Project	**Development of conservation cropping systems in the drylands of northern Iraq**
Project no.	**ACIAR/AusAID CIM/2008/027**
Workplan	**2008-09**

5. Operations – Workplan 2008-09

The workplan for 2008-09 was discussed and developed at the reporting/planning meeting at ICARDA on 7-11 September 2008. This is presented below in the format of the Project Document, to facilitate consistency and logical later reporting against planned objectives and activities.

5.1 Methodology

Project management and timetable

Overall leadership and coordination is by the Project Leader in the Commissioned Organisation ICARDA (Dr C. Piggin), with components in Iraq coordinated by the Iraq Coordinator (Dr S. Bader) and led by the Iraq Project Leader (Dr A. S. Al Rajibo). Activities in each partner institution are led by the designated Institution Project Leader. The leaders, roles and responsibilities of each institution are represented in Figure 5.1.1 Project Management and Implementation.

A Project Coordination Committee has been formed, chaired by the Project Leader and composed of the project leaders plus invited scientists from each institution, plus a representative from ACIAR and/or AusAID. This committee meets 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. The first meeting to review and approve project developments and work planning was held on 11 September 2008.

In Iraq, the Ninevah Implementation Committee, 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, will meet or interact monthly to plan, monitor, review and report on activities and achievements, and ensure that the agreed workplan is being implemented. The first meeting was held on 24 July 2008 to discuss the Ninevah workplan and prepare for the September planning meeting.

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.

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.

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

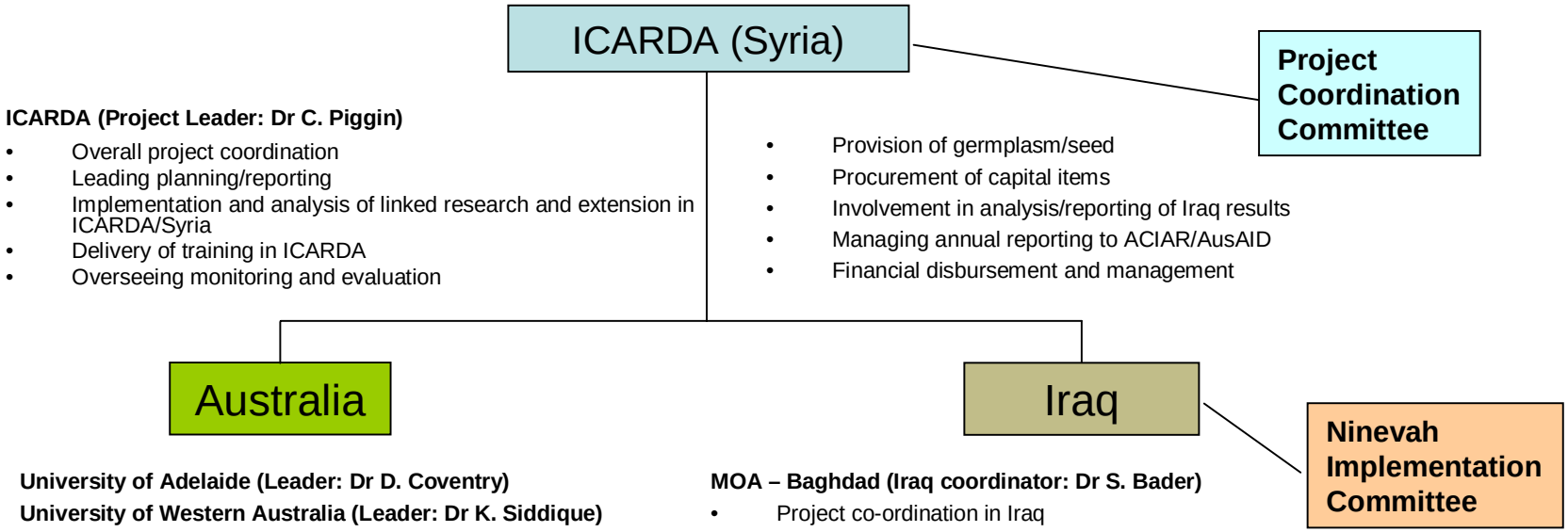

Table 5.1.2 Annual **Timetable of Main Events and Activities (July 2008-June 2011)**

