultancy, the No-till Farmers Association of Western Australia, through Dr Don Cummins and member farmers, will provide opportunities for Iraqi trainees at the University of WA to undertake small research projects and be involved in ongoing conservation cropping research and extension activities within farming communities near Perth.

The Department of Agriculture and Food Western Australia (DAFWA) has been a leading institution in research, development and extension in the agricultural sector in Western Australia for well over 100 years. It has played a key role in the development of dryland crop and pasture systems that have sustained the state's farmers and contributed strongly to its gross domestic product. The Mediterranean-type climate of Western Australia with its winter-dominant rainfall pattern is very similar to the climate experienced in the rainfed areas of Ninevah Governorate in Iraq. Many of the technologies based on biological principles developed in Western Australia have found application in other, similar environments such as northern Iraq. Several of the practices being researched and promoted by the project in northern Iraq, such as ZT and stubble retention, have been

introduced and extensively adopted by farmers in Western Australia, with the support of DAFWA.

The international projects arm of DAFWA has managed many projects in West Asia and North Africa contributing practical research and development in countries such as Libya, Tunisia and Iraq. Many staff have contributed to such projects in the areas of dry land crop, pasture and livestock production, thus placing DAFWA in a unique position to contribute to the project.

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.

5.3.4 Summary details of the role of each participant involved

ICARDA

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 the 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.

Dr Colin Piggin (Project leader) is an agronomist with extensive Australian and international experience in leadership of and research involvement 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 crop management component of the project.

Dr Kamel Shideed is an agricultural economist and Director of the Poverty and Livelihood Analysis Program. Of Iraqi nationality, he was formerly Director of the IPA research institution in Baghdad. His key role will be in advising and training Iraqi staff in the implementation of socio-economic surveys and in activities related to assessing the adoption and impact of improved agricultural technologies. He will be assisted by other socio-economists at ICARDA, including specialists in gender analysis.

Agronomist ICARDA (to be appointed) will assist in the planning, design, implementation, and assessment of cropping systems management practices and in training in agronomic research and cropping systems management.

Dr Osman S. Abdalla is the bread wheat breeder at ICARDA. His role in the project will include identification and dissemination of improved varieties; identification, evaluation and selection of new improved germplasm adapted to Iraqi conditions; evaluation and reporting of experimental results; and training in the identification and evaluation of potentially valuable germplasm.

Dr Stefania Grando is a barley breeder at ICARDA. Her role in the project will include identifying available improved varieties for immediate dissemination; identifying, evaluating and selecting new improved germplasm adapted to specific agroclimatic conditions and end uses in Iraq; evaluation and reporting of experimental results; and contributing to training in farmer participatory plant breeding approaches and the evaluation of potentially valuable germplasm.

Dr Mohammed Imtiaz (chickpea breeder) and Dr Fouad Maalouf (faba bean breeder) are part of the pulse breeding group at ICARDA. Their role will be in identifying and disseminating improved varieties; identifying, evaluating and selecting new improved germplasm adapted to specific agroclimatic conditions and end uses in Iraq; evaluation and reporting of experimental results; and training in chickpea improvement, including germplasm evaluation and crop management practices.

Dr Seid Kemal (pathologist), Dr Safaa Kumari (virologist) and Dr Mustafa Bohssini (entomologist) are part of the IPM group at ICARDA. The role will be in selection of germplasm and technologies for demonstration and research in Iraq; evaluation and reporting of experimental results; training in the monitoring and management of pests and diseases and in disease resistance, epidemiology and integrated pest management practices.

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.

Dr Koffi Amegbeto is an economist and specialises in seed production systems economics. He will be involved in evaluation of the adoption and impact of the seed development component of the project. He will also assist other ICARDA economists in advising and training Iraqi staff in the implementation and analysis of socio-economic surveys and in activities related to assessing the adoption and impact of improved agricultural technologies.

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 Juergen Diekmann is an agronomist and manager of the ICARDA farm. He will be involved in the linked agronomy program in Syria, provision of seed, procurement and modification of seeders, and training of Iraqi scientists in crop and research station management.

Dr Eddy De-Pauw is a GIS specialist and leads the GIS group in ICARDA. He will manage and implement the GIS component of the project.

Dr Rolf Sommer is an agro-systems modelling specialist. He will manage the experimentation and training associated with the crop modelling component of the project.

Dr Andrea Pape-Christiansen is a knowledge management specialist. She will assist with production and distribution of project information through the project website.

Mr Atef Haddad is research associate and agronomist. He will assist with the linked agronomy research and extension program and agronomy training at ICARDA. He will manage project liaison with Syrian scientists, local machinery manufacturers and farmers.

Iraq

Ministry of Agriculture

Dr Saleh M. Bader (Project Coordinator) is the Director General of the State Board for Agricultural Research at Abu- Ghraib, Baghdad. He is an experienced scientist and

research leader and coordinated the first phase of the project. He will provide liaison with the management of MOA and facilitate project operations, selection of trainees, and financial. He will also participate in annual project planning and reporting meetings.

Mr. Sa'ad H. Mohamed is the Research Head of the Socio-economics Dept., State Board of Agricultural Research, Abu- Ghraib, Baghdad. He will lead the socio-economics and monitoring and evaluation components of the project, with the support of other MOA, University of Mosul and ICARDA economists.

Mr. Watheq Abdul Kahar Al-Rawi is a researcher in the Socio-economics Department in the State Board of Agriculture Research in Baghdad. He will work together with Dr Sa'ad in the project socio-economics and monitoring and evaluation program.

Dr Kasim Khalil Kasim is a forage specialist and is the Director of Research for the State Board for Agriculture Research 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 agriculture engineer in the State Board for Agricultural Research 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 in the State Board of Agriculture Research at Rashidiya Experiment Station in Mosul. He will be involved in implementation of the germplasm improvement component of the project in Ninevah.

Mr. Mahdi Salh Kheder is an agricultural engineer in the State Board of Agriculture Research at Rashidiya Experiment Station, Mosul. . He will be involved in implementing the SBAR-Ninevah research component of the project.

University of Mosul

Dr Abdulsattar A. Al-Rijabo (Project leader) is a Lecturer/Assistant Professor, Agronomist, Agriculture College – Field Crop Department, University of Mosul. He was the Manager of the DOA in Ninevah and Project Manager during the first project 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 also take a lead role in the research and teaching program in crop management/agronomy.

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 of the project in Ninevah, in collaboration with SBAR economists and scientists.

Dr Suaad Irdeny Abdullah is a Professor (Entomology) in the College of Agriculture & Forestry at Mosul University. She will provide IPM input into the research and demonstration components of the project and into student training.

