



Australian Government

**Australian Centre for
International Agricultural Research**

Annual report

project

Development of conservation cropping systems in the drylands of northern Iraq

project number

CIM/2008/027

period of report

1 July 2012 – 31 May 2013

date due

31 May 2013

date submitted

May 2013

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1 Progress summary

The project leader for the third phase of the project joined ICARDA in July 2012, and a project instigation meeting was conducted in Amman where the previous progress was reviewed, objectives discussed, and a comprehensive work plan developed.

In the autumn of 2012, 29 zero-tillage (ZT) demonstrations were established in farmer fields throughout the Ninevah governorate in Iraq, and for the first time two or three demonstrations were sown in Kirkuk, Salahaddin and Anbar. Three major spring field days were held at Singar, Alqush and Telkief, which were attended by a total of 100 farmers and 50 staff – other smaller field walks were also conducted at other demonstration sites. A brief inventory of farmers in Ninevah indicated the area of conservation cropping continues to grow from 7,800ha last season to 10,800ha in 2012/13. In May, 25 new extensionists were appointed by the Ministry of Agriculture in Ninevah who will specialise on working with farmers to promote conservation cropping. While it was not possible to contact all conservation cropping farmer groups established in Syria during the previous phase of the project, many are continuing to operate despite the civil unrest. Fuel shortages restricted farming operations. However, this is proving to be a driver of adoption. In one case, a farmer stated that he was able to sow four times the area of crop with his ZT seeder compared to conventional methods requiring plowing because of a limited supply of fuel.

In Ninevah, various field experiments on weed management, row spacing, seed rate, variety improvement and other crop management factors were instigated by the University of Mosul and State Board of Agricultural Research (SBAR). Due to deteriorating conditions within Syria, there was restricted access to ICARDA's long term field experiments near Aleppo, but tillage treatments were completed by the beginning of November. Sowing with a cover crop was only possible in February, but the integrity of the experiments remains intact. To substitute for experiments and training which could not be conducted in Syria, project staff was able to travel safely to Erbil in the Iraq Kurdistan Region (IKR) on numerous occasions, where they established links with the Ministry of Agriculture and Water Resources. Subsequently, four new experiments were established at the Ankawa Research Centre in Erbil where seasonal conditions were favourable and good yields are expected. Successful training courses were also conducted in Erbil on ZT seeder calibration and operation (18 trainees) and data management and statistical analysis in Amman (11 trainees). Three new experiments were also established at Maru Research Station in Jordan, however, yields are expected to be low despite good rainfall due to a number of management issues. Research staff at the University of Western Australia and the University of Adelaide were appointed in early 2013 and field experimental activities in Australia have commenced.

Considerable progress was made in the development of locally-manufactured ZT seeders. In Mosul a group of innovative farmers/manufacturers completed a prototype 2m ZT seeder, and this was tested in the field by machinery experts at the University of Mosul and later in Erbil. The manufacture of 8-12 improved ZT seeders is currently underway and parts have been ordered to convert 20 existing conventional seeders to ZT for the coming season in Iraq. In Amman, the project team worked with Rama Manufacturing to complete its first prototype 4m ZT seeder, which was tested at Maru Research Station where it proved to be as effective as other more expensive imported seeders. Rama is currently working on the manufacture of a 2m prototype ZT seeder before starting a commercial production run.

For the first time in Iraq, ministerial approval was granted for the multiplication of pioneer seed by private farmers, and elite lines of wheat and barley were included in demonstrations of ZT sowing. The compilation of previous socio economic and biological data and a literature review of survey methodology and analysis are almost complete. A new farmer household survey has been formulated to act as a baseline in the new Iraqi

governorates and to monitor adoption in Ninevah, which will be implemented in September 2013.

Opportunistic training was also conducted by project staff in Jordan and Erbil, and the project contributed to ICARDA/JICA training in Erbil on conservation agriculture. Most of the six Iraqi students studying at the University of Western Australia and the University of Adelaide have completed their English training and have commenced their postgraduate courses.

In summary, the project is progressing well, despite ongoing civil unrest in Syria and Iraq, and most planned outputs and outcomes have been achieved following the relocation of ICARDA staff from Syria to Jordan and other regional offices. Following the establishment of good relationships and establishment of field experiments and training in Erbil, the project plans to expand these activities at this location during 2013/14.

2 Achievements

2.1 Achievements against project activities and outputs/milestones

The project leader for the third phase of the project - Dr Stephen Loss - commenced work with ICARDA in Amman in July 2012. A successful project instigation meeting was conducted in Amman during September 9-13 followed by the project steering committee meeting. The meeting was attended by the Australian Ambassador to Jordan, a representative from the Iraqi consulate, 32 Iraqi collaborators from all four governorates, Australian collaborators and ICARDA staff, plus Dr Eric Huttner and Dr Colin Piggan from ACIAR. During the meeting previous progress on research, extension and training was reviewed, objectives of the third phase were discussed and a comprehensive work plan was developed.

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

During late summer/early autumn, conservation cropping workshops were conducted by University of Mosul staff to raise awareness and knowledge in each of the new governorates. Twenty-nine ZT demonstrations were established in farmers' fields throughout the Ninevah governorate, and for the first time two or three demonstrations were sown in each of Kirkuk, Salahaddin and Anbar. Seasonal conditions have been favourable and fields sown with ZT seeders looked as good as or better than conventional tilled fields. Harvest is currently underway in most areas. Three major field days were conducted in March and April at Singar (35 farmers plus 20 staff from University of Mosul, Department of Agriculture and SBAR), Alqush (32 farmers and 15 staff), and Telkief (33 farmers and 18 staff). Other smaller field walks were also conducted at demonstration sites.