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

Technical implementation

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

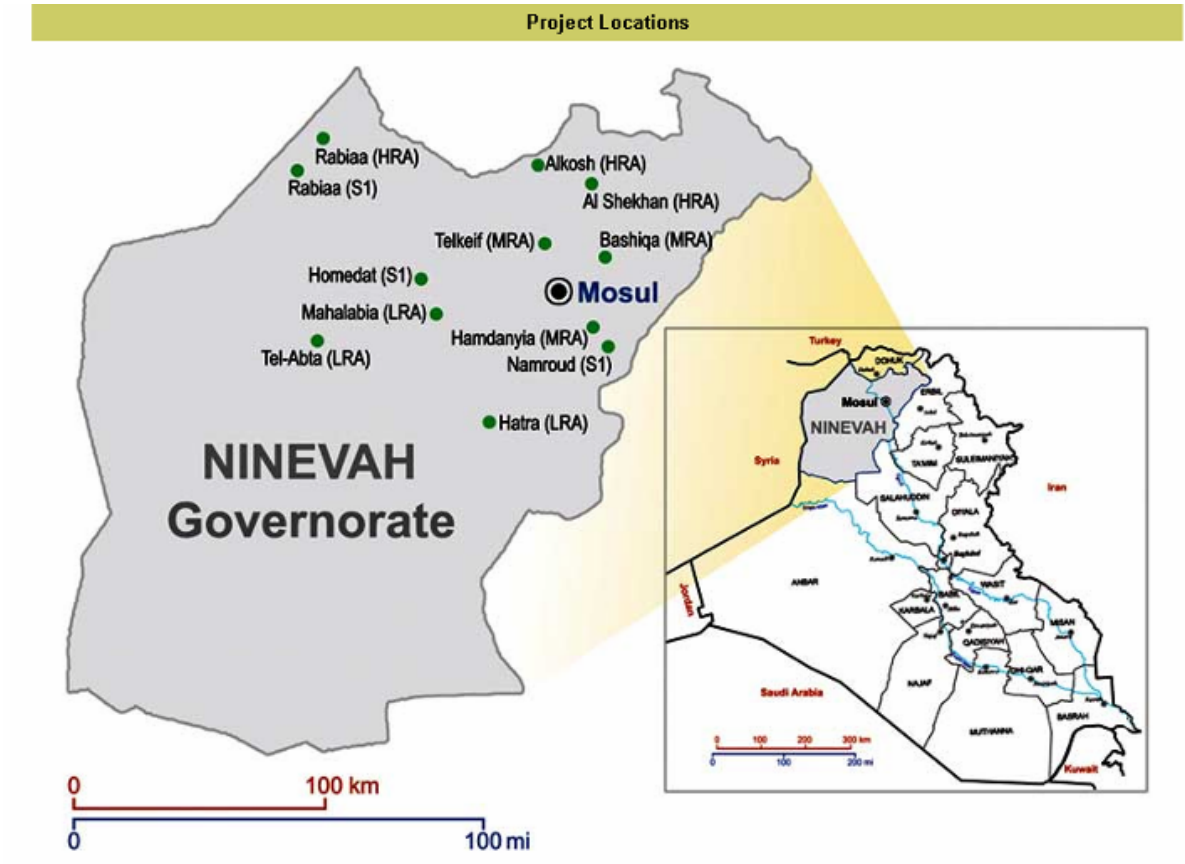

Figure 5.1.2: Locations of on-farm demonstrations:

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

University of Mosul scientists involved in the activities listed below will be:

Dr Moafak M.Ahmad, Dean ,College Of Agriculture and Forestry
Dr. Abdulsattar A.Alrijabo, Agronomist, Seed Production.
Dr. Abbas M.Al-Hasan, Forage and Range Management
Dr. Ahmed M. Sultan, Weed Control
Dr. Saad A. Samier, Agric. Mechanization
Dr. Hesham M. Hassen, Soil physics
Dr. Salim H. Anter, Weed Control
Dr. Suaad Irdeny Abdullah, Plant protection
Dr. Khalid H. Taha, Plant protection
Dr. Mohammed Yousif Al-Fahady, Crops Breeder.
Dr. Mohammed S.Al-Taweel, Crops Breeder.
MSc. Moayaser M., Crops Breeder
Msc. Mohammed A. Hajy, Agronomist

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

Based on the work plan agreed in the first planning workshop (September 2008), sites and participating host farmers and farmer groups for on-farm demonstrations from the first project will continue in twelve locations, with four sites (three with natural rainfall, one with supplementary irrigation termed SI) in each of the three rainfall zones (HRA, MRA, LRA). They will involve various combinations of crop management and improved varieties/lines, evaluating technologies detailed under activities 1.2 and 1.3.

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 some specific research trials under Objectives 2 and 3.

Demonstrations and trials will be established in host farmers' fields under the supervision and management of DOA and UniMosul project staff, under the leadership of Mr Jaffar Sedeeq Saeed and Dr Abdulsattar A Al-Rajibo, to ensure that the best-bet practices are correctly demonstrated. Demonstration treatments will have large plots (1 donum = 0.25ha) and, where possible, will have some replication to enable better analysis and interpretation of results. Some promising lines will be grown for seed production on smaller plots (100 m^2), providing a venue for farmers to observe the performance of these lines.

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, assisted 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, to complement project activities such as the field demonstration sites, training activities at ICARDA, and short term training 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, and 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

"Best bet" crop management options and lines/varieties of target crops were discussed and agreed at the September 2008 planning meeting, based on experience from the original project. These have been incorporated into the workplan as detailed below.

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

The crop management treatments in the Activity 1.2/1.3 management x variety/line demonstrations will include ZT (at all locations) and chisel plough (at some locations), chosen because of their promise (ZT) or their use by some HRA/SI farmers (chisel plough), compared with the farmers' conventional tillage practices. Most of the Activity 1.2/1.3 demonstrations will be factorial comparisons of tillage methods and crop varieties/lines with 3-4 replications and a plot size of 1 donum (0.25 ha) using district rotations/crop management.

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

The crop treatments in the Activity 1.2/1.3 management x variety/line demonstrations will include several "improved" lines/varieties wheat, barley, chickpea, lentil, faba bean and forage legumes adapted to HRA, MRA, LRA and SI zones, often in comparison with a local variety. Most of the Activity 1.2/1.3 demonstrations will be factorial comparisons of tillage methods and crop varieties/lines with 3-4 replications and a plot size of 1 donum (0.25 ha) using district rotations/crop management.

At some sites, there will be demonstrations of newer promising varieties/lines of some crops under farmer management for seed production, and also as demonstrations for farmers, using varying plot size and number of replicates depending on seed supply.