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

Dr Moafak M. Ahmad is the Dean of the College of Agriculture and Forestry. He will facilitate implementation, provision of facilities and involvement of staff and students in the project.

Dr Abbas M. Al- Hasan is Head, Department of Field Crops in the College of Agriculture and Forestry. He will provide management support and input into the research and demonstration components of the project and into student training.

Dr Ahmad M. Sultan is a Researcher in the College of Agriculture and Forestry. He will provide input into the research and demonstration components of the project and into student training.

Dr Saad A. Samier is a Researcher in the College of Agriculture and Forestry. He will provide input into the research and demonstration components of the project and into student training.

Dr Hesham M. Hassan is a Researcher in the College of Agriculture and Forestry. He will provide input into the soil and water science research and demonstration components of the project and into student training.

Dr Salim H. Antar is a Researcher in the College of Agriculture and Forestry He will provide input into the research and demonstration components of the project and into student training.

Dr Khalid H. Taha is a Researcher in the College of Agriculture and Forestry He will provide input into the research and demonstration components of the project and into student training.

Dr Mohammed Yousif Al-Fahady is a Researcher in the College of Agriculture and Forestry He will provide input into the research and demonstration components of the project and into student training.

Mr. Mohammed S. Al- Taweel is a Researcher in the College of Agriculture and Forestry He will provide input into the research and demonstration components of the project and into student training.

Mr. Moayaser Mohammed, MSc., is a Researcher in the College of Agriculture and Forestry He will provide input into the research and demonstration components of the project and into student training.

Mr. Mohammed A. Hajy, MSc., is a Researcher in the College of Agriculture and Forestry He will provide input into the research and demonstration components of the project and into student training.

Directorate of Agriculture Ninevah

The following staff in the Directorate will manage and implement the project demonstration program in 12 sites in Ninevah. This involves designing and locating the demonstrations, planting, managing, and measuring the crops and forages, 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. Jaafar S. Saied leads the DOA program and is the Manager of the Directorate of Agriculture in Ninevah

Mr. Bassam Yahya Kassim works in Follow up/First sector in the Directorate of Agriculture in Ninevah, and is responsible for the first sector (LRA)

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

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

Mr. Manhal Mati Yousif is Head of the Department of Planning in the Directorate of Agriculture in Ninevah

Mr. Azem Mohamed Yahya is Head of the Department of Protection in the Directorate of Agriculture in Ninevah

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

Mr. Mohana Fathel Al Tak is Director of the Analytical Laboratory in the Directorate of Agriculture in Ninevah

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

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

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

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

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

Mr. Zuhair Salem Abou is an Agricultural Engineer in the Directorate of Agriculture and Manager of Bashyqa Agricultural District (MRA)

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

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

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

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

Australia

University of Western Australia (UWA)

The Director of the Institute of Agriculture 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 Institute of Agriculture at the University. 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, Pakistan, Nepal, East Timor, Turkey and ICARDA. He was a major contributor to the first phase 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 to medium term trainees from various countries (including Iraqi scientists). Professor Siddique's specific responsibilities will be to contribute to planning, implementation and critically analyzing and publishing the data as technical and scientific papers. Professor Siddique will be the overall coordinator of the UWA component through the Institute of Agriculture, especially for training of postgraduate students and selected short term (6months) Iraqi trainees.

Dr Ken Flower is a Lecturer in the School of Plant Biology 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 relevant postgraduate students and short term trainees.

Dr Atakelty Hailu is a Senior Lecturer in the School of Agricultural and Resource Economics at UWA. His areas of expertise include socio-economics, sensitivity analysis and economic modelling. Dr Hailu interacted with Dr Saad Mohamed (Iraqi Agricultural economist) during the recent short term training in WA. In addition to attending relevant project planning meetings, Dr Hailu will be a co-supervisor of postgraduate students and short term trainees in agricultural economics.

Dr Jens Berger from CSIRO will consult through the University of Western Australia. He has been working in international agriculture, both with CGIAR centres and NARS, for more than 15 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 used this experience to develop a flexible 3-10 day course entitled 'An Introduction to Modern PC-based Data Handling and Statistical Methods' which has been presented at many research organizations in Australia, Cambodia, Nepal and India since 2000, with support from ACIAR, DEST and CLIMA. The course is extremely interactive and hands-on, and covers the range of skills required to design experiments, accurately record and manipulate data using spreadsheet and database software, analyse with statistical programs (Genstat, SPSS), and finally present and interpret results. In the current project Dr Berger will run a series of courses at ICARDA to strengthen the analytical capacity of Iraqi scientists, tailored to suit the existing skill level of participants. In addition, he will participate in project planning, especially in the design, analysis and interpretation of experiments.

In addition to the above individuals, UWA will provide part-time postgraduate supervisors for PhD and MSc students identified in the project. Supervisor's specific time allocation will depend upon the nature of the thesis topics and other research requirements. UWA will ensure that co-supervisors from project partners (e.g. ICARDA, DAFWA and Mosul University) will be sought. Special efforts will be made to locate at least one postgraduate student in Albany (DAFWA) to undertake field based research under the supervision of Dr Wal Anderson.

Department of Agriculture and Food Western Australia (DAFWA)

The staff of DAFWA will act in an advisory role to assist Iraqi partners with experimental designs, choice of treatments, essential measurements, and interpretation of results. In addition, there is a role in assisting the Iraqi scientists with scientific and technological information that is readily available in Australia, but not yet easily accessible in Iraq where intellectual isolation has been felt for many years.

DAFWA staff contributing to the project have expertise in crop, forage and pasture agronomy, plant breeding, soil science, agricultural engineering and machinery development, integrated pest and weed management, and animal production. DAFWA has considerable experience with conservation farming (reduced or ZT, stubble retention, herbicide technology), crop rotation, soil amelioration, integration of crops and animals in farming systems and the application of economic criteria in the research and development process. DAFWA staff will also be available to assist in supervision or co-supervision of trainees and post-graduate students.

Dr Wal Anderson is the leader of the DAFWA contribution, an agronomist who has experience over many years in similar projects in Syria, Iraq, Jordan, Pakistan, Iran, Morocco and Lebanon. He is a Principal Research Scientist, leader of cropping systems research at DAFWA, and an Adjunct Professor at the University of Western Australia.

Mr Robin Wilson is an experienced wheat breeder who has released many cultivars that have been widely grown in Australia. He has already contributed his material, based on his observations of the target environment, through ICARDA for selection/testing in the project in Ninevah Governorate (subject to seed multiplication at ICARDA). Robin will advise and assist with planning, interpretation and reporting in matters of wheat breeding and variety testing.