An inventory of farmers in Ninevah and other governorates indicated the area of ZT continued to grow from 7,800ha last season to 10,800ha in 2012/13, a 38% increase (Figure 1). The demonstration areas in the other new governorates are about 93ha. It was not possible to contact all conservation cropping farmer groups established in Syria during the previous phase of the project, but many are continuing to operate despite the civil unrest. Fuel shortages restricted farming operations, however this is proving to be a driver of ZT adoption in some areas. In one case, Mr Ali Alewi from Kamishley stated he was able to sow four times the area of crop by eliminating plowing and using a ZT seeder, compared to conventional methods. It is difficult to get accurate adoption figures out of Syria but various estimates suggested that 550-1,000 farmers are using ZT on 30,000-50,000ha, which is a great increase on 2011/12 when 537 farmers were known to be using ZT on 20,574ha (652 fields). It is hoped to clarify Syrian figures if the security situation improves during 2013/14.

The first 2m ZT seeder manufactured in Mosul was completed and tested in December 2012, and further improvements and modifications are required. There are plans to manufacture 8-10 seeders and convert another 20 existing seeders for the coming season – the required tines, points and presswheels have been ordered. In Syria, it was not possible to contact all eight manufacturers of ZT seeders, but difficulties with the supply of materials, parts and electricity, and transport have slowed down production. At least five seeders were made and sold. In late 2012, the Syrian Minister for Agriculture announced funding for 50 ZT seeders to support the expansion of conservation cropping technology, which is an indication of government support.

Figure 1: Area and numbers of farmers adopting ZT technology in Iraq and Syria since the project commenced. Accurate figures were not available for Syria for 2012/13.

No.	Activity	Outputs/ Milestones	Completion date	Comments
1.1	Demonstrate and promote uptake of ZT cropping widely in Ninevah districts.	<p>1.11 ZT interest groups: - 10 new districts, 12 existing districts, field days conducted.</p> <p>1.12 Demos established in 10 new districts, information extended.</p> <p>1.13 Verification trials conducted on ZT technologies in existing districts & information available to new growers</p>	<p>Jul 2013/14/15</p> <p>Jul 2013/14/15</p> <p>Jul 2013/14/15</p>	<p>Total of 29 demonstrations conducted in Ninevah including new and existing districts. Some sites include replication (Obj 2) and demonstration of new varieties (Obj 3).</p> <p>Most sites had field days.</p> <p>Trials to be harvested in June/July and results extended.</p>
1.2	Develop awareness and experience and encourage evaluation and uptake of ZT cropping in surrounding governorates.	<p>1.21 Establish linkages and working relationship with active stakeholders especially farmers.</p> <p>1.22 Study tour of active stakeholders to Ninevah and ICARDA (Jordan/Erbil).</p> <p>1.23 Establish 2 ZT interest groups in each governorate.</p> <p>1.24 Establish ZT demos in the 3 governorates - each with 2 districts in Yr 1 & 4 districts in Yr2 & 3.</p> <p>1.25 Field walks and field days conducted with interest groups.</p>	<p>Jul 2013/14/15</p> <p>Jul 2013/14/15</p> <p>Jul 2013/14/15</p> <p>Jul 2013/14/15</p> <p>Jul 2013/14/15</p>	<p>Good progress in all three new governorates and all milestones achieved in 2012/13.</p>

1.3	Facilitate farmer access to locally fabricated or modified ZT seeders for testing and evaluation in Iraq and Syria.	1.31 Increased availability of ZT machinery to all interest groups through technical and financial support for ZT modification of conventional seeders and fabrication of ZT seeders.	Jul 2013/14/15	Prototype ZT seeder completed in Mosul – see 2.21 for more details. There are plans to manufacture 8-10 ZT seeders in Mosul for the coming season. Parts have been ordered for seeder conversions (about 20) in Iraq. Syrian manufacturers have been adversely affected by civil unrest.
		1.32 Increased local and regional expertise and capacity to manufacture ZT machinery.	Jul 2013/14/15	
		1.33 Wide testing, uptake and adoption of ZT by farmers	Jul 2013/14/15	

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

In Ninevah, various studies on the response of grass weeds to Treflan herbicide application, row spacing and seed rates of wheat, and the effects of Topic herbicide in wheat crops were conducted at the University of Mosul and SBAR. Staff from the University of Mosul and SBAR also surveyed ZT demonstration sites for weeds, diseases and insect pests. Due to deteriorating security conditions within Syria, there was limited access to the long term field experiments at ICARDA's Headquarters near Aleppo. Nonetheless, through exceptional efforts of Syrian village-based staff, it was possible to impose the tillage-based treatments by the beginning of November, but sowing with a cover crop was only possible in February. So the integrity of the experiments remains basically intact. Crop growth in mid-May was reportedly good.

To substitute for experiments and training which could not be conducted in Syria, project staff was able to travel safely to Erbil in the Iraqi Kurdistan Region on numerous occasions, where they established links with the Ministry of Agriculture and Water Resources. Subsequently, four new field experiments were established at the Ankawa Research Centre in Erbil, where seasonal conditions were favourable and good yields are expected. In January, the site was visited by the Australian ambassador to Iraq, H.E. Lyndall Sachs and Mr Paul Roche from AusAID. Dr Eric Huttner and Dr Colin Piggan from ACIAR also visited the site in May, when a small farmer field day was conducted before harvest, attended by 15 farmers and about 12 staff from the Ministry of Agriculture and Water Resources. Three new field experiments were also established at Maru Research Station in Jordan, however, despite good rainfall yields are expected to be low due to a number of management issues such as weed and insect control.

With the inclusion of research programs in Australian institutions in the third phase of the project, researchers at the University of Western Australia (Cara Allen) and the University of Adelaide (Yo Zhou) were appointed in early 2013. Work plans were developed, and field activities for the 2013 season commenced in May.