The variety/line and crop management comparisons for each site are detailed below:

Demonstrations 2008/09

Supplementary irrigation areas (Tel Abta, Rabeea, Al-Namroud)

Location Tel Abta - LRA			
Crop	Cultivars	Planting methods	Experimental units
Durum wheat	Om Rabiaa/5 - Cham/3	ZT-Chisel-Control	2*3*4rep=24 donum
Bread wheat	Adnaniya - Tell affer/3	ZT-Chisel-Control	2*3*4rep=24 donum

Location Rabeea - HRA			
Crop	Cultivars 2 levels	Planting methods 3 levels	Experimental units
Durum wheat	Om Rabiaa/5 - Cham/3	ZT-Chisel-Control	2*3*4rep.=24 donum
Bread wheat	Adnaniya - Tell affer/3	ZT-Chisel-Control	2*3*4rep.=24 donum

Location Al-Namroud - MRA			
Crop	Cultivars	Planting methods	Experimental units
Durum wheat	Om Rabiaa/5 - Cham/3	ZT-Chisel-Control	2*3*4rep.=24 donum
Bread wheat	Adnaniya - Tell affer/3	ZT-Chisel-Control	2*3*4rep.=24 donum
Durum wheat	Lanhocan - Karonia	Seed prodn (1.4kg for 100 m^2)	2*4 rep. = 8 *25 m^2=200m^2

Bread wheat	Qimma/6- Ezaz/11	Seed prodn (1.2 kg for100 m^2)	2*4 rep. = 8 *25 m^2=200m^2

Note 1: Weed control - weed survey under all treatments (Dr. Ahmed M. Sultan, Weed Control, UniMosul, et al)

Note 2: Crop protection - wheat seed treated with Devedent (covered smut) and cruiser (leaf minor) before planting comparing with farmer land management (Dr. Suaad Irdeny Abdallah, entomologist, University of Mosul, et al)

Note 3: Soil traits – determination of soil properties under different agricultural system (Dr . Hesham M. Hassen UniMosul, Dr Saad D T Al-Malak SBAR Mosul, et al)

High rainfall areas (Al-qush, Al Shykhan, Rabeea)

Location Al-qush			
Crop	Cultivars	Planting methods	Experimental units
Durum wheat	Karonia - Cham/3	ZT-Chisel-Control	2*3*4rep=24 donum
Bread wheat	Cham/6 - Abo Gharaib/3	ZT-Chisel-Control	2*3*4rep=24 donum
Durum wheat	Ecacier /2 - Karonia	Seed prodn (1.4kg for 100 m^2)	2*4 rep=8 *25 m^2=200m^2
Bread wheat	Dejaj/5 - Inge/4	Seed prodn (1.2 kg for100 m^2)	2*4 rep=8 *25 m^2=200m^2

Crop	Cultivars	Planting methods 3 levels	Experimental units	Notes
Chickpea (Winter)	IPA 510 - Ghab/4	ZT-Chisel-Control	2*3*4rep=24 donum	
	Local		100m^2	
Chickpea (Spring)	IPA 510 - Ghab/4	ZT-Chisel-Control	2*3*4rep=24 donum	

	Local		100m^2	
Chickpea (Winter)	IPA 510 - Ghab/4 - Flip 97-706	Farmer planting method	3*4rep.=12 x 1/2 donum	3 additional farmers will grow set of varieties 20 kg/cultivar
	Gokche	Farmer planting method		One farmer will grow 100 m^2 for seed
Chickpea (Spring)	IPA 510 - Ghab/4 - Flip 97-706 - Gokche	Farmer planting method	4*4rep.=16 x 1/2 Donum	4 additional farmers will grow set of varieties 20 kg/cultivar
	Gokche	Farmer planting method		One farmer will grow 100m^2 for seed

Location Al Shykhan			
Crop	Cultivars	Planting methods	Experimental units
Durum wheat	Karonia/local - Cham/3	ZT-Chisel-Control	2*3*4rep=24 donum
Bread wheat	Abo Gharaib/3 - Sham /6	ZT-Chisel-Control	2*3*4rep=24 donum
Faba bean	Akwadilji - ILB	Chisel–Control	2*2*4rep=16 unit x 1/2 donum
	Local	Farmer planting method	100m^2

Location Rabeea			

Crop	Cultivars	Planting methods	Experimental units
Durum wheat	Karonia/local - Cham/3	ZT-Chisel-Control	2*3*4rep=24 donum
Bread wheat	Abo Gharaib/3 - Sham/6	ZT-Chisel-Control	2*3*4rep=24 donum

Note1: Weed survey under all treatments (Dr. Ahmed M. Sultan, Weed Control, UniMosul, et al)

Note 2: Crop protection - wheat seed treated with Devedent (covered smut) and cruiser (leaf minor) before planting comparing with farmer land management. (Dr. Suaad Irdeny Abdallah, entomologist, University of Mosul, et al)

Note 3: Crop protection - efficacy of Cruiser350 FS and Celest100 FS insecticides for protection of chickpea from *Fusarium solani* and lesser army worm comparing with farmer land management (Dr. Suaad Irdeny Abdallah, entomologist, University of Mosul, et al)

Note 4: Soil traits - determination some soil properties under different agricultural systems (Dr . Hesham M. Hassen UniMosul, Dr Saad D T Al-Malak SBAR Mosul, et al)

Medium rainfall areas (Telkief, Al-Hamdania, Bashyqa)

Location Telkief			
Crop	Cultivars	Planting methods	Experimental units
Durum wheat	Karonia - Om Rabiaa/5	ZT-Chisel –Control	2*3*4rep.=24 donum
Bread wheat	Cham/6 - Abo Gharaib/3	ZT-Chisel –Control	2*3*4rep.=24 donum
Durum wheat	Fada/98 - Karonia	Seed prodn (1.4kg for 100 m2)	2*4 rep. = 8 *25 m^2=200m^2
Bread wheat	Abo Ziek - Babaja/3	Seed prodn (1.2kg for 100 m^2)	2*4 rep. = 8 *25 m^2=200m^2
Barley	Rihan/3 - Jazzera/1	ZT-Chisel –Control	2*3*4rep.=24 donum
Barley	Alnanda/1- Fat/5	Seed prodn (1.2kg for 100 m^2)	2*4 rep. = 8 *25 m^2=200m^2

