

# PROJECT DOCUMENT

## SECTION 1: Project Outline

**Project title:** Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq

**Proposal stage:** Full

**Proponent's name:** ICARDA's Director for International Cooperation

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**Proponent's organisation:** ICARDA

**Commissioned organisation:** ICARDA

**Project type:** Large

**% funding to IARC** 100%

**Focus area/s:** Improving the productivity and efficiency of food crop and forestry systems

**ACIAR Research Program Area:** Crop Improvement and Management

**Project Number:** CIM/2004/024

**Geographic Region/s:** West Asia – North Africa

**Country/ies:** Iraq

**Funding request (totals for each year)**

Year 1	Year 2	Year 3	Total
638,000	281,340	281,340	A\$1,200,680

**Project Duration:** 3.2 years

**Proposed Start Date:** 01 May 2005

**Proposed Finish Date:** 30 June 2008

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### **Project summary**

Redevelopment of the agricultural sector is identified as a high priority by the Iraqi National Development Strategy (2005-2007) given that production comprises 8% of GDP; it provides employment for 20% of the population and sustains 7 million people in the rural areas. More than half of the cultivated area annually is sown to barley and wheat with some pulse legumes in the northern rainfed areas.

Production from these dryland crops is poor by international standards. Poor productivity is related to a combination of lack of widespread availability and use of modern, improved varieties and also poor crop management practices. The proposed project will contribute to the Ministry of Agriculture's (MOA) national development plans and will build on previous experiences in Iraq of ICARDA. Institutions in Australia, particularly University of Adelaide, Western Australian Department of Agriculture and Centre for Legumes in Mediterranean Agriculture, have a strong comparative advantage in providing relevant expertise to assist in both of these areas, particularly when coupled with ICARDA, which has expertise with barley, wheat and pulse legume germplasm and associated cropping systems management.

The project has four major objectives: 1) to identify, promote and widely disseminate amongst farmers in the rainfed cropping regions of northern Iraq "best-bet" improved varieties and crop management systems for wheat, barley and pulse and forage legumes; 2) to introduce, evaluate and select improved germplasm of wheat, barley and pulse and forage legumes for adaptation to rainfed farming systems in northern Iraq; 3) to identify, evaluate and select improved cropping system management options suited to rainfed farming systems in northern Iraq; 4) to enhance the capacity of Iraqi research and extension program to identify and evaluate potentially valuable germplasm and better crop/soil management technologies and promote their adoption by farmers.

The expected outcomes include, but are not limited to:

1. Available "best bet" technologies identified and prioritized
2. Acceptable technology packages promoted and disseminated
3. Efficient production systems of the seed needed in research and demonstrations established
4. New crop management options identified, tested and evaluated with farmers
5. Enhanced capabilities of Iraqi research program through joint research and specialized training programs
6. Enhanced capabilities in evaluating adoption and impact of improved technologies
7. Effective international collaborative networks between Iraqi, ICARDA and Australian institutions and scientists.

The project will have economic and social benefits in the targeted areas. It is expected to at least double the yields of barley and wheat and improve pulse and forage crops through the joint

development of appropriate cultivars and better crop management. The farmers, who are at the threshold of transition between a subsidized input system and a free market system, will encounter difficulties that could be attenuated by the expected improvement in crop yields and international competitiveness. Positive environmental impacts in terms of sustainability of the cropping systems, water savings and reduction in soil erosion and salinity development are also foreseen as a result of better crop/soil management technologies

The project will be focussed geographically in the northern Governorate of Nineveh, the main wheat- and barley- producing region in Iraq, with activities focussed on the three main agro-climatic zones (high rainfall areas (HRA) with rainfall >450mm, moderate rainfall areas (MRA) with rainfall 350-450mm, and low rainfall areas (LRA) with rainfall <200-350mm). The methodology will entail analysing farmers' practices and current production constraints, and identifying the potential technology options; identifying currently available and tested improved varieties and 'best bet' crop management practices that could be immediately demonstrated in farmers' fields in each agro-climatic zone; selecting the sites and the participating host farmers and farmer groups for on-farm demonstrations; establishing on-farm demonstrations; evaluating germplasm from Iraq, ICARDA, Australia, and other sources on-station and in farmers' fields; identifying and prioritizing constraints/limitations in crop production systems to identify improved crop management practices; identifying possible elements of improved crop and soil fertility management and matching tillage components; conducting on-station research on crop management options jointly with the farmer groups; implementing on-station and farmer-managed on-farm research trials of potential options. The training component of the project includes conducting training courses, workshops, individual training and visits to ICARDA and/or Australian partners. It is expected that the demonstrations, field days and publications will communicate project results and activities to a wide range of beneficiaries. The adopted farmer participatory approach is a sound strategy for ensuring rapid uptake of successful technology.

The MOA sees its new role as one which *“assists farmers with relevant research, extension, and demonstrations, and provides support to gain access to resources, modern techniques, and new markets.* The project is intended to enhance the extension and advisory capacity of the MOA to achieve this goal. The project will link with other programs and agencies working in the agricultural sector, including the MOA's national development programs, USAID (ARDI) and AusAID initiatives, through joint planning meetings and other measures, to ensure that activities are integrated.

## SECTION 2: Project Justification

### 2.1 Partner country and Australian research and development issues and priority

Various meetings and reports contributed to the development of this proposal. In particular, the proponents reviewed the *National Development Strategy 2005-2007*<sup>1</sup>, which was prepared through an extensive series of workshops drawing together sector experts from various Iraqi Ministries, the private sector and academia, and the *Transition Plan for the Agricultural Sector in Iraq*, prepared by the USAID Agriculture Reconstruction and Development Programme for Iraq (ARDI), April 2004<sup>2</sup>. Further background was provided through discussions with the Iraqi Interim Agriculture Minister Dr Abdul Amir Al-Abood at ACIAR in November 2003, debriefing by Trevor Flugge and Roger Hartley at AusAID in December 2003, discussions with Prof Lindsay Falvey on the report 'Agricultural Human Resource Development for Iraq' in March 2004, and discussions with Dr Don Plowman on the report 'Building Iraq's Agricultural Research and Extension Capacity' in April 2004.

The full proposal, including the project activities, work plan and implementation, was discussed and developed in detail at a workshop attended by representatives of all project participants and ACIAR, held at ICARDA in November 2004.

The proposed project will contribute to the Ministry of Agriculture's (MOA) national development plans, as documented in the reports above, and build on the previous experiences in Iraq of ICARDA and of the South Australian and West Australian Departments of Agriculture in the early 1980's that concentrated on the development of cropping systems for the semi-arid regions of northern Iraq.

Within the National Development Strategy, the main prioritized actions to be taken in the agricultural sector include increasing production and productivity through providing improved seeds, fertilizers and "scientific" exploitation of them; expanding the scope of development and research programs; rehabilitating the infrastructure of the agricultural sector; and building and reinforcing technical and administrative capacity through training and rehabilitation. The MOA sees the goal of the medium-term transition plan for agriculture to be "*providing a framework for the necessary transition from a centrally planned, non-competitive agriculture sector to one that is market-oriented, economically efficient, productive, and employment generating*". This vision was translated through ARDI/USAID proposed Transition Plan for Agricultural Sector in Iraq, which focuses on three components:

- **Creating a policy environment for market-led growth** and to address the enormous distortions in agricultural prices and markets created by past government interventions. The most important sub-sector, wheat, has been the most controlled and the most affected by the lack of open markets. The underlying policy toward wheat was for the government to subsidize inputs—including the entire technical package of equipment, fertilizers, and pesticides—and purchase the wheat. The rest of the agriculture sector was basically market driven, with minimal direct government interference. The result of these policies was a centrally planned, heavily subsidized, primarily modern sub-sector and a market-

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<sup>1</sup> The Iraqi Strategic Review Board. *National Development Strategy 2005-2007*. The Ministerial Committee on The National Development Strategy. September 2004.

<sup>2</sup> Agriculture Reconstruction and Development Program for Iraq (ARDI). *A Transition Plan for the Agriculture Sector in Iraq Final Report: Volume 1 and Volume 2*. Baghdad, April 2004.

based, mostly unsubsidized, more traditional sub-sector. Opening agriculture to market forces is intended to induce producers to change their production systems to become more competitive in commodities in which the country has a comparative advantage. This seems certain to be the case for wheat in rainfed areas.

- **Building capacity in the MOA and other ministries to support a market-based agriculture sector** and provide technical and marketing knowledge to farmers in Iraq who have not had access to modern inputs and technology. The MOA sees its new role as one which “*assists farmers with relevant research, extension, and demonstrations, and provides support to gain access to resources, modern techniques, and new markets*”. Capacity building of the MOA’s technical support functions, which centre on research and extension, would include reconstructing and re-equipping research and extension facilities that have been damaged and looted, upgrading them with modern equipment, and redeploying, retraining and refocussing staff.

Despite a strong research sector, with many staff having internationally acquired postgraduate qualifications, the MOA professional staff have been isolated from scientific and technological advances for 15 years. Only recently have they again started to receive current scientific and technical literature. They have not travelled to conferences nor participated in international M.Sc. and Ph.D. programs, and they have not had access to Internet and the latest computer technology. This gap can be closed with training, new equipment, and study tours to countries facing technical issues in agriculture similar to those in Iraq.

- **Supporting the MOA’s national programs for the development of the agricultural sector:** One of the new functions of the MOA should be coordination of international donor-funded projects to ensure they are in line with the overall goals or work of the MOA. Second, the MOA should be able to design pilot programs to establish technical and organizational solutions prior to large-scale implementation. These would include modest pilot testing with well-designed controls and data captured on the treatment, results, costs, and benefits of an intervention.