Considerable progress was made in the development of locally manufactured ZT seeders. Two machinery counterparts from the University of Mosul (Mr. Hisham and Mr. Mahmoud) and one from the Mosul group of innovative farmers (Mr. Waad) were appointed. Mr. Mahmoud is leaving to start a PhD in Australia under an Iraqi scholarship and was recently replaced by Mr Nawaf Jassim Mohammed also from the University of Mosul. Several meetings and training courses were held for the counterparts in Erbil where a 2.4m John Shearer pasture seeder was converted to ZT including press wheels made in Mosul and tested in November 2013. This was used to sow field trials at Ankawa. In Mosul the group of innovative farmers and manufacturers completed their first prototype ZT seeder in December 2012, and this was tested in the field by machinery experts at the University of Mosul in January and later in Erbil. Several improvements are now being implemented and the manufacture of 8-12 seeders is underway for project activities. In

Amman, the project worked with Rama Manufacturing to complete a prototype 4m ZT seeder including presswheels, the first of its kind for Jordan. This seeder was tested at Maru and used for sowing many of the experimental plots where it proved to be as effective as other imported ZT seeders. Rama is currently working on design and manufacture of 2m prototype ZT seeders, which will be used in Jordan, Iraq and elsewhere for experimental and demonstration purposes. Rama have considerable capacity to manufacture large numbers of ZT seeders should demand increase rapidly. In Syria, it was not possible to contact all eight manufacturers of ZT seeders, but many have experienced difficulties with the supply of materials, parts and electricity, and transport, and hence production slowed down. Nonetheless, some manufacturers continue to improve seeder design and manufacture, sometimes using higher quality parts from Turkey.

No.	Activity	Outputs/ milestones	Completion date	Comments
2.1	Investigate, verify and adapt conservation cropping technologies including agronomic practices, rotations, residues, crop-livestock interaction, pest-disease-weed dynamics and control, soil fertility-structure-biology dynamics and management and germplasm adaptation.	2.11 Agronomic CA research trials conducted at 12 existing demonstration sites in Ninevah <ul style="list-style-type: none"> • One long term trial site including +/- tillage & +/- stubble established and maintained for 3-5 yrs. • One IPM trial site in each of H, M, LRA including cereals and legumes with supplemental irrigation treatments. • Post-graduate survey/studies of crop establishment, growth, yield weeds, diseases & pests in trials and demonstrations (Obj 1). • Continuation of “replicated demo” sites (Obj 1). • Advice on CC practices provided by Uni Mosul • Other governorates may be included in later years. 	Jul 2013/14/15	Trials established according to plans and will be harvested in June/July. Results will be summarised and findings extended.
		2.12 Evaluation of germplasm to support release of improved varieties for conservation cropping systems in Ninevah <ul style="list-style-type: none"> • On-going evaluation of germplasm under CC practices at many sites. • At least one elite line of wheat, barley, lentil, chickpea and oat nominated to the Variety Release Committee for release and certification (2015). • Foundation seed provided for seed production (Obj 3), extension, & adoption (Obj 1). • Other governorates may be included in later years. 	Jul 2013/14/15	Trials established according to plans and will be harvested in June/July. Results will be summarised and extended.

	<p>2.13 Establishment of conservation cropping trials at Erbil</p> <ul style="list-style-type: none"> • SL & team members visit and evaluate potential • Establish an experiment including tillage x TOS x seed rate, and demonstration blocks of zero & conventional tillage. • Expand trials to facilitate more detailed research questions including more intensive soil, weed and disease measurements eg. tillage x disease x variety . • These sites will be used for training (Obj. 5). 	<p>Oct 2012</p> <p>Nov/Dec 2012</p> <p>2014/15</p> <p>2013-15</p>	<p>Four trials established according to plans (although no demo blocks) and will be harvested in June/July.</p> <p>Trials have been used for training and field day purposes.</p> <p>Results will be summarised and extended.</p>
	<p>2.14 Iraqi agronomist visits to Erbil for conservation cropping agronomy research training</p> <ul style="list-style-type: none"> • Four Iraqis visit for 1 month during seeding and spring for on-the-job training in ZT research and CC management (Obj 5). • These will become ZT agronomy 'champions' and pass on expertise gained to others in Iraq (Obj 1). 	<p>Jul 2013</p> <p>2014/15</p>	<p>This was not conducted in 2012/13 while the trials were established for the first time, however staff at Ankawa Research Centre (Erbil) have benefited from agronomy trial experience.</p>
	<p>2.15 Establishment of conservation cropping research trials near Irbid, Jordan</p> <ul style="list-style-type: none"> • Establish an experiment including tillage x TOS & disease. 	<p>Nov/Dec 2012</p>	<p>Three trials established according to plans and will be harvested in June/July. Results will be summarised and extended.</p>
	<p>2.16 Continuation of long term conservation cropping trials at Tel Hadya, Syria</p> <ul style="list-style-type: none"> • Continue long-term sites including tillage, TOS, rotations, residue and seed rate treatments. • May involve seeding & harvest in 2012/13 depending upon situation in Syria. • More intensive measurements and trials may be possible if Syrian situation improves. 	<p>Jul 2013/14/15</p> <p>2013-15</p>	<p>Tillage treatments were conducted in October 2012, then access was denied due to Syrian civil unrest. Sites were planted with a cover crop in Feb 2013 to maintain trial integrity, and harvest is expected in June</p>
	<p>2.17 Investigation of grazing effects on weed, disease and pests in conservation cropping systems in Western Australia</p> <ul style="list-style-type: none"> • Appoint Research Associate • Use existing long term trials and new trials to determine effects of crop residues on weeds, diseases and pests, and impacts of livestock grazing on soil fertility, soil moisture and farm profitability 	<p>2013/14/15</p>	<p>Research associate appointed and plans for field work completed and commenced.</p>