Forage legumes Dr Kasim K. et al	IPA/2001- Seil/587		2*5 rep= 8 *500 m^2 (2donum/cultivar)
Hay making Dr Kasim K. et al	75%common vetch:25%barley Local Black		1 ha

Location Al-Hamdania			
Crop	Cultivars	Planting methods	Experimental units
Durum wheat	Karonia - Om Rabiaa/5	ZT-Chisel-Control	2*3*4rep=24 donum
Bread wheat	Cham/6 - Abo Gharaib/3	ZT-Chisel-Control	2*3*4rep=24 donum
Barley	Rihan/3 - Jazzera/1	ZT-Chisel-Control	2*3*4rep=24 donum
Lentil	IPA/98 - Adlip /3	ZT-Chisel-Control	2*3*4rep=24 donum
Lentil	Local		100m^2

Location Bashyqa			
Crop	Cultivars	Planting methods	Experimental units
Durum wheat	Karonia - Om Rabiaa/5	ZT-Chisel-Control	2*3*4rep.=24 Donum
Bread wheat	Cham/6 - Abo Gharaib/3	ZT-Chisel-Control	2*3*4rep.=24 Donum

Barley	Rihan/3 - Jazzera/1	ZT-Chisel-Control	2*3*4rep.=24 Donum

Note1: Weed survey under all treatments (Dr. Ahmed M. Sultan, Weed Control, UniMosul, et al)

Note 2: Crop protection - wheat seed treated with Devedent (covered smut) and cruiser (leaf minor) before planting compared with farmer land management. (Dr. Suaad Irdeny Abdallah, entomologist, University of Mosul, et al)

Note3 : Soil traits - determination of some soil properties under different agricultural systems (Dr . Hesham M. Hassen UniMosul, Dr Saad D T Al-Malak SBAR Mosul, et al)

Low rainfall areas (Hatra, Tell Abta, Almahalabia)

Location Hatra			
Crop	Cultivars	Planting methods	Experimental units
Barley	Zanbaka - Local black	ZT-Control	2*2*4rep=16 donum

Location Tell Abta			
Crop	Cultivars	Planting methods	Experimental units
Barley	Zanbaka - Local black	ZT-Chisel-Control	2*3*4rep.=24 donum
Barley	Zanbaka/SLB 22-74 - Yazan	Seed prodn (1.2kg for 100 m^2)	2*4 rep= 8 *25 m^2=200m^2

Location Almahalabia			
Crop	Cultivars	Planting methods	Experimental units

Barley	Zanbaka - Local Black	ZT-Chisel-Control	2*3*4rep=24 donum
Vetch	IPA / 2001		

Note1: ZT seeders must be new local disc types, so we need to buy 3 modified disc ZT seeders

Note2: Weed survey under all treatments (Dr. Ahmed M. Sultan, Weed Control, UniMosul, et al)

Note3: Soil traits - determination of some soil properties under different agricultural system (Dr . Hesham M. Hassen UniMosul, Dr Saad D T Al-Malak SBAR Mosul, et al)

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) were identified by ICARDA during/following the September 2008 planning meeting. This seed will be dispatched to Iraq for screening for specified biotic and abiotic stresses in experiments using a randomized complete block design with three replications, and small plots of 10 m^2. In addition to yield measurements, the experiments will be monitored and scored throughout the growing season for desirable traits. Several constraint-specific nurseries will also be evaluated. Several forages were also identified for testing.

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

Lines for testing in Activities 2.2 and 2.3 were discussed/identified at the September 2008 meeting. ICARDA will source seed not available in Iraq for these trials.

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

For the elite line evaluation of 10-12 lines of bread and durum wheat, barley, chickpea and lentil, it was planned, depending on seed supplies, to test one set at Bashiqa under the control of crop breeder Mr Raad A. Hameed of SBAR and four sets under dryland conditions in northern Iraq under the control of crop breeders Dr Mohammed Yousif Al-Fahady and Dr Mohammed S Al-Taweel of UniMosul (including sites at both UniMosul and Rashidiya Research Station).

Specific chickpea international nurseries for tolerance to drought (CIDTN) and diseases *Ascochyta* blight (CIABTN) and *Fusarium* wilt (CIFWN) will be evaluated at Rashidiya Research Station, with artificial inoculation of *Ascochyta* and *Fusarium* and supplementary irrigation when necessary to simulate HRA conditions, under the control of Dr Maan M Salih of SBAR and Mr Sallo Sito Murad of DOA.

Promising lines of forage legumes (*Vicia sativa, V. dasycarpa, V. ervilia, Lathyrus sativus*) will be tested at Rashidiya Research Station under the control of Dr Kasim K Kasim of SBAR.

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

Two sets of putatively salt-tolerant wheat and barley lines for pilot testing for salt tolerance will be assembled and supplied by ICARDA and evaluated in replicated trials in farmer fields in irrigated sites at Wahdea in Baghdad Governorate and Sawaria in Wasit Governorate. This will be under the control of Dr Abdul Kareem HO and Dhiaa A Jasim of SBAR Baghdad.

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

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 3.1.1 will be supported by crop modelling under Activity 3.2. Trials will include:

1. Comparison of ZT and conventional tillage crop establishment with additional treatments of early/late sowing, ± stubble removal, N input and potential (stress-free) growth in long-term trials in ICARDA and Ninevah

- In Ninevah, this will be established at the University of Mosul farm under the control of Dr Abdul Sattar Al-Rajibo, 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. The background and methodology for the long-term experiment are given in the Experiment 3.1.1 descriptions below. Drs W Anderson, D Coventry and C Piggin will be advisers for this study.
- In ICARDA, the experiment, under the control of Dr C Piggin and Mr A Haddad, will be the continuation of the two established long-term trials with sowing time and stubble removal treatments, with monitoring of priority soil, water, crop and weed, pest, and disease parameters.