The Medium-Term Transition plan proposes a number of production programs, including:

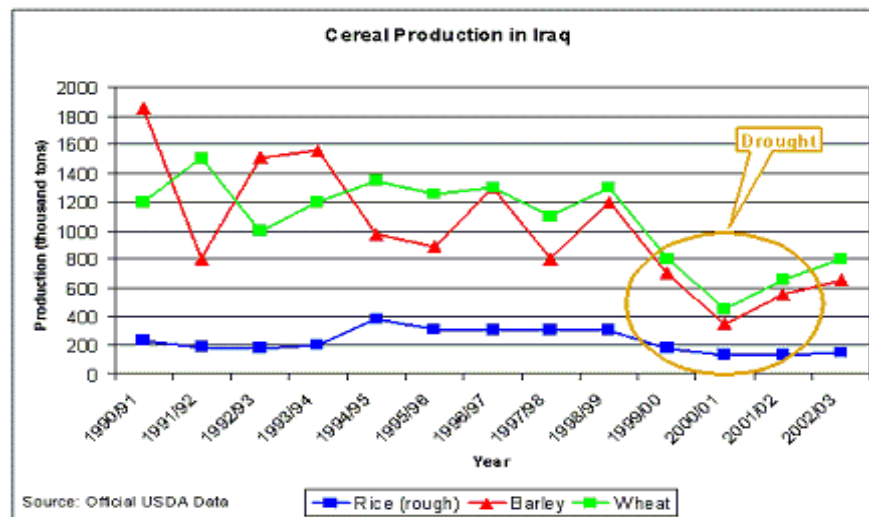
*National Wheat Production Program:* The wheat varieties and production technologies that produce high yields of grade 1 wheat in dryland areas are known. What has not been available is a country-wide program to introduce new technologies that farmers can adopt. The MOA is now conducting winter-sown wheat demonstrations with seed provided by ICARDA. The proposed ACIAR project will expand this to include other potential varieties. The project will also address other production constraints so that farmers can maximize their income from wheat by using the right mix of technology for their land and rainfall conditions.

*Sheep Production Program:* Livestock play an essential role in the lives of Iraqi farm families and includes the production of crops used for animal feed. The entire value chain is estimated to account for more than 50 percent of Iraq’s agricultural GDP and much of small-holder family income currently is derived from the sale of livestock. Within the livestock sector, the sheep sub-sector is considered to be the most economically important. Results from the proposed ACIAR project on barley, the major animal feed, and other forage crops, will inform the sheep production program currently planned as a pilot program to be implemented in the Wassit and Sulaymaniyah governorates.

*On-Farm Soil-Water-Crop Production Management Program:* This focuses on irrigated areas in southern Iraq, while the proposed ACIAR project will contribute to on-farm soil-water-crop production management systems in rainfed northern Iraq.

Redevelopment of the agricultural production sector has been given a high priority by the Iraqi Government to improve the livelihood of rural people and reduce dependence on importation of food. Agriculture currently provides about 8% of Iraq's GDP and 20% of its employment, and supports a rural population of 7 million people (of a total of approximately 26 million). Arable land is estimated at 11.5 million hectares, approximately 20-30 percent of the country's total area. The Food and Agriculture Organization (FAO) estimates only 8 million hectares are used for agriculture and less than half are cultivated annually. Seventy-five percent of the cultivated area is located in the central and southern regions. However, production of wheat, the staple food crop, and barley, an important livestock feed crop, is concentrated in the northern region. The following information and figures/map on the status of wheat and barley production in Iraq comes largely from Government of the United States of America publications summarised on the UN ReliefWeb sites listed below.

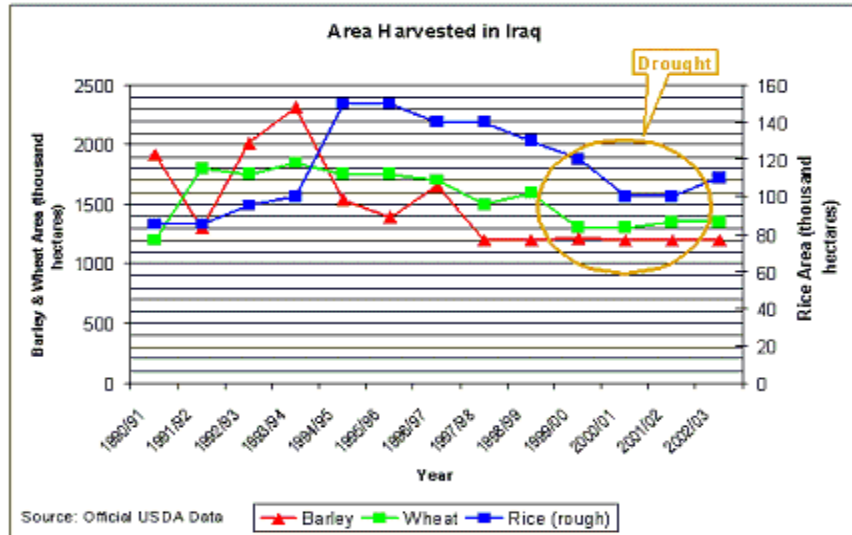
Agricultural production has actually declined by about 1.1% per annum over the past 15-20 years. Five-year average production estimates for Iraq are 860,000 metric tons (MT) of wheat and 720,000 MT of barley, and 210,000 MT of rice. Less than 100,000 metric tons of corn is also grown. Production of major crops has decreased steadily since 1990. Current total production of major grains is estimated to be down 50 percent from the 1990/91 level. Three years of drought from 1999-2001 significantly reduced production. Rain-fed areas suffered from severe reductions in rainfall. Irrigated areas were seriously affected by reduced water availability from diminished river flows.



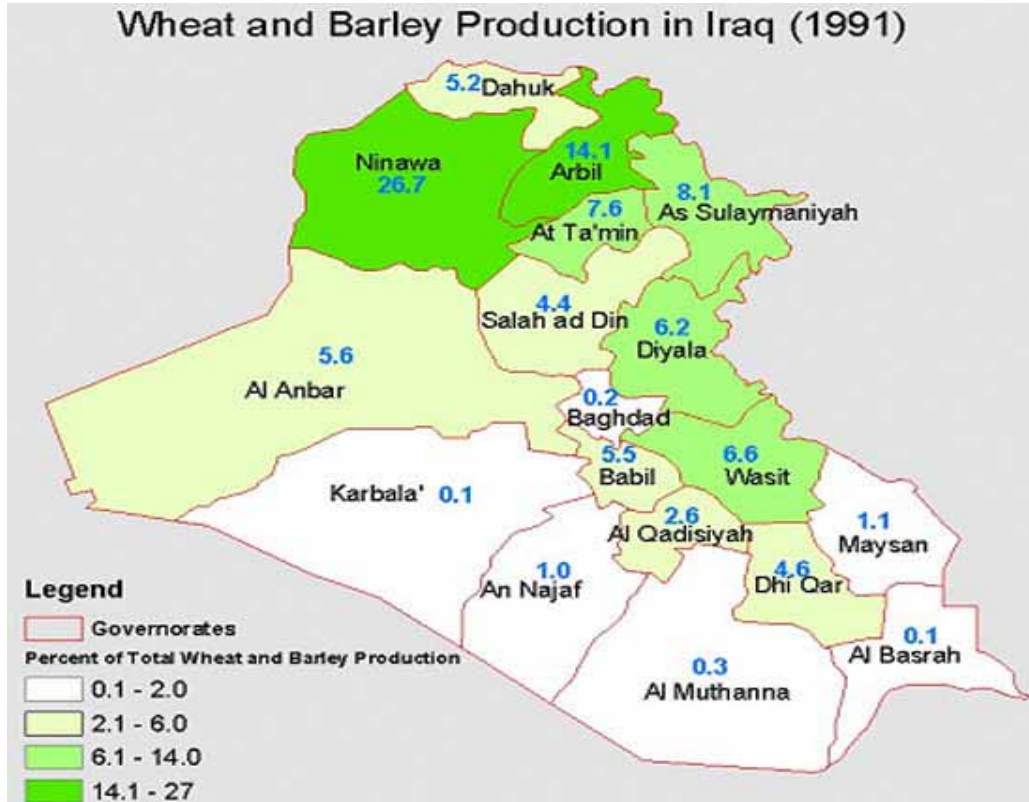
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Significant area and yield declines have resulted from shortages of inputs (i.e. seeds, fertilizers, pesticides) and machinery, irrigation related problems (increasing soil salinity from flood irrigation and lack of drainage, reduced irrigation water, deteriorating irrigation infrastructures), poor crop rotations to meet food deficits, and limited aerial spraying to control pests including the Sunn Pest (a major pest on wheat and barley in the region). An effort was made, in the early 1990's, to counter economic sanctions and increase domestic food production by raising areas

and yields. However, the gains made appear to have been short-lived and area has since stagnated. Rainfed wheat and barley are grown in the northern provinces of Nineveh and Erbil which account for one third of the total cereal production (see map). Agriculture in these provinces is largely rainfed and is based on mixed crop and livestock (small ruminant) production.