		<p>2.18 Investigation of soil biology and fertility in conservation cropping systems in South Australia</p> <ul style="list-style-type: none"> • Appointment of post-doctoral researcher • Conduct surveys of long-term ZT fields in south-east Australia, Iraq (& Syria) to provide understand key soil biology processes. • Use existing CC sites to investigate N and C cycling, soil moisture retention, and soil biology. 	2013/14/15	Post-doctoral researcher appointed and plans for field work completed and commenced.
		<p>2.19 Research results used to evaluate and improve conservation cropping systems at all locations</p> <ul style="list-style-type: none"> • Outputs from 2.11-2.18 reviewed at annual meetings to evaluate and modify approaches and select appropriate technologies to improve CC systems in all locations. • Produce technical and scientific papers - all drafts to be approved by SL for quality control and documentation before submission/ publishing. 	2013/14/15	Four conference papers produced – see publications.
2.2	Fabricate, modify, evaluate and improve locally-made ZT seeders in conjunction with manufacturers and farmers	<p>2.21 Machinery study visits undertaken from Ninevah to South Australia</p> <ul style="list-style-type: none"> • Select two machinery experts (young research engineers) as in-country leaders that meet criteria supplied by JD. • Annual study visits (3 wks) to Uni SA to coincide with seeding time to provide practical knowledge of ZT seeders (Obj 5). 	Jul 2013/14/15	<p>Mosul farmer/manufacturers completed first prototype in Dec 2012, which was tested by Uni of Mosul in Jan 2013. Further improvements are to be conducted.</p> <p>Counterparts appointed - one is leaving to start PhD in Australia and has been replaced.</p> <p>Australian study visit planned for late July 2013.</p>

		<p>2.22 Evaluation and improvement of ZT seeders in Iraq, Syria, Jordan and South Australia</p> <ul style="list-style-type: none"> • On-going field and lab evaluations of seeder performance and durability with informal feedback from extension staff, farmers, et al. at annual meeting and between meetings. • Seeder performance discussed informally during year and key improvements prioritised at annual meetings. • Formal evaluations of seeder improvements during Uni studies (post grads) and training courses involving key manufacturer/ farmer groups (Obj 5). • Feedback on improvements to manufacturers and farmers. 		<p>Rama 4m prototype (Jordan) completed and tested.</p> <p>John Shearer 2.4m pasture seeder converted to ZT including presswheels made in Mosul and tested in Erbil in Nov 2013.</p> <p>Mosul 2m prototype (Iraq) completed and tested – further improvements underway.</p> <p>Meetings held with counterparts/ farmers/Uni Mosul/ICARDA/JD in Nov 2012 and Mar 2013 in Erbil.</p>
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Objective 3: Develop and promote efficient and sustainable farmer-based seed production and supply systems.

Variety maintenance activities by the SBAR were undertaken as planned, and at the time of writing this report harvest was about to commence. the University of Mosul and SBAR planted foundation seed of bread and durum wheats, barley, oats, field pea and vetch, and large quantities of the wheat varieties Douma 1 and Cham 8 were included in ZT demonstration and seed production demonstrations. For the first time in Iraq, Ministerial approval was granted for private seed production and several pioneer seed producer farmers multiplied seed sometimes under irrigation. Four pioneer farmers were provided with a total of 400kg of nucleus seed of bread and durum wheat for quality seed production and marketing in conjunction with SBAR and University of Mosul. It is hoped these will form the basis for the village-based seed enterprises (VBSE) in 2013/14.

No.	Activity	Outputs/ milestones	Completion date	Comments
3.1	Provide promising new crop varieties/lines from ICARDA in Iraq for research, extension and seed production.	<p>3.11 Foundation seed of elite lines/ varieties of wheat, barley, oats, chickpea, lentil, field pea, safflower, vetch, Lathyrus supplied (10–100 kg)</p> <ul style="list-style-type: none"> • Iraqis to look at what is available for purification by SBAR and MU and further multiplication by VBSEs • 5 kg of what is available at ICARDA with preliminary description for variety registration purposes • Establish a back-up site for multiplication out of Iraq. Cost to be covered from the project to undertake the above activity by ICARDA in (Jordan/ Turkey/Erbil) • Provision of 100 MT of quality seed for new VBSEs to start with 	July 2013	<p>No requests for additional seed were made by SBAR.</p> <p>Variety maintenance and foundation seed production of 4 improved wheat and 2 barley varieties from the previous project phases were carried out at Rabia station (Ninevah) by SBAR.</p> <p>Pioneer farmers were provided with quality seed for demonstration and seed production and marketing.</p>

3.2	Develop a functional seed unit within the agricultural research system at Rashidiya RS and Mosul University to provide seed for research, demonstration and further multiplication.	3.21 Identification and supply of small equipment needs for two seed units <ul style="list-style-type: none"> list of equipment prepared according the project document by SBAR and Mosul Uni staff with possibilities of some modification. ICARDA can advise if needed. Equipment purchased and supplied to seed units 	July 2013	List of equipment and specifications for variety maintenance and quality seed production by VBS were provided in April 2013. Orders are currently being finalised.
		3.22 Provision of training on breeder and foundation seed production at ICARDA (Obj 5) <ul style="list-style-type: none"> Nomination of participants to be completed. An additional resource person may be required to assist in the training. 1-2 weeks course on breeder and foundation seed production in Jordan/Turkey for up to 25 participants. 	24 June to 4 July 2013	A course on variety identification and maintenance is planned to be held in Ankara.
		3.23 Provision of sufficient seed of germplasm and varieties for trials and demos in Ninevah and adjacent provinces <ul style="list-style-type: none"> Special nurseries of interest to SBAR and MU can be requested through the IN program coordinator Available seed from previously supplied germplasm to be provided by SBAR and University of Mosul 	November 2012	Pioneer farmers planted quality seed for demonstration and seed production in the target project areas in by SBAR and UoM.
3.3	Develop sustainable farmer/village-based seed production systems	3.31 Consolidation of existing individual seed producers (18) involved in local seed production and marketing under provincial seed producers association <ul style="list-style-type: none"> select/confirm VBSE program coordinator (VPC) establish VBSE coordination committee representatives of SBAR, Ninevah Agriculture directorate, SBSTC, Mosul Uni., Extension , pioneer famers and entrepreneurs identification of common issues such as technical (production, equipment, storage) and business operation (planning, management, marketing, etc) for improvement (Mosul Uni and SBSTC) contact, motivate and empower potential VBSE members to start seed business organize farmers consensus meetings to establish VBSEs provision of seed of best bet varieties, input equipment and basic training on technical and managerial aspects for farmer groups formal registration and establishment of linkages with relevant research, seed, extension and credit facilities provide advice on business planning, book keeping and seed marketing issues 	November 2012	Four pioneer farmers were provided with 400kg nucleus seed in total for quality seed production and marketing in conjunction with SBAR and UoM VBSE program coordinator will be appointed soon and other activities will start in October 2013.