Dr Reg Lance is an experienced barley breeder who has released many cultivars that are widely grown in Australia. Reg has interacted strongly with Iraqi visitors to WA with an interest in barley breeding. He is developing a set of doubled haploids (fixed lines) based on the target environment for testing and selection in Ninevah Governorate. Reg will advise and assist in the areas of barley breeding and variety testing.

Dr Glen Riethmuller is an agricultural engineer with 25 years experience over the period of transition from full cultivation during land preparation to adoption of ZT sowing systems by WA farmers. His experience has included both research and practical development of many aspects of agricultural mechanisation. Glen's contribution to the Project will be through practical assistance and advice on ZT technologies and machinery to project personnel, farmers and machinery manufacturers from Iraq/Syria/ICARDA.

University of Adelaide (UA)

Professor David Coventry will be responsible for the overall input of the University of Adelaide into the project. David is Professor of Agronomy in the School of Agriculture, Food and Wine, Faculty of Sciences. He will focus on the development of best-practice agronomy practice in the research and demonstration components of the project and the coordination of training opportunities from the University of Adelaide.

Associate Professor Jason Eglinton is the Leader of the University of Adelaide Barley Breeding Program. Dr Eglinton has a successful track record in breeding and commercial release of feed, hull-less and malting barley varieties, has been responsible for the development and supervision of the Australian low rainfall barley program. He is involved in extensive collaboration with ICARDA through projects supported by the GRDC and Molecular Plant Breeding CRC. Dr Eglinton will contribute expertise in trial site selection, and the agronomic, technical and logistics management of breeding programs.

Dr Jay Cummins is an extension specialist and Principal Consultant, International Farming Systems Development, Rural Solutions SA, Primary Industries and Resources South Australia. He has worked for over 20 years in extension and education in Australia, with experience in ACIAR, AusAID and DAFF projects in Eritrea, India and China. Jay will coordinate the planning and delivery of field-based technical training in South Australia as well as providing input into specialist workshop training at ICARDA.

Dr Jack Desbiolles is an Agricultural Research Engineer with a farming background and 17 years research experience. He has developed widespread 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 working linkages with the farming industry and machinery manufacturers, integrated into on-farm participatory farming system programs, at both local and regional levels in Australia. Dr Desbiolles' 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 within the grain growing industry. Dr Desbiolles will provide support in ZT machinery development and modification, as well as contribute to related operator/manufacturer training and postgraduate supervision.

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.

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	C. Piggin	Year 1	Aleppo – Australia	Collaboration with Australian partners and MSc/PhD supervision	4-6 weeks
2	C. Piggin	Year 2	Aleppo – Australia	Collaboration with Australian partners and MSc/PhD supervision	4-6 weeks
3	C. Piggin	Year 3	Aleppo – Australia	Collaboration with Australian partners and MSc/PhD supervision	4-6 weeks
4	ICARDA researcher	Year 2	Aleppo – Australia	Collaboration with MSc/PhD supervision	10 days
5	ICARDA researcher	Year 3	Aleppo – Australia	Collaboration with MSc/PhD supervision	10 days

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, thematic workshops	3 weeks
7	Australian partners, consultants and sub-contractors	Year 2	Australia-Aleppo	Annual review and planning meetings, thematic workshops	3 weeks
8	Australian partners, consultants and sub-contractors	Year 3	Australia-Aleppo	Annual review and planning meetings, thematic workshops	3 weeks

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 25	Year 1	Iraq-Aleppo	Annual review and planning meetings, joint report preparation, etc	3 weeks
10	Iraqi project scientists x 25	Year 2	Iraq-Aleppo	Annual review and planning meetings, joint report preparation, etc	3 weeks
11	Iraqi project scientists x 25	Year 3	Iraq-Aleppo	Annual review and planning meetings, joint report preparation, etc	3 weeks
12	Iraqi project scientists x 25	Year 1	Iraq-Aleppo	Group and individual training, joint data analysis	3-4 weeks
13	Iraqi project scientists x 25	Year 2	Iraq-Aleppo	Group and individual training, joint data analysis	3-4 weeks
14	Iraqi project scientists x 25	Year 3	Iraq-Aleppo	Group and individual training, joint data analysis	3-4 weeks

15	Iraqi Researchers x 2	Year 1	Iraq-Australia	Medium-term (6 months) training in Australia	6 months
16	Iraqi Researchers x 4	Year 2	Iraq-Australia	Medium-term (6 months) training in Australia	6 months
17	Iraqi Researchers x 4	Year 3	Iraq-Australia	Medium-term (6 months) training in Australia	6 months
18	Iraqi scientists x 4	Year 1 or 2	Iraq-Australia	MSc program at Australian institute/ICARDA (2 years)	2 years
19	Iraqi scientists x 2	Year 1	Iraq-Australia	PhD program at Australian institute/ICARDA (4 years)	4 years
20	University of Mosul MSc Students x 8	Year 1	Iraq-Aleppo	Short-term training at ICARDA	4 weeks
21	University of Mosul MSc Students x 8	Year 2	Iraq-Aleppo	Short-term training at ICARDA	4 weeks
22	University of Mosul MSc Students x 8	Year 3	Iraq-Aleppo	Short-term training at ICARDA	4 weeks

PC = partner country, A = Australia

6 Supporting documentation

6.1 Letters of support



اىكاردا
ICARDA

المركز الدولي للبحوث الزراعية في المناطق الجافة
International Center for Agricultural Research in the Dry Areas

3 July 2008

Dr. Peter Core
Chief Executive Officer
Australian Centre for International Agricultural Research
GPO Box 1571
Canberra ACT 2601
Australia

Development of conservation cropping systems in the drylands of northern Iraq

Dear Dr. Core,

It is my pleasure to submit, on behalf of all partners in the project, the full proposal for a second phase of the project for *Development of conservation cropping systems in the drylands of northern Iraq*.

This proposed second phase builds upon the progress and outputs achieved in CIM/2004/024: *Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq*, and takes account of the recommendations from the external review of the project, conducted in April 2008 by Dr David Connor.

The proposal has been developed in close collaboration with the Iraqi and Australian partners; all elements of the proposal were discussed and developed at a workshop, attended by representatives of all project participants, at ICARDA 13-17 April 2008. Key representatives of the Iraqi partners remained at ICARDA following the workshop to work with ICARDA in developing the details of the work plan and methodology.

Please accept this letter as confirmation of ICARDA's commitment to the above project. I confirm that ICARDA will continue to manage, coordinate and provide technical assistance to the project, supported by the appointment of a full-time Project Manager.

This project will continue to be a key part of our joint efforts to support agricultural research in Iraq with a view to restoring and enhancing the production capacity of farmers in rainfed areas of Iraq.

I look forward to your consideration of this proposal and to our future collaboration in this initiative.