From: <http://www.reliefweb.int/w/rwb.nsf/0/3395cfa0ff7a616f49256cb7001228a7?OpenDocument>



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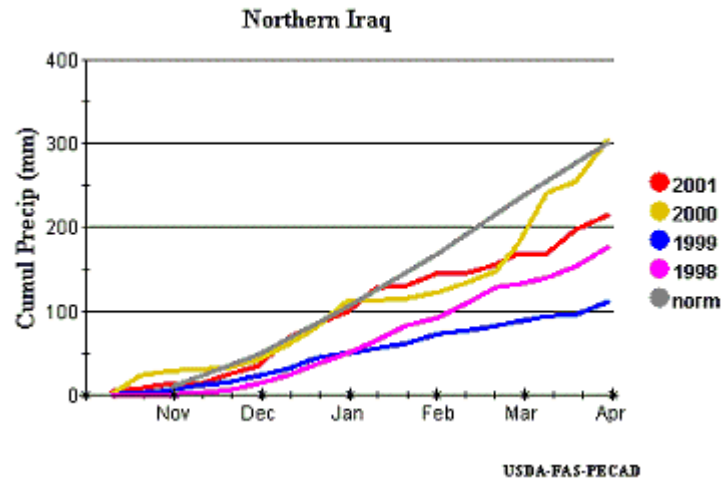
Whilst some Iraqi problems, like input subsidies, are largely political, solutions to the major agronomic problems defined in Iraq can be substantially supplied by improved research capacity and the application of existing technologies. Cropping systems research can produce an immediate result both for the crop production but also for animal production as reduction in fallow, more stubbles and introduction of legume forages complement the animal industries and should not be seen as competitive

Production technologies are based mainly on traditional deep cultivation and crop management systems, which have changed little over the last few decades. Introduction of improved varieties and improved crop management as part of integrated soil and crop management packages should significantly increase resource use efficiency (water, nutrients), reduce costs of production and enable higher crop productivity. The crop varieties currently used in commercial production and in research and development programs were sourced from a modest breeding program within the Ministry, from ICARDA or from material introduced as part of collaborative programs with Australia and other countries in the early 1980s.

The MOA has already evaluated improved varieties and crop management practices which have proved to be successful and are available for dissemination. However, under the current economic environment there is little incentive for farmer use them. The proposed government strategy is to shift to a market-driven agricultural system, which is intended to induce producers to change their production systems to become more competitive. This will require the development and dissemination of integrated packages of practices, appropriate for specific agroclimatic conditions that farmers can adopt to maximize their returns from rainfed crop production. As well as disseminating available technologies, the project proposes to evaluate potential solutions to production constraints identified by farmers.

Meeting this challenge is given a high chance of technical success. Soils in the region are considered to be fertile and productive, certainly by Australian standards. Average seasonal rainfall totals around 100-300mm during the growing season (see graph below) and can be variable; for example, three years of drought from 1999-2001 significantly reduced production, so drought tolerance of crops is a major target for improvement programs. Current average yields of wheat and barley of 0.73 and 0.62 t/ha, respectively, are less than half those expected under such conditions due to a combination of inappropriate cultivars and poor crop management practices. The target to at least double yields is based on the current levels of production and productivity improvements from a combination of improved crop husbandry and cultivars made elsewhere in the world, and particularly in Australia where regions with similar winter rainfall have averaged about 2.5% productivity gain per annum over the past 20 years.

There are similarities in the major constraints facing dryland cereal and pulse cropping in Iraq and southern Australia including drought and heat tolerance, salinity, B tolerance, grain quality issues (mainly extensibility for flatbread), and cereal diseases (mainly stripe rust) and pulse pests and diseases. These diseases are of major concern particularly in Nineveh province. These are all priorities for wheat, barley and pulse production in southern Australia, and several are the subject of major industry funded projects and research programs supported by universities and agriculture departments in southern and western Australia. The overlap of research interests between Australian institutions and ICARDA augur well for the success of the project.



From: <http://www.reliefweb.int/w/rwb.nsf/0/3395cfa0ff7a616f49256cb7001228a7?OpenDocument>

The Australian Government has responded to the priority to increase agricultural production in various ways through plans to assist with the redevelopment of infrastructure, refurbishment of Ministry of Agriculture facilities, support for significant short-term technical training, support for the development of a research-extension program, and support for longer-term (up to 3 years) research initiatives, including this proposal.

The two major regions for potential intervention, identified by representatives of the Australian and Iraq governments, are the northern dryland cropping areas and the central irrigated areas supplied by the Tigris and Euphrates. In both cases ICARDA and Australia have a strong comparative advantage to assist with research and development. This project focuses on the northern dryland cropping regions because these are extensive, current production is very low, significant progress from better adapted germplasm and better crop and soil management is feasible, and problems in the irrigated regions are longer-term, more complex and will require infrastructure development before real change can occur. In addition, working in this region provides a close link with international dryland agriculture through ICARDA. ICARDA programs with a focus on farmer participatory research proved successful in neighbouring countries like Syria, and Turkey, ensure that the immediate beneficiaries of the program will be the farmers themselves.

Other donors and groups are active in developing crop assistance projects in Iraq. For example, UNDP/FAO has developed a proposal and is seeking funding for a project entitled "Strengthening the capacity of the agricultural research and extension systems and their integration with tertiary education in Iraq." It proposes to re-establish Research Stations, to restore the Agricultural Extension Service, and to consider the means to integrate both systems with the Agricultural Colleges to improve the flow of information to farmers and students to support the long-term viability of agriculture in all of Iraq. The proposed costing is US\$11 million over 2 years. Given the enormity of the task of rehabilitation of agriculture in Iraq, there will be a need for extensive and on-going assistance for a considerable period. Nevertheless, it will be important to ensure efforts are complementary. This ACIAR project will endeavour to remain aware of and complementary to other crop development initiatives.

There were two previous Australian based projects in Iraq at Tel Afer Crop livestock area and Tel Sufuk (a dryland grazing area) directed by the Western Australian Department of Agriculture. Both projects in the early 1980s focused on improved system for cereal production

with emphasis on rotation with legumes (WAOPA 1982). Medic pastures and vetch were successfully established and best adapted leguminous pasture species defined (Francis 1980). Both projects saw the potential for cereal crop yields to be greatly increased with the introduction of improved variety testing technology (cone seeders and mini plot harvesters) which was rapidly adopted by the Iraqi counterpart. Landrace durum varieties and Mexipak bread wheats have increasingly been replaced by ICARDA lines. The project introduced Australian tractors and seeding equipment as well as the technology for their use by involvement of practical farmers in the projects.

## **2.2 Project context (relationship to previous research and other research) and research strategy**

The project aims is to contribute to the redevelopment of the dryland cropping sector in northern Iraq through the testing, promotion and dissemination of improved crop cultivars and crop management practices. The project has four major objectives:

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

The project will be focussed geographically in the northern Governorate of Nineveh, the main wheat- and barley- producing region in Iraq. Within the Nineveh Governorate, activity will be focussed on the three main agro-climatic zones (high rainfall areas (HRA) with average annual rainfall >450mm, moderate rainfall areas (MRA) with average annual rainfall of 350-450mm, and low-rainfall areas (LRA) with average annual rainfall of <200-350mm). Within these three zones, the agricultural research centres conducted both field and laboratory crop and livestock research, and were responsible for introducing new varieties, and producing and maintaining breeder and foundation seed under the supervision of the plant breeders.

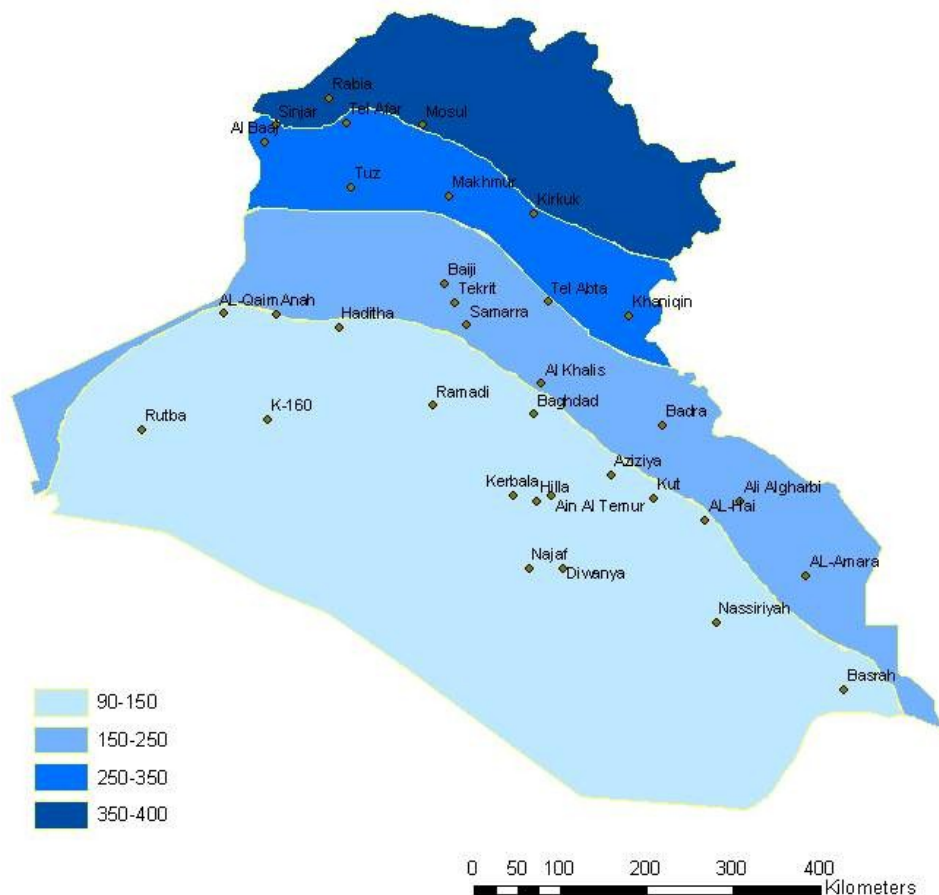
Rainfall is highly variable both between and within seasons and periodic droughts are common. The map below shows the average annual rainfall distribution in Iraq and the location of the research stations in Nineveh Province (Tel Afer, Rabia, and Rashidiya-Mosul). Rabia Research Station and Rashidiya Research Station (located within the boundaries of Mosul city) represent the MRA, while Tel Afer Research Station represents the LRA.