		3.32 Establishment of three additional seed production and marketing networks in the new governorates <ul style="list-style-type: none"> • based on needs assessment and linked to the Nineveh network 	2013/14	To be implemented next season
		3.33 Training undertaken for farmers, extension services and other stakeholders (see Obj 5) <ul style="list-style-type: none"> • organize one week train-the-trainers course on technical and managerial aspects for seed and extension officers on informal seed production and marketing for 10-12 participants (Jordan/Turkey/Erbil) 	13 to 24 October 2013	Training course planned
		3.34 Monitoring and evaluation of technical and economic performance of VBSEs <ul style="list-style-type: none"> • seed demand survey, business plans, profitability assessment) completed and used to improve performance (Obj 4) 	August 2013	These studies are linked to the socio-economic household survey for which the questionnaire development is at the final stages.

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

Good progress was made in the socio-economic activities, however there was some initial uncertainty about who was leading the Iraqi activities until February 2013 when Dr Saad Hatem was clarified as the on-going leader. The compilation of previous data and a literature review of survey methodology and analysis are almost complete. A comprehensive farmer household survey has been formulated to act as a baseline in the new governorates and to monitor adoption in Ninevah, which will be implemented in September 2013. These data (and data from other projects) will also be used to build a bio-economic farm simulation model to explore the drivers of adoption of the various components of conservation agriculture and optimum farmer practice.

No.	Activity	Outputs/ Milestones	Completion date	Comments
4.1	Analyse improved technology option performance, profitability, WUE, and acceptance by farmers.	4.11 Farm level analysis of the effects of ZT technology on (a) benefit & costs and (b) production and resource use efficiency <ul style="list-style-type: none"> • modification of data collection formats for the demo farms • compilation of available datasets (surveys, demos and long term trials in both Iraq and Syria - including irrigation water measurement) • literature review on CA technology evaluations • develop methods • theory (economic, environmental, livestock, input and resource use-efficiency) • data analysis • publications - drafts approved by SL for quality control and documentation before submission/ publishing • policy brief 	Sep 2013 Dec 2012 Jan 2013 Jan 2014 Dec 2014 Feb 2014 Dec 2014 Feb 2014	Delayed due to confusion in Iraqi component leadership (now clarified) but near complete.

4.2	Assess effectiveness of improved management options on adaptive capacity of local communities to climatic variability.	4.21 Better understanding of conservation cropping effects on farmers' resilience to risks <ul style="list-style-type: none"> • compilation of data • explore using crop simulation models for generating data for different states of nature • literature review • theory and methods • collection of missing data • data analysis • publications • policy briefs 	June 2014 Sept 2014 Oct 2014 Nov 2014 Dec 2014 Mar 2015 Mar 2015	All previous data collected except the long term trial data which will be made available up on request for data on specific variables. This will be done when the building of a bio-economic model is started.
4.3	Monitor adoption of improved technologies and identify constraints and provide possible solutions	4.31 Understanding and documentation of diffusion of ZT technology & farmers' perceptions <ul style="list-style-type: none"> • literature review (theory and methods) • data to be collected in 4.1 & 4.2 for Syria • data collection for Iraq • analysis to determine adoption drivers and constraints and provide recommendations and solutions 	Oct 2013 Dec 2012 Sep 2013 Dec 2014	Literature review largely completed Data analysis has started with the adoption and impact of CA in Syria
4.4	Assess the impacts of conservation cropping.	4.41 Understanding, quantification and documentation of economic impacts of ZT technology <ul style="list-style-type: none"> • use data from 4.1-4.3 for analysis 	2015	These activities are scheduled for year 3 as we need data from both the baseline and end of project surveys.
4.5	Identify enabling policy and institutional options	4.5 Policies and strategies for the promotion of ZT technologies developed and communicated to policy-decision makers <ul style="list-style-type: none"> • document current agricultural policies • analyze their effect on CA • policy recommendations to enhance adoption of the CA technologies • publications 	2014 and 2015	
4.6	Evaluate and promote sustainability of and lessons learned from conservation cropping projects in Iraq (and Syria)	4.6 Conduct socio-economic training <ul style="list-style-type: none"> • socio-economic data collection: 25 persons from DoA and 2 persons from new provinces for 5d • socio-economic evaluations for 10 persons for 14d each year • hands-on training for 1 researcher for 6 mths in Australia 	Sep 2013 Years 2 & 3 Years 2 & 3	
4.7	Analyze economics of seed and machinery production in Iraq and Syria	4.7 Analyze the economics, market and marketing conditions of seed/machinery production <ul style="list-style-type: none"> • Review demand for seed and seed producers businesses • Review machinery manufacturer businesses • Feed key outcomes back to Obj 1 and 3. 	Years 2 and 3	

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

The capacity development program progressed mostly according to plan. Conservation cropping workshops led by the University of Mosul were conducted in late summer 2012 in Kirkuk, Salahadin and Anbar. Following the establishment of demonstration sites in Ninevah and the other governorates including ZT, crop rotation and new improved crop varieties, various major and minor farmer field days were conducted at each site (see objective 1). There was good media coverage of the major field days. In May, 25 new extensionists were appointed by the Ministry of Agriculture in Ninevah who will specialise in working with farmers to promote conservation cropping. Immediately after receiving the Ministerial approval for their appointment an intensive training course was conducted for these specialists at the University of Mosul.