2. Evaluation of deep ripping to overcome hardpans

   - In one of each of the HRA, SI, MRA and LRA 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. Details of these experiments, under the control of Dr Saad Abdul Jabar Samir et al from Mosul University, are given in the Experiment 3.1.2 description below.

3. Evaluation of alternative crop and forage rotations

   - Evaluations will be established to assess alternative rotations possibilities for use under ZT. Some rotations will be compared with farmer rotations of continuous barley in LRA or continuous wheat in MRA.
     - In HRA, MRA and LRA sites, trials and demonstrations will assess alternative rotations with Nigella sativa, flax, safflower, vetch, grasspea and annual medic.
     - Demonstrations will be undertaken to evaluate forage and seed production of perennial grasses (*Agropyron, Phalaris, Lolium, Festuca, Dactylis*) in MRA and Atriplex (*A. nummularia, A. halimus, A. canescens*) in LRA.
   - These trials/demonstrations 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 rotations on weed, insect and diseases incidences.
   - Details of these experiments, with responsible scientists, are given in the Experiment 3.1.3 descriptions below.

4. 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. This will be under the responsibility of Dr. Ahmed M Sultan et al, weed scientist, University of Mosul.

5. Evaluation of adding polymer gel crystals to the soil to enhance water availability.

   - This exploratory research by the University of Mosul will assess a newly available technique of adding polymer gel to soil. One trial in each zone with wheat under HRA, MRA and SI or barley under LRA, with 3 rates of polymer gel (0, 5 or 10kg/donum) and 2 rates of fertiliser (50% or 100% of the recommended rate). Regular measurements will be made of soil moisture and other properties. Details of these experiments, under the control of Dr Abdul Sattar Al-Rajibo, are given in the Experiment 3.1.5 descriptions below.

6. Evaluate Integrated Pest Management (IPM) options for cereals (wheat, barley) and food legumes (chickpea, lentil) in Ninevah

   - It is planned to focus IPM on Sunn pest in wheat and Ascochyta blight in chickpea and establish IPM pilot sites in some of the HRA and MRA locations. In each pilot site, best bet practices for managing Sunn pest (early maturing variety, collection of Sunn pest adults from the field either manually or using the sweep nets, economic threshold, insecticides if necessary and early harvest) and Ascochyta (tolerant variety, fungicides) would be demonstrated in ¼ ha in comparison to farmer's practices in the other ¼ ha. A farmer field school, made of about 30 farmers, would be established around each of these IPM pilot sites, to meet with researchers and extension agents in these pilot sites on key occasions during the cropping season to discuss and practice the different management options. This will be under the responsibility of Dr. Suaad Irdeny Abdallah, entomologist, University of Mosul, in conjunction with Drs Dr M. Bohssini and Seid Kemal of ICARDA. Implementation will be discussed further amongst ICARDA and Ninevah entomologists/pathologists.

7. Evaluate the biological control of covered smut and root rot diseases in wheat

   - An experiment will be established by the University of Mosul in Al Shykan 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 an untreated control. Details of this experiment, under the responsibility of Dr Khaild H. Taha et al from Mosul University, are given in the Experiment 3.1.7 descriptions below.

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 some 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). This will be under the control of Dr Rolf Sommer of ICARDA.

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

This activity will continue from the initial start made in 2007/08, under the control of Drs Rajibo and Saad Samir of Mosul University in Iraq and Dr Colin Piggin and Atef Haddad, Colin Norwood and Shukri Ishmail in Syria. It will involve interaction and collaboration with small machinery manufacturers and farmers to modify existing seeders or design and build new seeders.

In Ninevah, there are several farmers, machinery manufacturers and a PhD student involved. 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

In Syria, four manufacturers involved and their fabricated machines will be tested for crop establishment and performance in ICARDA and farmer fields and further machines will be developed.

The project will purchase further modified seeders and use them in demonstrations and promote their uptake. The machines may cost around $3,500. Contractors and leading farmers will be especially targeted and involved in developing and promoting ZT seeders in both Ninevah and Syria. This should facilitate widespread adoption of ZT sowing.

Dr Jack Desbiolles from The Agricultural Machinery Research and Design Centre (AMRDC), University of South Australia, in a consultancy through the University of Adelaide, will make an annual visit to ICARDA each year to participate in meetings; assist and advise on design, modification and evaluation of locally-made ZT seeders; and train manufacturers, researchers, contractors and farmers from Iraq and Syria in the development, use and maintenance of zero-till planters.

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 and bulking up seed of oats, peas and brassicas under the control of Dr C Piggin and Mr A Haddad. Better-performing lines will be multiplied for wider testing, including in Iraq.

Small quantities of seed of oats (35kg/line) and peas (2kg/line) are available for 2008-09 and will be sent to Iraq for evaluation and seed production in trials with small plots (10-20m^2) and 4 replicates in HRA at Alqush, and MRA at Bashyqa and Rashadiya Research Station under the control of Dr Abdulsattar Al Rajibo. Both crops should be sown at about 100kg/ha to ensure good establishment.

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 ± stubble treatments to monitor soil properties and crop performance, with stubble removal simulating grazing. These 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, under the leadership of Mr Jaffar Sedeeq Saeed and Dr Abdulsattar A Al-Rajibo, and with farmers near collaborating machinery manufacturers in Syria, under the leadership of Dr C. Piggin and Mr A. Haddad.

Experiment 3.1 Descriptions

Experiment 3.1.1 Long term Cropping Systems Experiment at Mosul University

Background.