The low rainfall area (LRA) represents some 60-70% of the arable area. Production is primarily a barley/livestock system, unless supplemental irrigation is available. Livestock are the principal economic output, supported by barley, the major feed source, and extensive grazing on rangelands. However, pastures are of poor quality and have deteriorated, due to expansion of rainfed agriculture to marginal land or grazing areas, overgrazing, and inadequate range management, and livestock production is increasingly dependent on other feed sources. Options are limited mainly to improving barley production and promoting use of forage legumes to enhance cropping systems productivity and increase on-farm feed supplies. Research on both

aspects has already been carried out by previous Iraq/ICARDA collaborative projects (see Mashreq/Maghreb project below) and some options could be demonstrated immediately.

The moderate rainfall area (MRA) represents some 30% of the arable area. Production is primarily wheat/legumes (mainly lentils) production systems and barley/fallow systems. When supplemental irrigation is available, potatoes and other vegetables are grown. The high rainfall area (HRA) represents some 7-10% of the arable land. Production is more intensive and is based on wheat/legumes (chickpea) systems, with some lentil also grown. As in the MRA, when supplemental irrigation is available, potatoes and other vegetables are grown. Both bread and durum wheat is grown. Bread wheat is commercially preferred for bread making, while production of durum wheat has been primarily for on-farm processing for pasta, *burghul* (cracked wheat), *frikeh* (roasted green wheat) and other products for family consumption.

## Annual Rainfall (mm) Distribution



Courtesy of the Iraq National program for the Preparation of Agro-Ecological Zones Maps

With respect to land tenure, most arable land is farmed under sharecropping arrangements, with private ownership and rental of land increasing in the MRA and HRA. It is not known what effect the collapse of the central government may have had on sharecropping arrangements and this will be investigated by the project.

The region's soils are generally calcareous and low in phosphorus, nitrogen, and organic matter. In many areas, shallow soils limit the amount of available water for growing rainfed crops. Farming in Iraq is fully mechanized with many operations (particularly cereal harvest) provided by contract services. Fertilizers and other chemical inputs are used in MRA and HRA, but not so extensively in LRA. Seed has traditionally been obtained from several sources: farmers' save their own seed, farmer-to-farmer exchange, from the open market, or from government supported seed supplies. The central government was responsible for the widespread application of pesticides on rainfed cereal crops. In the absence of these spraying programs, alternative, and preferably integrated, pest management systems will be needed.

Improved germplasm of both cereal and legumes is immediately available. Many wheat and barley lines have been introduced over the past 25 years, but there is a need for a more comprehensive evaluation of modern material in Iraq. For example, many wheat, barley, and pulse lines have been introduced to Iraq by ICARDA and some varieties (Appendix 3) have been recently released in Iraq based on ICARDA germplasm (e.g. Waha, Sham, Um Rabia, Adnania, Rihan 03). These varieties have been used by farmers and can be further disseminated while undertaking testing/evaluation of new materials.

The effort placed on pulse and forage legumes in Iraq have been relatively small over that time and there is an opportunity to utilise them more in farming systems and local diets. There have been many advances made in improving the productivity and quality of pulses that could usefully be introduced into Iraq, including better yield, disease resistance, resistance to pod shattering, grain quality, and drought tolerance and the introduction of determinant characteristics. The pulses/legumes program will not be restricted to food legumes but will also include forage legumes (e.g. vetches and grasspea). In the LRA, barley is produced in barley/fallow or continuous barley rotations. Previous ICARDA studies have shown that forage legumes and thus barley/forage legume rotations are a viable option for this area. Small ruminants represent a principal economic output and source of income from these farming systems and there is demand for additional feed in the form of forage crops. ICARDA has a good range of well-adapted forage legumes and the project will include forage legumes in testing/evaluation activities.

The new materials will be evaluated initially under strict scientific protocols to identify plant characteristics that improve adaptation under north Iraq conditions. After this initial phase, selected material will be evaluated regionally with farmers. While there is no intent to commence a breeding program per se, this initiative could be a precursor to such a program in future. The national MOA scientists at the Abu Ghraib Research Centre will be provided with improved germplasm and training on crop improvement as a precursor to such an activity.

It is recognised that the impact of improved varieties on farm yields is greatly increased if they are incorporated into a package of improved production practices. Empirical studies conducted in Iraq through ICARDA-Iraq collaboration have shown that the net impact of improved varieties over local varieties (the impact that is solely attributed to the biological characteristics of the improved variety) did not exceed 50% for wheat and 19% for barley. Therefore, the project will also investigate and promote improved crop and soil management practices for each agro-climatic zone.

Iraqi agriculture under rainfed conditions in the targeted areas is constrained by cereal/fallow or continuous cereal mono-cropping systems, which contribute to low crop yields and resource degradation. More use of two-year (cereals/legumes) or three-year rotations (cereals/legumes/fallow) is badly needed

Potential research areas for improvement of cropping systems identified with Iraqi colleagues are tillage and sowing systems, pest and weed management and new crop rotation options. ICARDA research in Syria has shown that in the drier areas farmers tend to adopt risk adverse strategies rather than maximization of production, and are reluctant to invest in high levels of inputs. Soil fertility and crop management technologies developed jointly in participation with farmers through an adaptive process to given agro-ecologies and their specific conditions stand a better chance of adoption. Farmers' indigenous knowledge of their own soils and micro-environments also play a valuable part in identifying appropriate management practice.

For each particular crop, "best-bet" production packages will be identified - tillage, planting, seed and fertilizer rates, potential use of alternative nutrient sources (e.g., animal manure), etc. However, these also need to be combined at the cropping system (rotation) level with integrated pest, disease and weed management practices, and methods to best conserve soil moisture and improve water (rainfall) use efficiency.

Improving cropping system productivity will contribute greatly to the food security of Iraq and the farm income of many rural communities. Moreover, there is long-standing interaction and a wealth of information readily available based on ICARDA/Iraq collaborative activities in crop improvement with Nineveh Governorate.

While the field activities are located in Nineveh Governorate, project training and other capacity building activities will be extended to MOA staff in other Governorates, when and if appropriate. The project will develop partnerships between Ministry of Agriculture institutions in Nineveh Governorate in northern Iraq and Abu Ghraib near Baghdad, ICARDA, and Australian institutions with expertise in wheat, barley and pulse/forage legume improvement and cropping systems management and/or prior experience in the region (University of Adelaide, Department of Agriculture Western Australia, and CLIMA). The general intent is for ICARDA to provide leadership and Australian institutions to provide scientific support, mentoring and training, with ICARDA staff potentially having greater access to Iraqi sites to help with on-site monitoring and training.

The project will link with the AusAID initiative 'Building Iraq's Agricultural Research and Extension Capacity' and with other initiatives promoting improved cropping in Iraq, including an ACIAR project on IPM mentioned above. IPM trainees may have the opportunity to contribute to the field activities of this project on return to Iraq. The project will also link with the USAID ARDI (Agriculture Reconstruction and Development for Iraq) project, through the Ministry of Agriculture, to exchange information and ensure there is no duplication of activities.

The involvement of ICARDA has many benefits, as they have been able to maintain contact with Iraq over the past 25 years. ICARDA has recently facilitated several workshops with Iraqi scientists to discuss future needs and opportunities for collaboration in Jordan in November 2003 and at ICARDA in December 2003. Within the CGIAR system, ICARDA has the global mandate for improvement of barley, faba bean and lentil and the regional mandate for Central and West Asia and North Africa (CWANA) for improvement of wheat and chickpea, and their associated farming systems

Of particular relevance is the ICARDA Mashreq/Maghreb Project, an adaptive research program (<http://www.icarda.org/MMProject/MMHome.htm>) initiated in 1995 for the development of integrated crop/livestock production in the low-rainfall areas of West Asia and North Africa (WANA). The program encompasses two sub-regions of WANA: the Mashreq sub-region, including the countries of Iraq, Jordan, Lebanon, and Syria, and the Maghreb sub-region, including the countries of Algeria, Libya, Morocco, and Tunisia. The eight national programs, ICARDA, and the International Food Policy Research Institute (IFPRI) implement the project.

The project has developed a community approach that is intended to produce, with the participation of community members and other stakeholders, packages of “best-bet” technical, institutional and policy options to support livestock production in dry areas. The community approach has also focused on developing or strengthening appropriate local institutional support for community development plans. Considerable progress has been made in the development and delivery of technological packages related to on-farm feed production, alternative feed sources and improvement and management of small ruminants. New varieties of barley, oat, vetch and triticale adapted to harsh environments have been tested and adopted by farmers. Iraq has been a strong and active participant in the programme since its inception, working closely with communities in the mixed crop-livestock production systems of Nineveh Province. The Mashreq/Maghreb project is entering a third phase with funding from IFAD, and this ACIAR project will link with and build on experiences from the Mashreq/Maghreb project.

Risks are associated with the proposed transition to a market economy, the ongoing security situation, and uncertainty over investment in strengthening the MOA’s R&D capacity. Iraq’s agriculture is characterized by low productivity and growth, primarily due to the past policy regime which was not conducive to the development of a competitive efficient agricultural production system. In the past the main means of achieving the government’s goal of maintaining low food prices were through output price controls, restrictions on sale of outputs and strict production plans that required farmers to produce specific crops. A second factor was the highly subsidized supply of agricultural inputs to agricultural producers. These subsidies failed to motivate producers to adopt the most efficient production practices. Aligned with this was the absence of any formal credit system or institution that would support producers’ investment in alternative technologies.