Two successful training courses for Iraqi project collaborators were conducted on ZT seeder calibration and operation in Erbil (16 trainees) led by Dr Jacky Desbiolles from University of South Australia, and data management and statistical analysis in Amman (11 trainees) led by Dr Jens Berger from CSIRO. Lists of trainees are presented under 4 Training Activities. An opportunistic one day course was conducted in Erbil in November 2012 on ZT seeder conversion and performance assessment by Dr Jacky Desbiolles, and Dr Stephen Loss and Dr Colin Pigginn also contributed to one day of training on conservation agriculture for staff from the National Centre for Agricultural Research and Extension in Amman Jordan in May 2013. As part of the project training plan, two other courses on seed variety maintenance and science writing and communication are also organised for June. Various project staff also contributed to a training course on zero-tillage and crop rotation conducted in Erbil in March organised by ICARDA and the Japanese International Co-operation Agency (16 trainees). Training courses on participatory extension, socio-economic evaluation and agronomy field experimentation were reprogrammed to more appropriate times later in 2013.

The six Iraqi post-grads in Australia are all doing Master's degrees, which involve course work for 18 months and a research project for six months. All students have passed required English levels, are nearing completion of course work, and are starting their research projects. Student details and expected finish dates are as follows:

1. Mahmoud Ahmed Hassan Al Ardeny: GIS/RS: MSc, Curtin University through UWA (June 14)
2. Ayman Taher Mohsen Al Hobaity: MSc, agronomy - UWA (Dec 13)
3. Araz Sedqi Abdullah: MSc, agronomy - UWA (Dec 14)
4. Mahdi Salih Kheder: M Global Food & Agribusiness, socio-economics – Uni Adelaide(Dec 14)
5. Alaa Fakher Kadham Al-Hameedawi: M Plant Biotech, breeding – Uni Adelaide (Dec 14)
6. Jamal Abdufattah Yousuf : M Plant Biotech, faba bean breeding – Uni Adelaide (Dec 14)

All commenced January 2011 except Araz who commenced April 2012.

The Australian post graduate program has had some difficulties which put considerable pressure on University partners, related to the very low capacities and experience in English and in research of all Iraqi students. Experience to date emphasizes the importance and desirability of adhering strictly to agreed student selection criteria. The persistence, understanding and support from university partners to nurture all students through English and enable enrolment in appropriate Master's degrees is recognized and gratefully acknowledged.

Project collaborators attended various conferences as part of the project. In November 2012 the project supported Dr Mohammed Altaweel (University of Mosul) to attend the International Agronomy Conference in New Delhi, and in January 2013 Mr Mohamed Jabbar Abdulradh (Ministry of Agriculture) presented a paper at the International Conference on Conservation Agriculture in Southeast Asia, in Hanoi Vietnam. Also Dr Stephen Loss presented on the successful strategies employed in the earlier phases of the project at the International Conference on Development of Drylands, Beijing China.

No.	Activity	Outputs/milestones	Completion date	Comments
5.1	Raise awareness and provide training in Ninevah for Iraqis (managers, scientists, extension officers, farmers).	5.1 Increased awareness and initial understanding of conservation cropping in 10 new Ninevah districts and three new governorates especially for the 25 DoA extension specialists, other staff from the new governorates and farmers (20 persons x 7 days per visit) of: <ul style="list-style-type: none"> • Introduction to conservation cropping systems • ZT systems - entrepreneur farmers need to be identified & linked with objective 5.2 • ZT seeders - technical inputs important – ZT seeders/seed production – Obj 3. • seed production • spring field day – ZT v CT for farmers / technicians • media visit - 'Drumming' public relations / exposure 	Jul 2013/14/15	Good progress in Iraq according to plans. Also see Obj 1.1, 1.2 & 1.3.
5.2	Provide short- and medium-term training and joint data analysis at ICARDA presented by Australian and ICARDA scientists.	5.2 Courses conducted with field visits (if relevant) in: <ul style="list-style-type: none"> • scientific & report writing (10p x 7d x 2 visits) • participatory extension (18p x 14d x 2 visits) • ZT seeder design/performance (16p x 14d x 4 visits) – Obj. 5.1 • statistical analysis (10p x 14d x 2 visits) • ZT agronomy research (2p x 28d x 4 visits) - Obj 2.14 • spring farmer visit (20p x 7 x 3 visits) • seed production (10p x 14d x 2 visits) - Obj.3.2 • seed enterprise management (10px 14d x 3 visits) • socio-economic data collection: (20p x 7d) – Obj 4.6 • socio-economic evaluations (10p x 14d x 3 visits) – Obj. 4.6 • socio-economic students (3p x 2 mths x 3 visits) - Obj. 4.6 	April 2013 (16p) May 2013 (11p) A field day at Erbil May 2013	Three activities are completed. Others are planned for later in 2013 and 2014. Courses on participatory extension, agronomy research and socio-economics were programmed to more appropriate times.
5.3	Continue long-term training/joint research and MSc/PhD graduate research at Australian partner universities.	5.3 Conduct visits and postgrad training on CC in Australia <ul style="list-style-type: none"> • 2 visits x 6 mths to UWA for agronomist & socio-economist • 2 visits to Uni SA/Uni Ad for machinery counterparts, 3 wks Obj. 5.1 & 2.21 • 4 MSc and one PhD student (commenced Jan 2011) • 1 MSc graduate UWA (to commence 2012) 		All students undertaking MSc are progressing well.