It is highly likely that zero tillage will be adopted in northern Iraq and northern Syria as a response to the recent, steep rises in the cost of fuel for ploughing. The advantages of the system have been clear from a programme of demonstration plots and research trials that have been conducted in the ACIAR/AusAID/IRAQ/ICARDA research project. The grain yields for a range of crops and rainfall zones have been no less than those from conventional tillage and seeding methods. However, if farmers are to maximize their returns from the adoption of zero tillage they will need to understand any interactions, both positive and negative, that may occur in practice.

This proposal for a long term experiment aims to measure the possible interactions between zero tillage (ZT) sowing time (TS), fertilizer nitrogen (N) and stubble retention (SR) so that farmers can have some options for improving the productivity of the cereal/legume cropping systems.

Basal treatments

Basal fertilizer, most probably P, K and Zn, will be used across the experiment according to soil and/or tissue tests. Soil chemical tests (0-10cm and 10-40cm) will be conducted each year on all plots. If measurements show that the chosen site has soil compaction it will be deep ripped to disrupt the compact layer and gypsum added to assist re-formation of a new structure. The cereal crop used will depend on the rainfall zone: durum wheat, bread wheat or barley will be used. The rotation crop will also depend on the rainfall zone, either chickpea, lentil of faba bean. The rotation used will be cereal/legume for the duration of the experiment (at least 5 years). The cultivar chosen will be the best one each year for the relevant crop.

Weeds, insects, and diseases will be controlled across the whole experiment when required but only after their impact has been assessed by counting or scoring in all treatments.

Experimental design.

The experiment will be a 2^4 factorial with three replications (48 plots). Plots will be approx. 20m long and four metres wide (or a suitable size to fit double width of the available machinery). Double width plots will be used so that an extra treatment can be added if required in the second or subsequent years. The treatments will be laid out in a randomised block design. The area required will be approx. 80m x 70m, or a little over two donums.

The plots should be laid out in a randomised fashion in each of the three replications, leaving approx 5m between replicates for turning machinery and 5m at each end of the experiment for the same purpose.

Experimental Treatments

All combinations of the following:-

Tillage - Conventional (CT) Vs zero tillage (ZT)

Sowing time - Early (ES) Vs late sowing (LS) time. ‘ES’ will be at or close to the opening rains each season and LS will be 2-3 weeks after ‘ES’.

Nitrogen fertilizer- 30kgN/ha at sowing (LN) vs 90 kgN/ha (HN split into 30 kgN/ha at sowing plus 60 kgN/ha at stem elongation, when first node can be felt on the main stem of cereals). These rates are estimated for the MRA but if the experiment is sown in another

zone the rates can be adjusted. The nitrogen treatments will be applied in the legume phase but at lower levels.

Stubble retention (+S) Vs stubble removal (-S). Stubble from the –S treatments will be removed manually to a height of approximately 5-10cm before sowing each year.

The full factorial can be shown:-

Treatment Number	Tillage	Sowing time	Nitrogen	Stubble
1.	CT	LS	LN	-S
2.	ZT	LS	LN	-S
3.	CT	ES	LN	-S
4.	CT	LS	HN	-S
5.	CT	LS	LN	+S
6.	ZT	ES	LN	-S
7.	ZT	LS	HN	-S
8.	ZT	LS	LN	+S
9.	CT	ES	HN	-S
10.	CT	LS	HN	+S
11.	CT	ES	LN	+S
12.	CT	ES	HN	+S
13.	ZT	LS	HN	+S
14.	ZT	ES	LN	+S
15.	ZT	ES	HN	-S
16.	ZT	ES	HN	+S

Measurements

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, plant establishment, crop growth (aboveground-biomass and leaf-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.

Soil water – 0-20, 20-40, 40-60 cm depths sampled gravimetrically, one hole per plot. Samples taken at sowing, anthesis and maturity (weighed and dried at 105 C for 24 hours).

In addition to that described above the following will be measured:-

Early growth – biomass at approximately the end of tillering for cereals and at about 50-60 days after sowing for the legumes. Biomass should be collected by cutting all plants a ground level from 2 rows x 1m long in each plot. Samples should be dried at approx. 70^0C until crisp.

Anthesis dates - 50% anthesis or head emergence should be measured in the cereals on a representative 1m row in each plot.

Anthesis biomass should be taken as for early growth, above.

Grain yield should be measured on mechanically harvested samples from the inside rows of each plot.

Appropriate measures of grain quality should be taken such as grain protein%, % of small grain screenings, test weight (kg/hl) and 100-kernel weight in the cereals. Samples can be saved at harvest for this purpose. Grain size can be measured in the legume (100-seed weight).

Yield components - 2 x 1m rows should be sampled from each plot immediately before harvest. For the cereals the whole sample can be weighed, the number of spikes counted, the samples threshed, the grain weighed and the straw weight obtained by difference and grain numbers per spike and per m^2 can be calculated. For the legumes the same measures can be made but seed numbers calculated on a per plant basis.