Today, three market systems are currently operating: the government buys grain to support the national ration system; farmers sell independently to traders in Syria; and the internal market. Currently farmers’ output price is guaranteed (the government price represents the ceiling price). If the ration system/price subsidies are removed, market demand and therefore price of wheat and other food crops is expected to rise. The removal of input subsidies is likely to increase input prices in the short-term, which is why the project focuses on identifying the most efficient production practices for each cropping system, in order to maximize returns. The removal of subsidies is unlikely to have much impact in the LRA, where the principal crop is grown to provide livestock feed. Benefits from improving barley and other feed crop production will transpire through improved (more efficient) small ruminant production.

The project is ambitious and many constraints to the achievement of the project objectives are likely, particularly given the on-going security situation. The project will be implemented within Iraq by the Iraqi national program, and will, therefore, depend on the capacity of the MOA. The MOA has undertaken to provide the staff required to implement both the research and demonstration programs. The project includes a substantial training component for Iraqi staff. Despite the impressions given by international media coverage, the Iraqis are fully confident that they will be able to continue to conduct field work in the Province. They cite the example of the

USAID ARDI program in which the MOA has continued to implement demonstrations, even under difficult circumstances. The project work plans will need to be flexible so that the selection of sites for demonstrations and on-farm trials can be adjusted if necessary.

The project builds on ICARDA's past collaboration with Iraq and will ensure much closer linkages between ICARDA and the agricultural research and development program in Iraq. ICARDA is actively seeking funding for other projects or is linking Iraq into existing regional projects. These linkages will ensure that research and the promotion of adapted technologies will continue when Australian funding ceases.

## SECTION 3: Project Operations

### 3.1 Objectives

The aim of this project is to contribute to the redevelopment of the dryland cropping sector in northern Iraq through the testing, promotion and dissemination of improved crop cultivars and crop management practices.

The objectives are:

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

### 3.2 Outputs:

Objectives	Outputs	Assumptions	Applications
1. To identify, promote and widely disseminate among farmers in the rainfed cropping regions of northern Iraq "best-bet" improved varieties and crop management systems for wheat, barley and pulse and forage legumes.	1.1 Constraints/limitations in rainfed crop production identified through diagnostic study of farmers' existing practices. 1.2 Available "best bet" technologies identified and prioritized based on existing knowledge. 1.3 On-farm demonstrations established. 1.4 Potential constraints to adoption identified.	<ul style="list-style-type: none"> <li>• Better varieties/ technologies exist.</li> <li>• Land ownership, credit availability and markets don't constrain uptake.</li> <li>• Agricultural inputs are available to farmers</li> <li>• Information and experience from other projects (e.g. USAID ARDI) is available and shared.</li> </ul>	<ul style="list-style-type: none"> <li>• "Best bet" varieties and crop management practices established.</li> <li>• Farmer uptake of improved crop management systems.</li> <li>• Outputs provide basis for a comprehensive plan for ongoing</li> </ul>

Objectives	Outputs	Assumptions	Applications
	1.5 Acceptable technology packages promoted and disseminated. 1.6 Assessment of potential adoption and impact		MoA extension program.
2. To introduce, evaluate and select improved germplasm of wheat, barley and pulse and forage legumes for adaptation to rainfed farming systems in northern Iraq	2.1 Cultivars of these crops that produce higher yields and/or better satisfy local market requirements through better disease resistance, drought tolerance, bread quality characteristics, etc., identified and evaluated with farmers at research stations and in farmers' fields. 2.3. Efficient production systems of the seed needed in research and demonstrations established.	<ul style="list-style-type: none"> <li>• Functional research system (personnel, equipment and facilities) is re-established in Nineveh province.</li> <li>• Diverse germplasm with useful traits is available from project partners.</li> </ul>	<ul style="list-style-type: none"> <li>• Selected germplasm utilized in promotion and dissemination program under Objective 1.</li> <li>• Capacity of Iraqi program in germplasm evaluation enhanced.</li> <li>• Outputs could provide a basic component of a future Iraqi breeding program</li> </ul>
3. To identify, evaluate and select improved cropping system management options suited to rainfed farming systems in northern Iraq.	3.1 Specific production constraints, identified under Output 1.1, for which there are no immediate available technologies are identified and prioritized. 3.2 New crop management options that solve these constraints identified, tested and evaluated with farmers.	<ul style="list-style-type: none"> <li>• Functional research system (personnel, equipment and facilities) is re-established in Nineveh province</li> </ul>	<ul style="list-style-type: none"> <li>• Identified crop management packages utilized in promotion and dissemination program under Objective 1.</li> <li>• Capacity of Iraqi program in crop, pest and disease management research enhanced.</li> </ul>
4. To enhance the capacity of Iraqi research and extension programs to identify and evaluate potentially valuable germplasm and better crop/soil management technologies and promote their adoption by farmers	4.1 Enhanced capabilities of Iraqi research program through joint research and specialized training programs. 4.2 Research and extension staff are better able to promote and disseminate new technologies in partnership with farmers. 4.3 Enhanced capabilities in evaluating adoption and impact of improved technologies.	<ul style="list-style-type: none"> <li>• Iraqi personnel are able to participate in capacity building and international networking activities.</li> </ul>	<ul style="list-style-type: none"> <li>• Iraqi personnel have the capacity to re-establish an agricultural R&amp;D system in Iraq.</li> <li>• Iraqi personnel have capacity to set up wider national training program</li> <li>• Iraqi personnel have greater access to, and opportunities to</li> </ul>

Objectives	Outputs	Assumptions	Applications
	3.4 Effective international collaborative networks between Iraqi, ICARDA and Australian institutions and scientists.		participate more widely in, international research.

### 3.3 Research methodologies and project travel

The project activities are detailed in the flow chart (3.3.a) and summarized below.

It should be noted that:

- Activities under objective 1 will be implemented by field teams in all three agroecological zones.
- However, implementation of activities under objectives 2 and 3 (on-station research) will be dependent on the full rehabilitation of the research stations. It should be noted that the proposed *Transition Plan for the Agricultural Sector in Iraq* includes proposals for reconstructing and re-equipping research and extension facilities that have been damaged and looted, and upgrading them with modern equipment. However, whether this will be achieved in time to benefit the research stations involved in this project is unlikely.

Therefore, the project will fund the purchase of some essential farm and small-plot equipment, lab and office equipment and building rehabilitation needed to implement the research trials at one of the three research stations of Rabia, Tel Afer and Rashidiya. This is likely to be Rabia station, which was the principal research station prior to the war and served all three agroecological zones for seed multiplication. Alternatively, Tel Afer (in the low rainfall agro-ecological zone) will be rehabilitated. The decision will be taken by MOA in consultation with ICARDA.

- The on-station trials at this one research station will then be replicated in trials on farmers' fields in all three agroecological zones.

Activities in Iraq will be implemented by staff of the MOA, until the security situation in Iraq substantially improves. All activities will be implemented base on detailed work plans developed together with ICARDA and Australian partners, and the results reviewed in detail at annual coordination and planning meetings. MOA staff are fully capable of implementing the program and will be supported by training in specific aspects within the project. MOA personnel will include one team, consisting of 4 to 5 extension staff, in each agroclimatic zone and research scientists at each of the three research stations in Nineveh Governorate, to include crop scientists, an agronomist, a plant protection specialist and a socio-economist.

#### Methodologies

The project will start with an analysis of farmers' practices and current production constraints, and the identification, from existing information, of potential technology options that are already available and can be demonstrated to farmers.

A baseline survey will be carried out by the Iraqi team following the methods established by ICARDA for other regional projects. The Iraqi team will visit ICARDA to prepare and discuss the survey methods. The research and extension teams in each agroclimatic zone will then undertake the survey, using the tools developed with ICARDA.

The survey will collect information on constraints and limitations in production in the three identified agro-climatic zones of Nineveh Province and assess potential marketing and policy constraints to adoption of improved technology options. Information will be collected on seed production and storage systems and the capacity of the farmers generally to uptake the technologies developed as a result of the project. The survey will include a study of the availability of inputs and the 2005 harvest and subsequent crop marketing. This baseline analysis is expected to include information for each of the main cropping systems on management practices, machinery specifications (e.g. availability and size of tractors, type of tillage implements and planting equipment, use of fertilizer spreaders and sprayers, etc.), the current type and amount of inputs being used (fertilisers, pesticides) and associated constraints (nutrition, weeds, diseases, pests), and marketing information on both inputs and outputs (availability, prices, market access, etc). The data will be disaggregated to provide information on the different gender roles that may have implications for village extension programs. The information from the survey will serve as a baseline for future adoption and impact assessments.

Existing information on potential available technology options, which have already been tested in Iraq, including registered Iraqi varieties of target crops and crop and pest management options, will be compiled and reviewed. The Iraqi team will prepare a comprehensive list of germplasm introduced and evaluated over the past 15 years.

A round table discussion involving all partners, including Iraqi research and extension personnel and representative farmers, will be held at ICARDA in Syria in May/June of 2005. This meeting will identify the initial suite of germplasm to be demonstrated in the first year, taking account of information on prior testing and material available from the international collections and from Australia. The discussion group will determine the quality and agronomic characteristics required of improved varieties and agree on the conditions and methodology of evaluation including best-bet management practices for the region.

The first Annual Project Coordination Meeting involving all project partners will be held immediately following this round table discussion at ICARDA to decide the best bet technology options for demonstration in each agro-climatic zone. The work plan for the year 2005/2006 cropping season will also be prepared.