5.4	Support Iraqi collaborators to attend workshops/ conferences.	5.4 Support for collaborators to attend conference or workshops <ul style="list-style-type: none"> overseas trips for 2p per year 	Nov, Dec 2012 and Mar 2013	Mohammed Altaweel, Mohamed Jabbar Abdulradh and Stephen Loss attended conferences.
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2.2 Project contribution to the Australian aid program

As a result of your project in the reporting period:

1.	Estimate approximately how many people gained access to and used improved agricultural technologies from your project?	More than 600
2.	Estimate what percentage were women?	Less than 1%
3.	Estimate the additional agricultural production in US dollars?	14.0 million

4. *What are the sources of your estimates?*

- 1) Numbers are based on farmers using ZT in Iraq and Syria as shown in Figure 1. Other beneficiaries include seeder manufacturers, seeder contractors, and seed producers.
- 2) Previous farmer household surveys indicate women are not involved in farm management and ownership in Iraq and Syria, and that the status of women especially in rural areas is not as advanced as other countries. However, wives and daughters of male farmers are likely to benefit indirectly from adoption of conservation cropping through higher family incomes and more time available for social and other activities - see 3.3.2 Social Impacts for more information. There is a valid argument that for every farmer there is potentially a wife and several daughters who could derive some benefit. Women will also benefit from improvement in environmental conditions.
- 3) Adoption over 30,000ha in Syria and 10,000ha in Iraq in 2012/13, with an average benefit of \$300/ha and \$500 respectively, associated with reduced fuel, labour and seed costs, and increased yields – see 3.3.1 Economic Impacts for more details.
5. *During the project's activities, do you expect to contribute to the results outlined above? Please comment.*

Adoption has been built up over the life of the project since 2005. We expect adoption to continue growing as a result of this third phase, although in Syria this will partly depend upon the future security and access situation.

3 Impacts

The project continued to have impacts on a number of fronts during the third phase.

3.1 Scientific impacts

Given that the harvest of the first field experiments of this project phase is yet to be completed, the scientific impacts were relatively minor to date. Data on plant depth and density showed the Rama ZT seeder prototype (Jordan), a converted John Shearer ZT seeders were as effective as more expensive imported ZT disc and tine seeders. Data collected during the previous phase of the project was presented at scientific conferences (see objective 5). Also the summary of the extensive data from long term experiments conducted at Aleppo, statistical analysis, and preparation of scientific manuscripts is underway. Three initial scientific papers are planned: 1) tillage x TOS x rotation; 2) tillage x crop x seed rate; 3) tillage x crop x variety.

3.2 Capacity impacts

Two formal courses were organised by ICARDA (plus contributions to other courses) for a total of 27 Iraqi trainees – see objective 5 for further details. Within Iraq, many workshops and training courses were conducted by the University of Mosul for research and extension staff. Post-graduate courses for the six Iraqi students studying at the University of Western Australia and the University of Adelaide are ongoing.

3.3 Community impacts

3.3.1 Economic impacts

Economic impacts of conservation cropping will be thoroughly analysed as part of objective 4. In the meantime, estimates suggest the economic benefit for Iraqi farmers could be more than \$500/ha (\$300/ha due to increased yield, \$50/ha for fuel savings, \$140/ha for reduced seed rate, less \$15/ha for an extra herbicide application). Hence, this benefit over 10,000ha could currently generate \$5.0 million for Iraq during the 2012/13 season. In Syria wheat prices are not as high as Iraq (less subsidised), and the benefit is more than \$300/ha, which could be worth \$9.0 million over 30,000 ha in 2011/12.

3.3.2 Social impacts

Analysis of a Syrian farmer survey conducted in 2010 showed the perceived benefits of ZT include reduced costs, and increased production leading to higher family incomes and more time for non-agricultural work and activities. These could bring significant social impacts such as more leisure time for farmers and more family opportunities for social interaction and recreation. Farmers and machinery manufacturers involved in local fabrication of seeders in Iraq and Syria see the potential of the technology and possibilities to develop ZT seeder businesses as adoption and demand for seeders grow. Further social impacts will be explored in subsequent surveys in Iraq as part of the socio-economic studies under objective 5.

3.3.3 Environmental impacts

In the long-term trials at Aleppo, improvements in soil carbon, available phosphorus, water stable aggregates and water infiltration were measured. As conservation cropping is adopted within the Middle East, widespread improvements in soil fertility, water quality (less run off and erosion) and atmospheric benefits (less carbon dioxide emissions, dust storms and smoke) can be expected.

3.4 Communication and dissemination activities

Website – during the first year of this phase of the project ICARDA built on the website developed in the previous phases with content for a general website covering all ICARDA conservation agriculture projects in the region. Project staff made major contributions to the new website which highlights this project's strategies and successes as a model for other countries and projects. The new website should be functioning by July 2013. Project partners will be able to access the latest project documents and selected presentations given at meetings for reference and re-use. The website will be open to the public and will provide information to the wider scientific community and donors on research, development, and capacity building by the project in Iraq and Syria.

Project reports and publications:

Several articles in ICARDA's "What's New" newsletter appeared in 2012/13, and the project was featured in the 2012 ICARDA Annual Report.

The following conference publications were prepared:

Abdulradh, M.J., Wegener, M.K., and Shideed, K. 2012. Technical Efficiency of Wheat Production Under Different Cropping Systems in Ninevah Province, Iraq: A Stochastic Frontier Production Function Analysis. *Proc. of 3rd International Conference on CA in Southeast Asia*, Dec 2013, Hanoi, Vietnam.

Alrijabo, A.J., and Al Ajrawy A.Y.H. 2013. The effect of tillage, row spacing and polymer gel addition on growth and yield of bread wheat in Ninevah Iraq. *Proc. of Interdrought Conference*, Sept 2013, Perth Western Australia.

Loss, S., Feindel D., Haddad, A., Khalil, Y, Alrijabo, A.S., Piggitt, C 2013. Adoption of conservation cropping in dryland regions of northern Iraq and Syria. *Proc. of the Int. Conference on Development of Drylands*, Beijing China. Mar. 2013.

Loss, S., Feindel F., Sommer R., Haddad, A., Khalil, Y, A.S., Piggitt, C 2013. The effect of conservation agriculture on soil fertility in northern Syria. *Proc. of American Society of Agronomy*, Tampa Florida. Nov. 2013.

4 Training activities

For general details of training and capacity development see Objective 5, under 2. Achievements.