Experiments 3.1.2 Evaluation of deep ripping to overcome hardpans

Four trials will be conducted in the following zones:

SI - Al Namroud using bread wheat Tell affer/3

HRA - Alqush using bread wheat Abo Gharaib/3

MRA - Telkief using bread wheat Cham/6

LRA – Tell Abta using barley Local black

Soil treatment/establishment - 3 levels.	Experimental design
Local Subsoiler + ZT Vibrating Subsoiler + ZT ZT	3*4rep=12 donum
Dr Saad Abdul Jabar Samir et al, Uni Mosul	

Experiments 3.1.3 Evaluation of alternative crop and forage rotations

High rainfall areas

Experiments	Crops	Cultivars	Experimental design
HRA Akqush Crop rotation- weed control Dr. Ahmed M Sultan et al, Uni Mosul	Nigella-wheat Wheat-wheat	Drought tolerant Nigella Abo Gharaib /3 wheat	4*5rep=4donum (500m^2per plot)
HRA AlShykan Mixed cropping Dr. Ahmed M Sultan et al, Uni Mosul	Flax Mixture Wheat	Drought tolerant cultivars	3*5rep=3donum (500m^2per plot)

Medium rainfall areas

Experiments	Crop/forage	Cultivars	Experimental design
MRA Al-Hamdania Mixed cropping Dr Abdul Sattar Al-Rijabo et al, , Uni Mosul	Safflower Mixture Barley	Safflower-drought tolerant early spiny cultivar Barley Rihan-3	3*5rep=3donum (500m^2per plot)
MRA Telkief Crop rotation- weed control Dr. Ahmed M Sultan et al, Uni Mosul	Nigella-wheat Wheat-wheat	Medical crop any drought tolerance cultivar-Wheat Karonia	4*5rep=4donum (500m^2per plot)
MRA Al-Hamdania Crop rotation- weed control Dr. Abbas M.Al-Hasan, et al, Uni Mosul	Medic-barley Barley-barley	M.rijidula or M.polymorpha Barley Rihan/3	4*5rep=4donum (500m^2per plot)
MRA Mosul Uni Evaluation of perennial forage grasses Dr. Abbas M.Al-Hasan, et al, Uni Mosul	Agropyron Phalaris Lolium Festuca Dactylis	Drought tolerant lines	Evaluation & seed production 100m^2 each
MRA Telkief Evaluation of Lathyrus sativus Dr .Kasim K. Kasim et al	Vicia sativa Lathyrus sativus	Drought tolerant lines	Evaluation & seed production 100m^2 each

Low rainfall areas

Experiments	Crops/forages	Species/cultivars	Experimental design
LRA Tel Abta Mixed cropping Dr Abdul Sattar Al-Rijabo et al, Uni Mosul	Safflower Mixture Barley	Safflower-drought tolerant early spiny cultivar Barley Zanbaka	3*5rep=3donum (500m^{2}per plot)
MRA Hatra **MRA Mosul Uni** Saltbush evaluation Dr. Abbas M.Al-Hasan, et al, Uni Mosul	Atriplex spp.	A. nummularia A.halimus A. canescens	3*4 rep = 300m^2 (25 m^2=per plot) 1 kg seed/species

Experiments 3.1.5 Evaluation of adding polymer gel crystals to the soil to enhance water availability

Four trials will be conducted in the following zones with the treatments listed below:

SI - Al Namroud using durum wheat Om Rabiaa/5

HRA - Alqush using durum wheat Cham 3

MRA - Telkief using durum wheat Karonia

LRA – Tell Abta using barley Zambaka

Fertilizer - 2 levels	Polymer gel - 3 levels	Experimental units
50 or 100% of lab test fertilizer recommendation	0, 5 or 10 kg / donum	2*3*4rep=24 donum
Dr Abdul Sattar Al-Rijabo et al, Uni Mosul		

Experiment 3.1.7 Evaluate the biological control of covered smut and root rot diseases in wheat

Experiment	Crop	Treatments	Expt design
HRA AlShykan Effect straw treatment and K on growth and infection with covered smut and root rot diseases Dr. Khalid H. Taha et al, Uni Mosul	Wheat	1.Straw treated with *Trichoderma harzianum* biocontrol spores 2. K fertilizer 40 kg/donum 3. Straw treatment plus K 4. Control	4*4rep=1600 m^2 (100m^{2}per plot)

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

The GIS activity will be provided by the GIS group at ICARDA (Drs De-Pauw, Goebel, Wu) and involve the GIS group in DOA Ninevah (Supervisor Mr Mahmod Ahmed Hasan Al Ardeny)

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.

The training timetable will be:

- Introduction to ArcGIS/advanced GIS extensions 2 weeks early 2009
- Introduction to Remote Sensing and image interpretation 2 weeks early 2009
- Land-resource mapping I (climate, soil properties) 2 weeks summer 2009
- Land-use/land-cover mapping 2 weeks summer 2009
- Land-resource II (LGP)/land-suitability /yield mapping 4 weeks spring 2010

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.

The timetable will be:

- Data collection: Autumn 2008 to summer 2009
    - Climatic data from Ninevah and adjacent governorates (daily rainfall, temperature, humidity, sunshine, wind 1961-current)
    - Soil maps, soil profile descriptions from Ninevah Governorate
    - Crop yield statistics of Niniveh Governorate
    - Base maps (borders, roads, settlements, water courses)
    - Purchase of the rational satellite images
- Mapping of climate resources (rainfall, temperature, PET, drought risk, LGP) Summer 2009 to spring 2010
- Digitizing of soil map/creation of land resources geodatabase Summer to autumn 2009
- Mapping land use/land cover from satellite images with field data Summer to autumn 2009 and 2010
- Collection of local knowledge on land suitability Winter 2009 and 2010
- Creation of crop requirement tables and mapping of land suitability for main field crops and new crops Spring to summer 2010

- Data availability permitting, mapping of actual and potential yield and production of main field crops Summer 2009 and 2010

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.

- Analysis of experiment data to create refined requirement tables for promoted technologies Summer 2010
- Effectiveness assessment of adoption of no-till technology from satellite images Autumn 2010
- Data availability and significant differences permitting: Autumn to winter 2010 and 2011
    - mapping of recommendation domains of promoted technologies
    - mapping of potential yield and production increases due to promoted technologies

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 in the beginning in year one will 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. This will be under the control of Dr R. Sommer and it is considered 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

The program to develop systems for breeder, basic, foundation and farmer seed in Ninevah will require coordination and contributions from the SBAR, Ninevah DOA, State Board for Seed Production, Project Coordinator, Project Leader and Heads of involved institutions. From ICARDA, it will require contributions from Project Leader, Seed Section, Plant Breeders, Seed Health Laboratory and Purchasing and Supply.