Participants will include research and extension personnel and representative farmers. The workshop would be held in April 2005 with the opportunity to examine field trials crops at ICARDA and to visit activities in agroclimatic zones similar to those of the Nineveh target region. The extensive program conducted by ICARDA in the region represents a strong backup to the project in the evaluation the target crops in essentially the same agroclimatic conditions and soil types as represented in Nineveh.

Based on the work plan, Iraqi scientists will select the sites and the participating host farmers and farmer groups for on-farm demonstrations. About 3-5 demonstrations in each of the three agro-climatic zones will be established (10-15 demonstrations total). The overall aim is the development of variety specific production packages. Extension and research personnel will jointly select the representative sites in each region with selected farmers/farmer groups. The details of the on-farm demonstrations will be discussed and finalized during the Annual Coordination Meeting. Working closely with farmers/farmer groups, the project will establish the on-farm demonstrations in different areas. Introduced lines will be compared to locally used varieties. Data collection will be comprehensive, including establishment, phenology, seed weight and numbers, and crop yield. Appropriate quality attributes of the grain that relate to its ultimate use as human food or stock feed would be assessed. Research, Extension, and Farmers

group will monitor demonstrations and jointly evaluate options to identify preferences and/or potential constraints to adoption. Farmer's Field Days and IPM farmer field schools will be organized at one location in each zone. Extension material for demonstrations will be prepared, printed and distributed to the stakeholders. The MOA and other government policy makers, the media and other stakeholders will be invited to attend field days at demonstration sites. The potential adoption and impact of technologies based on information from baseline surveys and results from demonstrations will be assessed and potential changes made for improvement.

The first Annual Coordination meeting will also identify potential improved germplasm of wheat, barley and pulse and forage legumes that has not yet been tested widely in Iraq, for evaluation first in on-station trials and then in farmers' fields in Iraq. Germplasm from Iraq, ICARDA's international nurseries, Australia, and other sources will be evaluated and increased on-station during the growing season of the first year of the project. Introduced lines will be compared to locally used varieties. Data collection will be comprehensive, including establishment, disease resistance, phenology, seed weight and numbers, and crop yield. Appropriate quality attributes of the grain that relate to its ultimate use as human food or stock feed would be assessed. The improved lines will be evaluated in the research station (one in each agro-climatic zone, depending on extent of rehabilitation) in a farmer participatory approach. The protocols for recording of data on various aspects will be discussed and finalized. The data from individual farmers and farmer groups will be compiled, and analysed for identification of best entries in different agro-climatic conditions.

In subsequent annual project review and planning meetings the results of the previous year's evaluation will be presented, reviewed, discussed, and the best entries for evaluation in the next season identified. Selected entries from the first year will be evaluated in the research stations (3 trials) and in replicated trials on farmers' fields in 3 sites in each agro climatic zone (3x3 = 9 trials). These entries will be jointly evaluated with farmer groups. Similarly for selected entries from Year 2. Joint evaluation will result in identification of elite lines suitable for different agro-climatic zones. The best lines on the basis of three-year evaluation will be identified; their morpho-agronomic traits compiled and submitted to the variety registration committee for registration and eventual release for general cultivation.

The Breeder and Nucleus Seed production of the lines entering registration will be simultaneously produced at Rabia research station for research and demonstrations. The facilities and capacities for seed production and demonstration should be strengthened through supply of equipment and training.

Based on collective knowledge and the results from the baseline survey of production constraints, the first round table discussion (noted above) will identify and prioritize those constraints/limitations in crop production systems that are not addressed by readily available technologies, and which need further research to identify improved crop management practices. Potential research areas identified with Iraqi colleagues are tillage and sowing systems, pest and weed management, and new crop rotation options. WAHRI at the University of WA can provide training in herbicide use and resistance (see objective 4).

A joint crop improvement and crop/soil management workshop will be held at ICARDA headquarters in Syria to identify possible elements of improved crop and soil fertility management and matching tillage machinery components, taking account of experience with similar farming systems experience in ICARDA and Australia. This will result in a suite of "best bet" options to be selected for testing in Northern Iraq. This will require simultaneous selection of matching crop varieties above for the improved systems being proposed. Workshop

participants will include research and extension personnel and representative farmers. The workshop would be held in September 2005 with the opportunity to examine field trials crops at ICARDA and to visit the agroclimatic zones similar to those of the Nineveh target region.

On-station research on crop management options will be conducted jointly with the farmer groups to fill gaps in information. The input-output data collected from these experiments will result in understanding the cost benefit analyses of some of the management options. The results of various experiments of 1st year will be compiled, analysed, and reviewed in the Annual Coordination Meeting and plan of work for 2nd year discussed and agreed upon. Based on 1st year's results, on-station and farmer-managed on-farm (3 sites in each agro-climatic zone) research trials of potential options will be implemented in the second year, with joint evaluation of options with farmer groups. The data collected for various inputs and outputs will determine the cost benefit ratios and also the farmer's preferences and constraints will be identified for modification of the crop management options. The same methodology will be followed in the third year.

The joint evaluation of options with farmer groups may result in gathering information on the farmers' preferences and constraints encountered in adoption of the cultivars and the package of production, with a view to identifying where assistance is needed in mitigating constraints to adoption.

### **Training and Capacity Building**

A detailed training program will be developed at each Annual Project Coordination Meetings, including short term (3-4 weeks) training courses, workshops, individual training and visits to ICARDA and/or Australian partners, and selective longer term activities. Appropriate location of training, visits, etc and involvement of ICARDA and Australian partners in training activities, to be decided based on comparative advantages of ICARDA and Australian partners and relative costs. The Ministry of Agriculture will nominate staff for training.

Training is expected to include short-term training courses in germplasm evaluation, cropping systems management, seed production & seed quality control, integrated pest/disease/weed management, and extension methods 20 Iraqi staff per year; individual training for MOA staff in economic analysis, adoption and impact assessment; and visits of senior Iraqi scientists (one per year) to one Australian research institute (6-8 weeks). The project will also support the participation of Iraqi personnel in regional or international workshops and conferences of relevance to the project. The MOA, in nominating staff for training, and ICARDA, in the design of training content, will ensure that trained personnel are in a position, on their return to Iraq, to benefit from their experience and to both consolidate and implement their training

ICARDA and the Australian partners will also investigate Post-graduate training possibilities for Iraqi personnel, which can be funded from other Australian sources.

### 3.3. a. Flow chart (Methodologies)

Objective	Activity	Time line (Yr & mo) Assume start May 05	Milestone
1. To identify, promote and widely disseminate amongst farmers in the rainfed cropping regions of northern Iraq “best-bet” improved varieties and crop management systems for wheat, barley and pulse and forage legumes.	1.1 Compile and review current available information on farmers’ practices and production and economic / marketing constraints.	Yr 1, m1 (May 05)	Review completed – gaps in information identified
	1.2 Baseline survey and analysis of production constraints/limitations in individual agro-climatic zones (survey team to be identified from Iraq).	Yr 1, m2-3 (Jun-Jul 05)	Survey completed. Major production constraints identified in each zone
	1.3 Compile, review and analyse existing information on potential available technology options, i.e., options already tested in Iraq, including registered Iraqi varieties of target crops and crop management options ( <i>explained further under methodology</i> ).	Yr 1, m2-3 (Jun-Jul 05)	Analysis of potential available technology options completed
	1.4 Round table discussion between project partners and representative farmers from the three agro-climatic zones to review options and decide best-bet technologies to be promoted in each zone	Yr 1, m-5 (Sep 05)	Agreed list of best-bet technology options to be demonstrated in each agro-climatic zone
	1.5 First Annual Project Planning meeting of all project partners (immediately following round table discussion).	Yr 1, m5 (Sep 05)	Annual research and training plan for first year
	1.6 Based on work plan, select sites and participating host farmers and farmer groups for on-farm demonstrations. 3-5 demonstrations in each agro-climatic zones (10-15 demonstrations total)	Yr 1, m5-6 (Sep-Oct 05)	Sites, host farmers and participating farmer groups identified.
	1.7 Implement on-farm demonstrations	Yr 1 (Nov05-Jun06) Yr 2 (Nov06-Jun07) Yr 3 (Nov07-Jun08)	On-farm demonstrations established at each site. Methods (protocols) for monitoring and farmer evaluation developed
	1.8 Monitor demonstrations and jointly evaluate options with farmer groups to identify preferences and/or potential constraints to adoption.	Yr 1 (Nov05-Jun06) Yr 2 (Nov06-Jun07) Yr 3 (Nov07-Jun08)	Input-output data collected and cost-benefit analyses of demonstrations completed. Farmers’ preferences recorded and potential constraints identified.