Yours sincerely,

PP
Mahmoud Solh
Director General

Fax: Director General's Office (963-21) 2225105	Tel: Headquarters at Tel Hadya (963-21) 2213433; 2213477; 2225112; 2225012	P.O. Box 5466, Aleppo, Syria
Headquarters at Tel Hadya (963-21) 2213490	City Office, Aleppo (963-21) 5743104; 5746807; 5748964	E-mail: ICARDA@cgiar.org
City Office, Aleppo (963-21) 5744622	Street Address: Aleppo-Damascus Highway, Tel Hadya, Aleppo, Syrian Arab Republic	Web site: http://www.icarda.org

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Republic of Iraq
Ministry of Agriculture
Senior Deputy Minister Office

جمهورية العراق
وزارة الزراعة
مكتب الوكيل الأقدم

Dear Dr. Al-Solh

The Ministry of Agriculture (MOA) through the State Board for Agricultural Research and the Directorate of Agriculture of Ninevah has been integrally involved in the implementation of ACIAR CIM/2004/02 "Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq" during 2005 /08. The project has made excellent progress developing and promoting technologies which have great potent to make dry land cropping systems more productive, profitable and sustainable.

These technologies need to be developed further and extended widely to maximise benefits and impacts for farmers and the rural poor and we are very keen to do this through involvement in the planned continuation of the project. Our management and senior scientists, along with those from the University of Mosul, have been fully involved in the detailed planning for this project extension so that it accords with MOA priorities and strategies.

The MOA is ready to support and provide any needs for project implementation in Iraq.



Dr. Subhi Al-Jumaily
Senior Deputy Minister/ MOA
9th July, 2008

From: Dr. Abdul sattar Alrijabo dr_alrijabo@yahoo.com
To: Colin Piggin <c.piggin@gmail.com>

Cc: M.solh@cgiar.org

Date: Wed, Jul 9, 2008 at 5:04 PM
Subject: Re: UniMosul letter of support

Dr. Mahmoud Solh Ref: ICARDA Date: July 9, 2008

Cc/ Dr. C. Piggin
ICARDA

Dear Colleagues:

The University of Mosul through the College of Agriculture and Forestry has been integrally involved in the implementation of ACIAR CIM/2004/024 Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq during 2005-08. The project has made excellent progress developing and promoting technologies which have great potential to make dry land cropping systems more productive, profitable and sustainable.

These technologies need to be developed further and extended widely to maximize benefits and impacts for farmers and the rural poor and we are very keen to do this through involvement in the planned continuation of the project. Our management and senior scientists, along with our partners from the Ministry of Agriculture (MOA) through the State Board for Agricultural Research and the Directorate of Agriculture, have been fully involved in the detailed planning for this project extension so that it accords with University of Mosul priorities and strategies. We are especially pleased with the increased focus on graduate and technical training in Australia.

The University of Mosul is ready to support and provide any needs for project implementation in Iraq.

Thank you with my best regards.

Dr. Moafak M. Ahmad
Dean, College of Agriculture and Forestry,
University of Mosul,
Mosul, Iraq

From: Ninevah Agriculture agrimosul@yahoo.com
Reply-to: agrimosul@yahoo.com

To: Colin Piggin <c.piggin@gmail.com>

cc"Ali, Tara" <ali@aciarc.gov.au>,
"Fox, Paul" <fox@aciarc.gov.au>

Date: Wed, Jul 9, 2008 at 5:24 PM
Subject: Re: UniMosul letter of support and CV for Mr Jaafar Sedeeq Saeed (DOA)

REPUBLIC OF IRAQ
MINISTRY OF AGRICULTURE
NINEVAH DIRECTORATE OF AGRICULTURE, MOSUL

Dear Dr. Piggin,

Thank you very much for your e-mail concerning the project extension .The DOA in Mosul is fully support the project extension and ready to provide any needs for the project implementation in the northern of Iraq.

Furthermore, the DOA, Mosul over the past period of the project implementation in Iraq, have the done best to provide all what was required to insure the proper implementation of the project through the field demonstrations as planned at ICARDA. It is worth mentioning that there was a strong cooperation between DOA ,Mosul University and the State Board of Research in order to serve the project aims. The zero tillage technology was introduced, for the first time, in the farmers' fields in the north of Iraq through the project. The results were very encouraging, particularly to the farmers.

As with respect to the research part of the project, it is the responsibility of both Mosul University and the State Board of Research. We will cooperate with them in order to insure the project implementation with the aim to help developing the rain fed agriculture in the north of Iraq.

Thank you.

Best regards.

Jaafar Sideque Said
Director of Agriculture,
Mosul,Iraq.



THE UNIVERSITY OF
WESTERN AUSTRALIA

OFFICE OF THE VICE-CHANCELLOR

VICE-CHANCELLOR

Professor Alan Robson AM
BAgSc (Hons), PhD (W.Aust.), FTSE, FAIAS
Hackett Professor of Agriculture

Our ref:
Your ref:

9th May 2008

Mr Peter Core
Director
Australian Centre for International Agricultural Research
GPO Box 1571
CANBERRA ACT 2601

Dear Peter

**ACIAR Project: Development of conservation cropping systems in the drylands
 of northern Iraq**

The University of Western Australia (UWA) strongly supports the above project, currently being developed for funding from ACIAR through the International Centre for Agricultural Research in the Dry Areas (ICARDA) in collaboration with Iraqi Ministry of Agriculture and Australian Institutions. The project builds on and is a continuation of ACIAR CIM/2004/024: *Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq*, implemented from July 2005 to June 2008 in Ninevah Governorate in northern Iraq. UWA was an active participant in the above project. The proposed new project aims to increase the production and sustainability of dryland cropping systems through the testing and promotion of better varieties and crop management technologies.

UWA appreciates the opportunity to be a collaborator in this project through its Institute of Agriculture and wishes to convey to you its support for the project. In addition to the availability of relevant technical experts, UWA will train Iraqi students for their post-graduate degree in relevant areas as part of the proposed project. Professor Kadambot Siddique, Chair in Agriculture and Director of the Institute of Agriculture will be the leader of UWA component of this project.

Yours sincerely

Alan Robson
Vice-Chancellor

Office of the Vice-Chancellor, The University of Western Australia, M464, 35 Stirling Highway, Crawley WA 6009
Phone +61 8 6488 2808 Fax +61 8 6488 1013 Email Alan.Robson@uwa.edu.au



Department of Agriculture and Food
Government of Western Australia



15 May 2008

Mr Peter Core
Director
Australian Centre for International Agricultural Research
GPO Box 1571
CANBERRA ACT 2601

Dear Peter

ACIAR PROJECT: DEVELOPMENT OF CONSERVATION CROPPING SYSTEMS IN THE DRY LANDS OF NORTHERN IRAQ

The Department of Agriculture and Food Western Australia (DAFWA) strongly supports the development of this project as a continuation of ACIAR Project CIM/2004/024: 'Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq'.