Responsible scientists will be Drs Zewdie Bishaw, Abdoul Aziz Niane, Koffi Amegbeto in ICARDA and Mr Jaffar Sedeeq Saeed, Dr Abdulsattar A Al-Rajibo and Dr Kasim Kasim in Iraq. Both Iraq and ICARDA will need to nominate a technical leader for Objective 5.

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 requested/appropriate 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 of existing breeder and basic seed production procedures and facilities (equipment, storage) at ARC-Rabiaa

Appropriate procedures and facilities (equipment, storage) developed/acquired for breeder and basic seed production 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.

This objective will be implemented under the direction of Dr Sa'ad H. Mohamed, Head SBAR Economics Department, Mr. Watheq Abdul Kahar Al-Rawi, Researcher SBAR and Dr. Emad Yousif Ismael Abdullah, Assistant Professor, Economics, University of Mosul, in Iraq and Drs K. Shideed and K. Amegbeto in ICARDA. 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 CO_2 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 or Dr Ross Kingwell, 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

For the training program, candidates will be nominated by the Project Coordinator Dr Saleh Bader and Project Leader Dr Abdul Sattar Al-Rajibo, after consultation amongst SBAR, DOA and UniMosul collaborators. Candidates will be selected jointly by all project partners. Iraq partners will facilitate travel and ICARDA and Australian collaborators will make arrangements for training.

Activity 7.1: Develop and agree on program of training:

The program of training was discussed at the September 2008 planning meeting. Possible topics which can be provided by Australia and ICARDA are listed below. It was agreed that MOA, ICARDA and Australian partners would 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 (25 Iraqi staff per year).

Agreed action

- Some specific areas have been identified. Additional topics may be added
- The nature of training will vary from individual to group training

- Responsibility: Project Coordinator Iraq (Dr Bader) will provide names of potential candidates (in consultation MOA, DOA and MU) to Dr Piggin. ICARDA and Iraq institutions will jointly make arrangements and ICARDA will implement courses through relevant scientists and the training unit.
- Time Frame: 7th November 2008 for the first batch of trainees

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.

Agreed action:

- The workshop duration will be one week - prior to or immediately after the annual planning meeting at ICARDA. However there is some flexibility to this
- Up to 30 participants will attend the workshop
- The workshop theme should closely match the project objectives and needs
- Attention must be given to involve relevant participants at the workshop
- Time Frame: Details of the workshop and participants to be finalized by 30th June each year of the project
- Responsibility: Drs Piggin and Bader in consultation project team as required

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

Study visits

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. They will produce a written report at the completion of their training period.

Australian partners provided a list of potential topics at the September 2008 planning meeting:

1. Tillage machinery utilisation and development (4 people for 3 weeks)
2. Long-term experiment management/ permanent field day site management (design, key measurements, sample handling)
3. Nutrition (K, Zn, micronutrients)
4. Socio-economics
5. Group management/ participative approaches (survey based approaches, Analysis of socio-economic data)
6. Variety evaluation/basic agronomy
7. GIS (salinity, Murray catchment/river management)
8. Broomrape (Orobanche) control
9. Agricultural engineering design (ZT seeders)

Agreed action:

- Instead of one full six month training, it was agreed that a short and focused visit by a group of relevant staff from Iraq to Australia on a specific topic will be considered (e.g. No Tillage Technology machinery development and adoption)

- Iraqi team to identify potential first batch of candidates and provide their CVs to Dr Piggin. Guidelines provided in the project document will be followed
- Time Frame: 7th December 2008
- Responsibility: Dr Bader

Post-graduate degree training

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.

Australian partners provided the following list of potential topics for postgraduate training to Iraqi Project coordinator at the September 2008 planning meeting:

1. Carbon dynamics (stubble retention/grazing; use of soil models)

2. Weed ecology (weed competition in ZT systems)

3. Barley germplasm characterisation of photoperiod, vernalisation genes at molecular level (GxE in standard breeding program; GxE with molecular understanding)

4. Agronomy/physiology studies with different levels of stubble retention (genotype influence on seedling mortality; heat stress at anthesis and maturity; seeding rate, depth of seeding, row spacing effects)

5. Machinery aspects of ZT cropping systems (optimising seed-furrow environment; water harvesting (press wheels etc.); management of hardpans)

6. Long-term site, conservation cropping (agronomy type project)

7. Plant density issues in newly established ZT systems (soil seed contact; soil water relations; relations between soil moisture and compaction)

8. Genotype X Management study – wheat from different areas and eras (barley cvs from Iraq region)

9. Socio-economics on no-till systems (Iraq data)

10. Ascochyta resistance in chickpea (breeding and molecular technology using wild genes)

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.

Agreed action:

- Iraqi team to identify potential candidates and provide their CVs to Dr Piggin. Guidelines provided in the project document will be followed
- Time Frame: 7th December 2008

- Responsibility- Dr Bader)

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.

Agreed action:

- In addition to the guidelines mentioned in the project document potential participants must present a paper or poster at relevant conference/workshop.
- Additional support for attending the conference/workshop should be sought from elsewhere
- Identify potential conferences and workshops relevant to the project activities and communicate to Drs Piggin and Bader (by all project members)
- Participation at the "4th Conservation Agriculture World Congress" in New Delhi (4 - 7 February 2009) was discussed. Relevant project team members to express their interest to Drs Piggin and Bader. (Time Frame: 15th October 2008)

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 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 field work and visits/days to proceed	Improved varieties are adopted by participating farmers

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	Recommendation s for wider dissemination

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

5.5 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