Objective	Activity	Time line (Yr & mo) Assume start May 05	Milestone
	<p>1.9 Field days for farmers and development of extension material to disseminate information on new options.</p> <p>1.10 Annual project review and planning meetings to review results of previous year and agree work plan for coming year</p> <p>1.11 Assess potential adoption and impact of technologies based on information from baseline surveys and results from demonstrations.</p>	<p>Yr 1, Yr 2, Yr 3</p> <p>Sep 06 Sep 07</p> <p>Yrs 2 and 3</p>	<p>Field days for farmers and other stakeholders held each year (May). Extension material prepared and distributed.</p> <p>Annual reports. Annual research and training plan for next year</p> <p>Adoption and impact assessments completed</p>
<p>2. To introduce, evaluate and select improved germplasm of wheat, barley and pulse and forage legumes for adaptation to rainfed farming systems in northern Iraq</p>	<p>2.1 Identify potential lines from Iraq, ICARDA's international nurseries, Australia, and other sources.</p> <p>2.2 First Annual Project Planning meeting of all project partners.</p> <p>2.3 Introduce and evaluate improved lines in the three research stations (one in each agro-climatic zone). Jointly evaluate lines with farmer groups.</p> <p>2.4 Annual project review and planning meeting to review results of 1<sup>st</sup> years evaluation and agree work plan for 2<sup>nd</sup> cropping season</p> <p>2.5 Selected entries from Yr 1 will be evaluated in the research stations (3 trials) and in replicated trials on farmers' fields in 3 sites in each agroclimatic zone (3x3 = 9 trials). Jointly evaluate cultivars with farmer groups.</p> <p>2.6 Annual project review and planning meeting to review results of 2<sup>nd</sup> year's evaluation and agree work plan for 3<sup>rd</sup> cropping season</p> <p>2.7 Selected entries from Yr 2 will be evaluated in the research stations (3 trials) and in replicated trials on farmers' fields in 3 sites in each agroclimatic zone (3x3 = 9 trials). Jointly evaluate cultivars with farmer groups.</p>	<p>Yr 1 (May – August 05)</p> <p>Sep 05</p> <p>Yr 1 (Nov05-Jun06)</p> <p>Sep 06</p> <p>Yr 2 (Nov06-Jun07)</p> <p>Sep 07</p> <p>Yr 3 (Nov07-Jun08)</p>	<p>List of potential lines for evaluation</p> <p>Agreed list of lines to be evaluated. Annual research and training plan for first year</p> <p>Methods (protocols) for monitoring and farmer evaluation developed. Selection of best entries.</p> <p>Annual reports. Annual research and training plan for next year</p> <p>Selection of best entries in each research station and in each farmer's field for further evaluation.</p> <p>Annual reports. Work plans for next year</p> <p>Agreed list of selected lines for each agro-climatic zone</p>

Objective	Activity	Time line (Yr & mo) Assume start May 05	Milestone
	2.8 Identify promising lines for registration and release. 2.9 Develop capacity at Rabia station to produce seed for research and demonstrations	Yr 3 (Jul 08) Yr 1	List of lines Equipment purchased and seed quality control in place.
3. To identify, evaluate and select improved cropping system management options suited to rainfed farming systems in northern Iraq.	<p>3.1 Based on collective knowledge, identify and prioritize those constraints/limitations in crop production systems that are not covered under Objective 1 and that are not addressed by other projects and activities in Iraq, which need further research to identify improved crop and soil management practices (done alongside activities 1.1 – 1.4 under Objective 1)</p> <p>Potential research areas already identified with Iraqi partners are: tillage and sowing systems, pest and weed management, and new crop rotation options.</p> <p>3.2 First Annual Project Planning meeting of all project partners</p> <p>3.3 On-station research on crop management options to fill gaps in information. Joint evaluation of options with farmer groups.</p> <p>3.4 Annual project review and planning meeting to review results of 1<sup>st</sup> year and agree work plan for 2<sup>nd</sup> year</p> <p>3.5 Based on 1<sup>st</sup> year's results implement on-station and farmer-managed on-farm (3 sites in each agro-climatic zone) research trials of potential options Joint evaluation of options with farmer groups. Identify potential constraints to adoption.</p> <p>3.6 Annual project review and planning meeting to review results of 2<sup>nd</sup> year and agree work plan for 3<sup>rd</sup> year</p>	<p>Yr 1, m-5 (Sep 05)</p> <p>Yr 1, m5 (Sep 05)</p> <p>Yr 1 (Nov 05 – Jun 06)</p> <p>Sep 06</p> <p>Yr 2 (Nov06 – Jun07)</p> <p>Sep 07</p>	<p>List of production constraints to be addressed in research trials</p> <p>Annual research and training plan for first year</p> <p>Methods (protocols) for monitoring and farmer evaluation developed. Input-output data collected and cost-benefit analyses of trials. Farmers' observations recorded</p> <p>Annual reports. Research and training plan for 2<sup>nd</sup> year</p> <p>Input-output data collected and cost-benefit analyses of trials. Farmers' preferences recorded and potential constraints identified</p> <p>Annual reports. Research and training plan for 3<sup>rd</sup> year</p>

Objective	Activity	Time line (Yr & mo) Assume start May 05	Milestone
	<p>3.7 Based on 2nd year's results implement on-station and farmer-managed on-farm (3 sites in each agro-climatic zone) research trials of potential options Joint evaluation of options with farmer groups. Identify potential constraints to adoption.</p> <p>3.8 Identify options for introduction into promotion and dissemination program under Objective 1.</p>	<p>Yr 3 (Nov07 – Jun08)</p> <p>Yr 3</p>	<p>Input-output data collected and cost-benefit analyses of trials. Farmers' preferences recorded and potential constraints identified</p> <p>List of identified options. Recommendations for measures to mitigate constraints to adoption.</p>
<p>4. To enhance the capacity of Iraqi research and extension program to identify and evaluate potentially valuable germplasm and better crop/soil management technologies and promote their adoption by farmers</p>	<p>4.1 Annual Project Meetings: Develop program of training including on-the-job coaching, short term (3-4 weeks) courses, workshops, individual visits to ICARDA and/or Australian partners, and selective longer term activities*. MOA to nominate suitable staff for training.</p> <p>4.2 Short-term training courses in germplasm evaluation, cropping systems management, seed production &amp; seed quality control, integrated pest/disease/weed management, and extension methods (5 x 4 trainees = 20 Iraqi staff per year)*</p> <p>4.3 Individual training for MOA staff in economic analysis, adoption and impact assessment (2 persons).</p> <p>4.4 Senior Iraqi scientists (one per year) visit one Australian research institute (6-8 weeks)</p> <p>4.5 Support participation of Iraqi personnel in regional or international workshops and conferences of relevance to the project (potential workshops to be identified by project partners. MOA selects participants).</p> <p>* Appropriate location of training, visits, etc and involvement of ICARDA and Australian partners in training activities, to be decided based on comparative advantages of ICARDA and Australian partners and relative costs.</p>	<p>Year 1 (Sep 05) Year 2 (Sep 06) Year 3 (Sep 07)</p> <p>Yrs 1, 2 and 3</p> <p>Yr 1</p> <p>Yrs 1, 2 and 3</p> <p>Yr 1, Yr 2, Yr 3</p>	<p>Annual report on previous years training (Yrs 2 and 3); Agreed detailed training plan for next year (participants, subjects, locations)</p> <p>20 Iraqis complete training each year</p> <p>2 Iraqi staff complete training and develop work plans for economic analysis, adoption and impact assessment</p> <p>2 Iraqi scientists visit Australia each year</p> <p>Iraqi personnel interact with international research community.</p>

## 3.3.b Travel Table

Person(s) or position travelling	Approximate date of travel	From / to	Purpose	Duration (days Travel Allowance)
<b>PART A Commissioned Organisation or IARC</b>				
None, unless security situation in Iraq substantially improves, in which case budget for travel for Iraqis to Syria, would be used partially for travel of ICARDA staff to Iraq.				
<b>PART B Australian Collaborating Organisation/s</b>				
DAWA: Project scientist	Yr 1, Sept	Perth to Aleppo, Syria	Attend planning workshop and annual coordination meeting	10
CLIMA: Project scientist	Yr 1, Sept	Perth to Syria	Attend planning workshop and annual coordination meeting	10
University of Adelaide	Yr 1, Sept	Adelaide to Syria	Attend planning workshop and annual coordination meeting	10
DAWA: Project scientist	Yrs 2 and 3 Sept	Perth to Syria	Attend annual coordination meetings	10
CLIMA: Project scientist	Yrs 2 and 3 Sept	Perth to Syria	Attend annual coordination meetings	10
University of Adelaide	Yrs 2 and 3 Sept	Adelaide to Syria	Attend annual coordination meetings	10
<b>PART C Overseas Partner Organisation/s</b>				
Trainees (23)	Yrs 1, 2 and 3 Various times of year depending on subject of training and scheduled training courses	Iraq to Aleppo, Syria	Training	4 weeks
One senior Iraqi scientist	Yr 2, May	Iraq to Adelaide	Visiting scientist	6-8 weeks
One senior Iraqi scientist	Yr 2, May	Iraq to Perth (DAWA)	Visiting scientist	6-8 weeks
One senior Iraqi scientist	Yr 3, May	Iraq to Perth (CLIMA)	Visiting scientist	6-8 weeks
Iraqi research team (Project Coordinator and Team Leaders)	Yr 1, Sept	Iraq to Aleppo, Syria	Attend planning workshop and annual coordination meeting	10 days
Iraqi research team (Project Coordinator and Team Leaders)	Yrs 2 and 3 Sept	Iraq to Syria	Attend annual coordination meetings	10 days

### 3.4 Intellectual properties and other regulatory compliance

As an international centre, ICARDA's research outputs are regarded as public goods. ICARDA operates according to the following clause stated in all its research agreements:

“All inventions, improvements, original works and/or discoveries, which are conceived or made during collaborative projects by one or more employees of each partner will remain the property of that partner, which will have the right to seek intellectual property protection. Each partner would grant the other partner the right to use such inventions, improvement, original works and/or discoveries internally for research purposes only. Each partner would grant all NARS partners the rights to such inventions, improvement, original works and/or discoveries internally for non-commercial purposes. Each partner will not transfer to third parties or sell or commercialise in any form the intellectual property conceived or made during collaborative projects without prior written approval of the other partner.”

In arrangements with national programs, ICARDA operates within the CGIAR's policy on plant genetic resources, which has been developed within the context of international conventions and agreements.

There will be extensive transfer of genetic resources to Iraq. Plant genetic material from ICARDA and from the Australian institutes will be freely available to Iraq, subject to the terms of the respective institute's Material Transfer Agreements.