I understand that the application for funding by ACIAR is being developed in collaboration with the Iraqi Ministry of Agriculture, the University of Adelaide, the University of Western Australia (UWA), the International Centre for Agricultural Research in Dry Areas (ICARDA) and DAFWA. The existing project has been in our view, an example of successful international collaboration and we have greatly appreciated the opportunity to take part.

The proposed new project is being negotiated in full partnership with the Iraqi participants and will continue some previous elements but with more emphasis on increasing the production and sustainability of the cropping systems in Ninevah Province, through testing and introduction of appropriate management methods.

We appreciate the opportunity to continue our collaboration and wish to offer our continued support through contributions from our technical experts and participation, with UWA, in post-graduate training. Dr Wal Anderson, Manager of our Cropping Systems Project and Adjunct Professor at UWA, will be the leader of the DAFWA component of the project.

Yours sincerely

Ian Longson
DIRECTOR GENERAL

OFFICE OF THE DIRECTOR GENERAL

3 Barou-Hay Court, South Perth WA 6151, Postal Address: Locked Bag 4, Bentley Delivery Centre WA 6983
Tel: (08) 9368 3236 Fax: (08) 9368 1205



SCHOOL OF AGRICULTURE, FOOD & WINE
FACULTY OF SCIENCES

PROFESSOR ROGER A LEIGH
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MOBILE 0406 363 576
roger.leigh@adelaide.edu.au
CRICOS Provider Number 00123M

14 May 2008

Mr Peter Core
Director
ACIAR
GPO Box 1571
Canberra ACT 2601

Dear Mr Core

RE: Letter of Support for the proposed ACIAR Project entitled "Development of conservation cropping systems in the drylands of northern Iraq."

I am writing to confirm the University's strong support for the ACIAR project proposal with the above title that is being submitted by ICARDA, with a significant input from the University of Adelaide. Professor Coventry and Associate Professor Jason Eglinton are able to commit the specified time in relation to their input on behalf of the University of Adelaide.

The University has been actively involved in the first phase of the ACIAR project ('Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq - CIM/2004/024'). We welcome the opportunity to commit to this new phase of the Iraq work. As well as providing relevant technical inputs, we see an enhanced opportunity for training Iraqi students in postgraduate programs.

I am confident that with the leadership and extensive experience provided by the partners of this project that this project will be successful and accordingly I strongly support the application.

Yours sincerely,

A handwritten signature in blue ink that reads 'R. Leigh'.

Roger A Leigh

Cc: Dr Colin Piggin
Professor David Coventry
Assoc Professor Jason Eglinton

6.2 Curricula vitae of key personnel

Dr Colin Piggin

Nationality: Australian

Current Address: Oakleigh, Corowa NSW 2646, Australia

Telephone: 02 60350576

Fax: 02 60350525

Email: c.piggin@gmail.com

Education

- Ph.D. Agronomy University of Melbourne, Australia 1976
- B.Sc. Agriculture University of Melbourne, Australia 1964

Languages

- English (native language)
- Bahasa Indonesia (fluent spoken and written)

Summary of Experience and Expertise

Strong research and development experience and expertise in crop and pasture agronomy and weed management through involvement over more than 30 years in R & D in temperate and tropical farming systems in Australia and most developing countries in Asia, the Pacific, the Middle East and Latin America. Special research interests in germplasm conservation, crop establishment, conservation farming (zero-tillage), shrub and forage legumes, and weed ecology/biology. Strong professional interest in Indonesia [Timor], Philippines, China and Syria through living and working in these countries and also in India, East Timor and Laos through long collaborative involvement. Living in the Philippines (6 years), China (2 years), Indonesia (6 years) and Syria (2 years) has given diverse experience and strong knowledge of the systems and cultures of Asia and the Middle East. Strong practical knowledge of Mediterranean-type agriculture through long-term involvement in a family crop and livestock farm in the southern Riverina of s.e. Australia.

Strong agricultural management experience and expertise through leadership of two large overseas development projects over 8 years, of a large Australian agricultural research institute over 5 years, and two CGIAR institute research programs over 5 years. Knowledgeable on funding of Australian and International agricultural R & D through long involvement in Australian and CGIAR institutes and in the Australian Centre for International Agricultural Research (ACIAR).

Current Position

Consultant in crop research and development

Adviser to the International Center for Agric Research in Dry Areas (ICARDA) on conservation cropping in temperate dry areas of CWANA and LA and on an ACIAR project on crop improvement/management in Iraq

Employment history and details

Most recent position 2005 –

Employer: International Center for Agricultural Research in the Dry Areas, Director, Program on diversification and sustainability of crop and livestock production systems, ICARDA, PO Box 5466, Aleppo, Syria.

Position held: 2005-07 Director, Program on diversification and sustainability of crop and livestock production systems

2005-ongoing Consultant and adviser on Conservation cropping and the ACIAR crop improvement/management project in Iraq

Duties: Led the research and development activities of the diversification and sustainability program at ICARDA, involving the livestock and agronomy groups, and contributed to corporate management as one of 6 research directors at the institute. R & D focuses on cropping (wheat, barley, lentil, chickpea, faba bean) and small ruminants (sheep, goats), which are the dominant enterprises of farmers in the mandate Central and West Asia and North Africa (CWANA) regions. This involved directing a team of 6 international scientists plus some 20 graduate research assistants and 20 field aides. There was considerable interaction with R & D groups in institutions and universities in the Middle East, North Africa, Asia, and Latin America.

Programs undertaken were on the major problems in dryland livestock (forage supply, nutrition, management, marketing) and crop production (weeds, drought, submergence, soil acidity, nutrient availability). Activities were implemented through research partnerships with NARS and ARO collaborators in the CWANA region. Research was planned, conducted and reviewed together with NARS and other partners through annual technical meetings and regular country visits.

Personal technical management activities included initiation and coordination/leadership of an ACIAR-funded project on "Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq." Personal research was undertaken focusing on conservation farming including zero-till crop establishment, alternative crops (oilseeds, oats, lucerne) and agroforestry incorporation into farming systems.

Previous positions

1999–2005 Crop Program Manager, Australian Centre for International Agricultural Research (ACIAR), Canberra, Australia

Management/coordination of some 30 collaborative R & D projects on field crops, horticulture and pastures involving developing country, IARC and Australian research groups in developing countries in Asia, Latin America and the Middle East.

1995–1998 Upland and Rainfed Lowland Rice Program Leader, International Rice Research Institute (IRRI), Philippines

Management of the upland and rainfed lowland program involving some 20 international scientists, NARS partners/collaborators in Asia and Latin America, and ARO partners in Australia, USA and the UK.