The two training courses specifically completed by the project and list of trainees are as follows:

1) Zero Tillage Seeder Features, Calibration and Operation

31 March - 04 April 2013, Ainkawa Research Station, Erbil, Iraq

No.	Trainee	Governorate	Specialization
1	Ra'ad makeef Ahmad	Al Anbar	Extension
2	Salam Asmael Ibrahim	Al Anbar	Soil Chemistry
3	Anmar Abdalateef Hussin	Al Anbar	Extension
4	Rauof Hussin	Agri. Research Center - Erbil	Machinery/Extension
5	Osman Abdulah	Agri. Research Center - Erbil	Field Crops
6	Jamal Ahmad	Agri. Research Center - Erbil	Soil and Water
7	Sarmad Kakay	DOA-Kirkuk	Field Crops
8	Mahdi S. J. Al Badr	DOA-Kirkuk	Field Crops
9	Yazen Tawfiq	DOA_Mosel	Agri. Machinery
10	Zaid Mohamed	Uni. Mosel	Field Crops
11	Nawaf Jassim Mohamad	Uni. Mosel	Field Crops
12	Husham Abdullrahman	Uni. Mosel	Agri. Machinery
13	Mahmoud Awad	Uni. Mosel	Agri. Machinery
14	Ziyad Tariq	DOA_Mousel	Extension
15	Younis Hamadi Kasim	SBAR	Agri. Machinery
16	Anmar T. Ahmad	SBAR	Machinery
17	Fadel Ahmad	Salahadeen	Statistics
18	Marwan Dhiab Ghanim	Salahadeen	Machinery

2) Experimental Design, Data Management & Statistical Analysis

26 - 30 May 2013 Amman Jordan

No	Trainee	Governorate	Institute
1	Farhan Jasim	Al Anbar	Agriculture College/ Al Anbar University
2	Niama Darweesh	Salahaddin	Agriculture/ Tikrit University
3	Mohammed Salman	Anbar	Ministry of Agriculture/ Anbar DOA
4	Mhana Jaro Al Lahib	Ninevah	State Board of Agriculture Research (SBAR)
5	Salam Khaleel	Ninevah	Directorate of Agriculture
6	Yahya Al Qasem	Ninevah	Directorate of Agriculture
7	Moyassar Mohammed	Mosul	Agriculture/ Mosul University
8	Salim Antar	Mosul	Mosul University
9	Hassan Ashraakalee	Kirkuk	Agriculture/ Kirkuk University
10	Mahdi Jasim	Kirkuk	Directorate of Agriculture
11	Mujahed Hamdan	Baghdad	State Board of Agriculture Research (SBAR)

5 Intellectual property

None

6 Variations to future activities

No major variations to future activities are expected. Given good experiences in Erbil during 2012/13, field experimentation, and training activities will be expanded.

7 Variations to personnel

The new leader for the third phase, Dr Stephen Loss, commenced with ICARDA in July 2012 based out of the Amman office. Several budgeted ICARDA staff made limited or no contribution to the project and consequently, there were savings in salaries. For example, soil scientist Dr Rolf Sommer resigned from ICARDA in December 2012, while legume pathologist Dr Seid Kemal was relocated to Ethiopia and has had little opportunity to contribute. Also, a research associate and field technicians were not required in Aleppo, but these will be employed in Erbil and possibly Jordan during 2013/14.

In April 2013, a new project coordinator from the Ministry of Agriculture was appointed - Dr Muhajid Al Kubaisy, SBAR, Baghdad.

8 Problems and opportunities

Civil unrest and insecurity in Iraq made travel and project coordination and implementation difficult during the first two phases of this project (2005-2012), however, the outstanding endeavour of the Iraqi collaborators resulted in good progress against outcomes. The situation in Iraq remains unstable and turmoil escalated again during April elections in all governorates targeted by the project.

Now we are faced with a similar story in Syria where the dramatic increase in hostilities during 2012 resulted in an evacuation of all non-Syrian staff and location of the project leader to Amman, Jordan. However, this was anticipated when developing the project workplan, and the substantial experimental and training program at Tel Hadya Syria was partially moved to the Iraq Kurdish Region at Erbil and to Jordan. These trial sites are more expensive and less convenient to manage than Tel Hadya, where excellent facilities, technical support and active field sites were within walking distance of the ICARDA office. At the project instigation meeting there was some uncertainty whether Jordan or Erbil should be the main focus for field experiments and training. However, subsequent visits to Erbil confirmed the suitability of the Ankawa Research Centre and the cooperation and enthusiasm of the staff. Erbil is only 70 km from Mosul, and training programs conducted there incur reduced travel costs for Iraqis. It is hoped that Mr Atef Haddad and Mr Yaseen Khalil to Erbil will lead the experimental and training programs in Erbil. So Jordan is now seen as a secondary site for field experimentation and training, although as ICARDA develops its own infrastructure and technical support as planned, project activities may also be expanded.

The project coordinator from the University of Mosul, Dr Abdul Sattar was obliged to take study leave in India during October 2012. This led to a delay in organisation of the field demonstration and purchase of seed, fertilizer and capital equipment. Such study leave will not occur again for the remainder of the project.

There is also an opportunity for the project to contribute to the promotion of conservation cropping in IKR, where there is great enthusiasm for this new technology. The project will work closely with The Ministry of Agriculture and Water Resources to create ZT seeders and increased awareness and farmer testing of the technology.

Dr Stephen Loss also established links with other ACIAR projects managed by ICARDA. He attended the instigation meeting of the north Africa conservation agriculture project (CSE-2011-025) in October 2013 and is keeping abreast of developments with the ACIAR small ruminant project in Iraq and forages in Afghanistan project. He also contributed to the instigation/annual meetings of other ICARDA projects which contain elements of conservation agriculture.

9 Budget

A full budget acquittal will be prepared for ACIAR at the end of June, 2013.

The 2012/13 budget will be underspent because:

- 1) The project team was assessing the potential of field trial work in Erbil and Jordan before purchasing capital machinery and equipment. This will now go ahead mainly for Erbil.
- 2) With the relocation of ICARDA staff from Syria, and other technical staff not yet appointed, savings in salaries were possible.
- 3) Some training and field experiment activities were delayed to the second half of 2013.