1993–1994 Crop Program Coordinator, Australian Centre for International Agricultural Research (ACIAR), Canberra, Australia

Management/coordination of some 30 collaborative R & D projects on field crops, horticulture and pastures involving developing country, IARC and Australian research groups in developing countries in Asia, Latin America and the Middle East.

1988–1992 Director, Institute for Sustainable Agriculture, Department of Agriculture, Tatura, Victoria

Leadership and management of the major research and extension institute of the Department of Agriculture in Victoria, Australia. This institute had 2 major research campuses and 2 major extension offices, with 100 scientists and 100 support staff. It conducted R & D on major issues of dairying, horticulture, salinity, cropping and beef production in the major irrigated food bowl of Australia.

1982–1987 Team Leader and Pasture Agronomist, NTT Livestock Project (AusAID), Timor, Indonesia

Leadership of a major integrated development project in West Timor, with 30 full and part time advisers, improving livestock (cattle, goats, poultry) and crop production, water supply and roads, in collaboration with the local departments of livestock, cropping, village development, public works and the regional University.

1980–1981 Project Director and Agronomist, China-Australia Livestock Project (AusTrade), Hunan Province, China.

Leadership and agronomy adviser for a major dairy and beef cattle and sheep development project at Nan Shan State Farm in Western Hunan Province., leading a team of 4 Australians and counterparts from the Chinese Bureau of Animal Husbandry. The project successfully developed and extended improved pasture and livestock management technologies.

1978–1979 Multiple Cropping Research Agronomist, Philippine-Australia Development Project (AusAID), Zamboanga del Sur, Philippines.

Implementation of a crop research and development program with the Bureau of Plant Industry, as part of a large development project improving road, irrigation and agriculture in the southern Philippines.

1968–1978 Research Officer/Senior Research Officer, Keith Turnbull Research Institute, Department of Crown Lands and Survey, Victoria

Implementation of a research and extension program on the ecology and control of a range of temperate Mediterranean weeds of crops and pastures in south-east Australia.

Publications

Over 30 publications and 100 conference papers and book chapters

Dr Saleh M. Bader

Nationality: Iraqi

Qualifications

- B. Sc. 1972 Agricultural Sciences (Horticulture), College of Agriculture, Univ. of Baghdad.
- Ph. D. 1980. Plant Physiology, (Tissue Culture), Agriculture and Horticulture College, Agronomic Institute, Univ. Cluj – Napoca. Romania.

Employment

- 1973–1976 Ass. Agric. Engineer/ Palm and Dates Res. Center / Scientific Res. Foundation
- 1976–1980 Graduate student at Rumania for Ph.D. in Plant tissue culture at Cluj – Napoca University
- 1980–1983 Scientific Researcher / Palm and Dates Dept./ Agriculture & Water Resou. Res. Center/ Scientific Research Council
- 1983–1985 Head of Palm & Dates Dept./ AWRRC/ SRC
- 1985–1986 Scientific Researcher
- 1986–1990 Senior Scientific Researcher / PDD / AWRRC / SRC
- 1990–1992 Head / Fudhailia Res. Station / State Board for Agricultural Research / Ministry of Agriculture
- 1992–1994 Head / Tissue Culture Dept./ SBAR / Min. of Agric
- 1995–1996 Date Palm Expert / Arab Organization For Agricultural Development / Sudan
- 1996–1998 Head / Palm & Dates Res. Dept./ SBAR / Min. of Agric
- 1998 Chief Scientific Researcher
- 1998–2003 Head / Palm & Dates Res. Dept./ Genrral Company for Hort. & Forestry / Min. of Agric
- 2003–2004 Deputy Director General / GCHF
- 2004 Expert
- 2004 Director General / State Board for Agricultural Research

Field of Work

Date Palm Production 1973 – 1980

Date Palm Production & Propagation (Plant Tissue Culture) Since 1980.

Publications

23 peer-reviewed publications and 11 conference and other papers.

C.V

Name	Abdul Sattar A.Jassim
Date of Birth	Nieneverah / Mosul/ 1960
Certificate of Education	BS.C Horticulture – agricultural college/ Baghdad university 1982 Master of Horticulture _ Forestry and agricultural college mosul university /1985 . Doctoral of Biology philosophy / Baghdad university/ college of science/1991 , promotion to assistance teacher on 29/12/2004 .
Field	Production of seeds – Technology of seeds .
Address	Mosul / AL Hadbaa section
E – Mail	agrimosul@yahoo.com,dr_alrijabo@yahoo.com
Employment Address	Ministry of Higher Education and Science Research / Mosul university/ College of Horticulture and Forestry / agronomy Dep.
Scientifically and Managerial position occupied	- Manager of Mabeen AL Nahreen Company for seeds production from 1994 up to 1999 . - A teacher of agronomy department /1999 . -Manager of Nieneverah agriculture directorate/ 2003 . - A teacher of agricultural college / dep .of Agronomy - Manager of the project of production and develop of cereals and legumes in dry Area (ICARDA)/ form 2005 up to now .
Publication	Seed Technology book .
Practical experiences	Practical experiences in the field of seed Technology . Management experiences during his work in the field mentioned above .
Awarded and Thanks	24 book of thanks and Regards during his work .

Mr Jaafar Sedeeq Saeed

Nationality: Iraqi

Qualifications

M.Sc. 1989, Horticulture, College of Agriculture and Forestry, University of Mosul, Iraq

Diploma 1978, Agricultural Science, College of Agriculture, University of Sofia, Bulgaria

B.SC 1971/72, Agronomy, College of Agriculture, University of Sulaymaniyah, Iraq

Employment

1973-74 Iraqi Ministry of Agriculture

Co-partner for the FAO agricultural extension expert in the al-Museiub Agricultural project.

1974-76 Directorate of Agriculture ,Mosul, Iraq

1976 Sinjar branch of agriculture. Responsible for horticulture and forestry.

Transferred to the department of horticulture and forestry, DOA, Mosul.

Appointed as the head of the department of horticulture and forestry in 1980, Mosul, Iraq.

Appointed as the head of the department of agricultural affairs, DOA, Mosul, in 1993.

Appointed as the acting director, DOA, Mosul, since 1994 up to date in addition to the head of the department of agricultural affairs.

Participated in several training courses in Bulgaria, Algiers, Jordan, Egypt and Syria.

Participated in several conferences and workshops inside and outside of Iraq.

Assistant director for the ICARDA project in Iraq and given the responsibility of the legume activity of the project.

Participated in the agricultural Extension Revitalization In Iraq (IAER) with cooperation of USA.

Participated in Auc - Desert Development Center Training course in Egypt in 2007.

Director of the agricultural extension program for the development of agriculture in Mosul, Iraq.

Publications

Several scientific papers published in the scientific journals in Iraq.

Professor Kadambot H.M. Siddique

Position: Chair in Agriculture and Director

Nationality: Australian

Address (business): Institute of Agriculture, The University of Western Australia, Faculty of Natural and Agricultural Sciences, 35 Stirling Highway, Crawley, Western Australia 6009

Tel: (+61 8) 6488 7012

Fax: (+61 8) 6488 7354

Mobile: 0411 155396

Email: ksiddique@fnas.uwa.edu.au

Web: www.ioa.uwa.edu.au

Education

- 1977 – BSc (Ag) Hons, Agricultural Science, Kerala Agricultural University, India
- 1979 – MSc (Ag), Crop Physiology, Indian Agricultural Research Institute, New Delhi, India
- 1985 – PhD, Environmental and Crop Physiology, The University of Western Australia

Honours

- 2005 – Fellow of the Australian Academy of Technological Sciences and Engineering
- 2001 – Urrbrae Award for Outstanding Contribution to Australian Agricultural Research, Urrbrae Memorial Trust
- 1999 – Innovation and Technical Excellence Award, Pulse Improvement Team, Agriculture Western Australia
- 1999 – Outstanding Service Award – Crop Update Working Group, Agriculture Western Australia
- 1981-1984 – PhD Fellowship Postgraduate Research Scholarship, The University of Western Australia
- 1977-79 – Junior Fellowship for MSc (Ag), Indian Council of Agricultural Research, New Delhi, India
- 1979 – Gold Medal for Outstanding MSc (Ag) Student, Indian Agricultural Research Institute, New Delhi, India
- 1973-77 – Undergraduate Merit Scholarship, Kerala Agricultural University, Kerala

Academic and Research Career

- 1980-1981 – Research Associate, International Centre for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria
- 1985-1992 – Cereal Physiologist, Department of Agriculture Western Australia
- 1992-1996 – Senior Pulse Agronomist/Physiologist, Department of Agriculture Western Australia
- 1996-2001 – Principal Pulse Agronomist/Physiologist, Department of Agriculture Western Australia and Sub-Program Leader, CLIMA
- 2000-2001 – Leader, Pulse Productivity Sub-Program, Department of Agriculture Western Australia

- 2001-2006 – Director and Professor (Crop Science), Centre for Legumes in Mediterranean Agriculture (CLIMA), Faculty of Natural and Agricultural Sciences, The University of Western Australia
- 2000-2006 – Adjunct Professor, Muresk Institute of Agriculture, Curtin University of Technology, Perth, Western Australia
- 2007-Present – Guest Professor of Lanzhou University
- 2007-Present – Honorary Professor of Gansu Academy of Agricultural Sciences
- 2007-Present – Adjunct Professor of Ministry of Education Key Laboratory of Arid and Grassland Ecology, Lanzhou University
- 2007-Present – Visiting Professor Faculty of Agriculture, University Putra Malaysia

Publications

- 2 Theses
- 150 refereed Journal articles and reviews
- 25 Books/Book chapters
- 85 Conference and workshop publications
- 104 Technical and miscellaneous publications

Scientific Journal Editorship and Committee Membership

- Chair of Editorial Advisory Board of the Australian Journal of Agricultural Research (2004-present)
- Member of Editorial Advisory Board of the Australian Journal of Agricultural Research (1999-present)
- Member of Editorial Advisory Board of the European Journal of Agronomy (2003-present)
- Member of the Editorial Board of the Journal of Biological and Environmental Sciences (2005-present)
- Member of the Editorial Advisory Board of the International Journal of Post-harvest Technology and Innovation (2005-present)
- Member of the Advisory Board of the Agricultural and Marine Sciences Journal, Sultan Qaboos University, Muscat, Oman (2005-present)
- Member of the Editorial Advisory Board of the International Journal of Plant Production (2006-present)

Invited Speaker at International Symposia

- Global Grain Legume Drought Research Conference, New Delhi (1995)
- 3rd International Food Legume Conference, Adelaide (1997)
- *International Lathyrus* Genetic Resources Network , New Delhi (1998)
- 2nd International Plant Physiology Congress, New Delhi (2003)
- International Chickpea Conference, Raipur (2003)
- 4th International Crop Science Congress, Brisbane (2004)
- 4th International Food Legume Conference, New Delhi, India (2005)
- 5th European Grain Legume Conference, Lisbon, Portugal (2007)

Dr Walter Keith Anderson

NATIONALITY: Australian *CITIZENSHIP:* Australian

QUALIFICATIONS: Hawkesbury Diploma of Agriculture, 1960

B.Sc. Agr. (Hons. I), Sydney, 1968

M.Sc. Agr., Sydney, (external), 1970

Ph.D., University of New England, 1977

THESE:

Co-supervisor of undergraduate and postgraduate studies and Examiner of Honours, Masters and PhD theses from Australian Universities.

HONOURS

Fellow of the Australian Institute of Agricultural Science. Adjunct Professor, School of Plant Biology, University of Western Australia.

ADDRESSES

Home - 1084 Millinup Rd., Porongurup, Western Australia 6324

Telephone (08) 9853 2225. Email wmanderson@bordnet.com.au

Work - Agriculture Western Australia, 444 Albany Highway, Albany, Western Australia 6330

Telephone (08) 9892 8412

Facsimile (08) 9841 2707

Email wanderson@agric.wa.gov.au

Employment History

Current (from 2006)

- Manager (Principal Research Officer), Cropping Systems Research Project, Department of Agriculture and Food, Albany, Western Australia.

Management of a team of researchers located in regional Western Australia using a diagnostic approach to provide management options for farmers to improve crop yields to the levels set by seasonal rainfall each year. The work is funded by industry (30% or \$2.5 million over 5 years) and by the state government (70%).

1994 to 2005

- Manager (Principal Research Officer), Wheat Agronomy Research Project, Agriculture Western Australia, Albany, Western Australia.

State-wide responsibilities for leadership and management of research project into the agronomy of wheat-based cropping systems. The project is funded through competitive grants from external sources (75%) and government sources (25%). It is comprised of 20 staff located in regional centres. Personal research includes influence of crop agronomy on wheat grain quality and development of an approach to cropping systems research.

2003 and 2004

- Agricultural Relief Rehabilitation Programme Specialist, Plant Production and Protection, Rome and Amman (approx. 4 months in total).

Two, short-term assignments for the Food and Agriculture Organisation of the United Nations (FAO). The first was one month spent in Rome assessing the requirements for replenishment of seeds and fertilizers for the main food crops of Iraq in the event of

disruption due to war. This plan was used for the initial stages of rehabilitation in the wake of the second Gulf War. The second assignment of three months was spent in Amman (UN personnel were not initially permitted back into Iraq after the war) consulting with Iraqi and UN personnel from various agencies to write and submit proposals to rehabilitate and re-develop various sectors of the agricultural economy destroyed by the wars and associated events (seed production, research and extension infrastructure, fisheries, irrigation, veterinary services).

2000

- Team Leader Plant Production, Iraqi Kurdistan (5months) and Baghdad (1 month).

Assignment for the FAO. Co-ordination and strategic planning of rehabilitation of cropping sector in northern Iraq (seed and fertilizer imports and distribution, pure seed production, rehabilitation of research infrastructure and crop research programmes). Conducted training course in variety identification and pure seed production for Iraqis whilst in Baghdad.

1983-1994

- Senior Research Officer, Department of Agriculture, South Perth Western Australia.

Cereal agronomy research. Supervision of up to six externally funded research projects in cereal agronomy and physiology employing up to ten research staff. Personal research in development of high yield packages for wheat and oats, optimum flowering times for crop cultivars and interactions between cultivars and agronomic practices. Member of State Wheat Advisory Committee, Wheat Research Committee of Western Australia, Quality Wheat Co-operative Research Centre.

1979-1983

- Senior Research Scientist, International Centre for Agricultural Research in Dry Areas, Aleppo, Syria.

Research in agronomy of bread wheat, durum wheat, barley and triticale as part of the Cereal Improvement Program. Experimental projects conducted at the Centre in Aleppo and in collaboration with national scientists in Syria, Jordan, Pakistan and Lebanon. Participation in regular training courses (six months) for scientists from North Africa and West Asia and irregular, in-country courses in the region (Morocco, Tunisia, Turkey). All projects were aimed at increasing yields in rain fed, Mediterranean type environments by the combination of high-yielding cultivars and improved production practices.

1977-1979

- Research Leader, Department of Agriculture, Albany, Western Australia.

Co-ordination of regional research in crops, pastures, animal production, plant pathology and entomology. Personal research in crop adaptation (barley, lupins, rapeseed) and pasture utilisation (effects of stocking rate on clover 'scorch' disease). Responsible for regional research activities of four research and five technical staff.

1974-1976

- Research Fellow, University of New England, Armidale New South Wales.

Personal research into the adaptation of sunflower in Australia (PhD study). Intensive field study to determine the optimum locations and sowing times for sunflower. Co-operative work funded by Rural Credits Development Fund, Economic Oil Industries (Unilever) and Yates Seeds.

1973

- Teaching Fellow in Land Use Planning and Management, School of Natural Resources, University of New England.

Co-ordinating post-graduate diploma courses and advising on student projects.

1970-1972

- Senior Research Fellow and Leader, Ord Research Project, Kununurra WA.

Development of a production system for irrigated grain sorghum and its integration with lot fattening of beef cattle. Experiments on possible rotation crops soybeans, peanuts, sunflower and maize. The team of three research fellows and one technician, employed by the University of New England, were responsible for contract research funded by a consortium of three commercial companies.

1969

- Research Agronomist, seconded to CSIRO, Division of Irrigation Research, Griffith NSW.

Research under both field and controlled environment conditions, into the germination and emergence responses of cotton cultivars at low soil temperatures.

1968

- Research Agronomist, NSW Department of Agriculture, Narrabri.

Field research into emergence and early growth of cotton and soybeans.

1964-1967

- Undergraduate, University of Sydney

1961-1963

- Extension Agronomist, NSW Department of Agriculture, Yanco, Narrabri, Deniliquin.

Agronomic experiments with cotton, sorghum, soybeans, rice, maize, pastures and other crops. Training in extension methods.

Short term assignments

Iran 1992 – assessing the requirements for a planned, agricultural research institute to service high altitude areas (400 staff)

Iraq/Jordan 2000, 2002, 2004 – assessing the needs for rehabilitation of the Iraqi agricultural production, research and extension systems and short term emergency relief for farmers.

Morocco 1998 to 2000 – Collaborative agronomic research in Morocco and germplasm exchange with Moroccan durum wheat researchers.

Publications

Published eight books and chapters, forty-nine refereed publications, and sixty-two conference and other papers

Professor David Coventry

Sustainable Agricultural Production

The University of Adelaide, Roseworthy Campus

Date of birth: 28th October 1947 (Brisbane, Australia), Australian citizen

Academic qualifications

B.Agr.Sci. (University of Melbourne 1970) M.Agr.Sci. (University of Melbourne 1972)

Dip.Ed. (University of Melbourne 1972) Ph.D. (University of Western Australia 1975)

Research interests

Crop agronomy; sustainable agricultural systems; soil acidity; rhizobial ecology; resource use efficiency; tillage systems

Current professional contributions/consultancies

- DAFF – Eritrea College of Agriculture Development Project (2005-2008)
- Board Member, CRC Plant-Based Management of Dryland Salinity (2003-2007)
- AW Howard Trust member (1996-2008)
- SA Crawford Fund Committee member (2004 – 2008)
- Team Leader IDP Australian Development Scholarship Selection, Indonesia (2003-2008)

Employment History

- Professor Sustainable Agricultural Production, The University of Adelaide, Roseworthy Campus. 1996- present (including Head of Department 1996-2003).
- Program Manager, Division of Soils, CSIRO. 1994-1996
- Director, Rutherglen Research Institute. 1987-1994
- Senior Research Officer, Rutherglen Research Institute, Rutherglen (Department of Agriculture, Victoria). 1980-1987
- Senior Adviser (Agronomy), Indo-Australian Sheep Breeding Farm, Hisar, Haryana, India (ADAB/DAV). 1978-1980
- Agricultural Research Officer, Mallee Research Station, Walpeup, (Department of Agriculture, Victoria). 1975-1977

7 Appendix A Intellectual property register

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

7.1.1 Administrative details

Project ID	Assigned by ACIAR
Project Title	Development of conservation cropping systems in the drylands of northern Iraq
Assessment provider	Dr Elizabeth Bailey
If not Australian Project Leader, provide title	Head, Resource Mobilization and Project Development Unit, ICARDA
Date of assessment	23 May 2008

7.1.2 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 wheat, barley, oat, pea, pulse and forage legumes 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

7.1.3 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 / Commissioned Organisation	GIS data sets and data sets for cropping systems simulation. Rights to all for use for research purposes only
Iraq	design for tillage equipment. Full rights in Iraq. Rights for Commissioned Organisation and Australian organisations for research purposes only
Syria / Commissioned Organisation	design for tillage equipment. Commissioned Organisation will have rights to use IP and share with others (under agreements).

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
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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	GIS databases/maps: restricted to research use only

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