### 3.5 Project personnel

#### (i) List of participants involved in the project

##### *Australian Commissioned and collaborating organisations (or IARC)*

Name	Sex (M/F)	Agency	Position	% Time in project	Funded by
Project Manager	M	ICARDA	Director, Diversification and Sustainable Improvement of Crop and Livestock Production Systems	20	ICARDA
Kamel Shideed	M	ICARDA	Agricultural economist	10	ICARDA
Mustafa Pala	M	ICARDA	Cropping systems management / agronomist	10	ICARDA
Hanadi Dessougi	F	ICARDA	Soil management and crop nutrition	10	ICARDA
Osman Abdullah	M	ICARDA	Bread wheat breeder	10	ICARDA
Miloudi Nachit	M	ICARDA	Durum wheat breeder	10	ICARDA
Stefania Grando/ Salvatore Ceccarelli	F/M	ICARDA	Barley breeder	10	ICARDA
Rajendra Malhotra	M	ICARDA	Chickpea breeder	10	ICARDA
Ashutosh Sarker	M	ICARDA	Lentil breeder	10	ICARDA
Ali Abd El Moneim	M	ICARDA	Forage legume breeder	10	ICARDA
Amor Yahyaoui / Bassam Bayaa	M	ICARDA	Pathologists: IPM	10	ICARDA
Mustapha El- Bouhssini	M	ICARDA	Entomologist: IPM	10	ICARDA

Name	Sex (M/F)	Agency	Position	% Time in project	Funded by
Prof K Siddique	M	UWA-CLIMA	Agronomist	10	UWA
Dr P White	M	DAWA-CLIMA	Pulse agronomist	5	DAWA
Dr J Berger	M	UWA-CLIMA	Agronomist/physiologist	5	UWA
Mr W McLeod	M	DAWA-CLIMA	Plant pathologist	5	DAWA
Mr. K. Alcock	M	DAWA	Weed management	5	DAWA
Dr. W. Anderson	M	DAWA	Systems Agronomy	10	DAWA
Mr. R. Lance	M	DAWA	Barley Breeder	5	DAWA
Prof D. Coventry	M	Un. Adelaide	Agronomist/Soil Scientist	10	Adelaide
G. Gill	M	Un. Adelaide	Weed agronomy	10	Adelaide
I. Newburg	M	Un. Adelaide	Extension methods specialist	10	Adelaide

***Partner country (or country research institutions)***

Name	Sex (M/F)	Agency	Position	% Time in project	Funded by
Abdul-satar Alrajbu	M	MOA	Project Manager	100	MOA
Adnan Aladary	M	MOA	Team Leader	100	MOA
Kasim Khalil	M	MOA	Team Leader	100	MOA
Kahran Saed	M	MOA	Team Leader	100	MOA
Research teams (3 x 6)*	M/F	MOA	Researcher	50%	MOA
Extension staff (20)*	M/F	MOA	Technician	50%	MOA

\* The Ministry will assign (with names to be advised):

a) three research teams, each consisting of barley, wheat and legume scientists, an agronomist, a plant protection specialist and a socio-economist, to implement the research program (baseline surveys, on-farm trials, monitoring and evaluation) in each agroecological zone. One of these teams will also be responsible for the on-station research under Objectives 2 and 3.

b) three extension teams, each consisting of 4 to 5 staff, that will be responsible for implementing the demonstration program under Objective 1 in each of the 3 agroclimatic zones.

**(ii) Description of the comparative advantage of the institutions involved**

ICARDA's mission is to improve the welfare of people through research and training in dry areas of the developing world, by increasing the production, productivity and nutritional quality of food, while preserving and enhancing the natural resource base. The geographic scope of ICARDA's research covers the countries of West and Central Asia and North Africa (CWANA) and other developing countries with sub-tropical and temperate dry areas. ICARDA has global responsibility for the improvement of lentil, barley and faba bean; responsibility in dry areas for the on-farm management of water, the improvement of small ruminant nutrition and productivity, and the rehabilitation and management of rangelands; and responsibility in the CWANA region for the enhancement of the productivity of bread and durum wheat, chickpea, forage legumes and their associated farming systems, and for ensuring the conservation and management of the natural resource base of water, land, and biodiversity.

Iraq lies within the eco-regional mandate of ICARDA and, therefore, from the very establishment of the Center, ICARDA has collaborated with the national programs in Iraq comprised of institutions of the Ministry of Agriculture, IPA Center for Advanced Agricultural Research, and the Universities of Baghdad, Mosul, and Dohuk. ICARDA holds annual/biennial coordination meetings with the NARS of Iraq in which joint research program and human capacity resource development activities of the previous period are reviewed and plans for next year developed.

To conserve its genetic resources collections, in 1996 the national program of Iraq sent hundreds of genetic resources accessions of different crops to ICARDA to be held in the long-term cold store in a “black box” format. The number of accessions of Iraqi origin held in major gene banks outside Iraq is limited; the largest collection is at USDA (1,113 accessions) while ICARDA holds 1,003 accessions of mandated crops. ICARDA has distributed 1501 germplasm accessions from our gene bank holdings to Iraq for use in crop improvement programs

Over the years ICARDA has distributed to breeding programs in Iraq a wide range of improved genetic material. As a result improved varieties of spring bread wheat (6) and durum wheat (2) from the CIMMYT/ICARDA wheat program; and barley (4 varieties), lentil (2), and chickpea (4) from ICARDA have been released to Iraqi farmers and are being grown on large areas (see Annex 2). For example, there is estimated to be some 200,000 ha of the barley variety Rihane 3 grown by farmers in rainfed areas in northern Iraq, representing about 14% of the barley sown annually.

ICARDA is unique among the CGIAR centres in having a Seed Unit, which is dedicated to improve the diffusion of genetic improvements from research to farmers, mostly by strengthening national seed systems. At present the ICARDA Seed Unit is widely recognised as a lead center and source of expertise on issues related to seeds in the region and beyond. The Seed Unit also has the expertise to provide training in seed industry development, including production and quality control.

Iraq participates in a regional adaptive research program for the *Development of Integrated Crop/Livestock Production in Low Rainfall Areas of WANA* (the “Mashreq/Maghreb project” noted earlier) coordinated by ICARDA. This project has developed a community approach to produce, with the participation of community members and other stakeholders, packages of “best-bet” technical, institutional and policy options to support livestock production in dry areas. The community approach has also focused on developing or strengthening appropriate local institutional support for community development plans. Considerable progress has been made in the development and delivery of technological packages related to on-farm feed production, alternative feed sources and improvement of the management and productivity of small ruminants.

With respect to human resources and capacity building, ICARDA has trained a total of 347 Iraqi scientists in various training courses since 1979 including recently in the application of biotechnology for crop improvement and training in GIS and remote sensing. ICARDA is already a partner with the University of Hawaii within the USAID supported AHEAD (Agricultural Higher Education and Development) to rehabilitate the research infrastructure and agricultural research programs at the University of Mosul’s College of Agriculture and Forestry and the University of Dohuk’s College of Agriculture, and has also provided technical assistance to the USAID supported ARDI (Agricultural Reconstruction and Development for Iraq) through the provision of quality seed.

The Department Agriculture of Western Australia (DAWA) has of climatic and agricultural systems comparable with northern Iraq. DAWA is the key provider of farming systems and crop improvement research that has taken Western Australian cropping systems to the forefront of applications of minimum tillage, weed management and high yielding cereal and pulse crops.

The Roseworthy Campus of the University of Adelaide provides ideal facilities for the capacity training of Iraqi scientists (Objective 4 of the project). Roseworthy has relatively cheap accommodation available in serviced apartments for the visiting scientists. Library resources, computing and agronomy and crop breeding personnel are located on this Campus. Further, the Roseworthy Campus is linked with the Waite Campus by a dedicated (1 hour) bus service; specialist plant breeding is undertaken at the University's Waite Campus.

**(iii) Summary details of the research capacity, skills and role of each participant involved**

***Ministry of Agriculture, Iraq:***

The Ministry will be primarily responsible for implementing the demonstration program in the three agroclimatic zones in Nineveh Governorate and the research trials in the research station(s). The Ministry will appoint a full-time Project Manager who will coordinate all activities within Iraq and coordinate activities with the Project Manager at ICARDA and, where needed, with the USAID ARDI project. The Ministry will be responsible for managing the project funds allocated for activities within Iraq.

Ministry personnel will include one team, consisting of 4 to 5 staff, in each agroclimatic zone that will be responsible for implementing the demonstration program under Objective 1. In addition, the Ministry will assign scientists at each of the three research stations in Nineveh Governorate, to include barley, wheat and legume scientists, an agronomist, a plant protection specialist and a socio-economist. All staff will participate in the annual project review and planning meetings. At each site, the Agricultural Section head will provide coordination.

The Ministry will be responsible for identifying and nominating the staff that will participate in training, visits to Australian institutes and other capacity-building activities.

***ICARDA:***

ICARDA will be responsible for the overall management of the project and will conclude a project agreement with ACIAR. Under this project agreement, ICARDA will sign a separate agreement with the Ministry of Agriculture of Iraq, specifying how the project will be implemented, the roles and responsibilities of each partner, and management of budget and expenditures.

ICARDA will appoint a Project Manager from its senior staff. This is expected to be the Director of ICARDA's new megaproject on *Diversification and sustainable improvement of crop and/or livestock production systems in the dry areas*. (MP4 in ICARDA's Medium-Term Plan). In the interim, Dr. Ali Abd El Moneim is acting as the Project Manager. MP4 contributes to the overall aim of developing productive and sustainable agricultural systems that conserve the resource base while supporting rural livelihoods in the dry areas. Major elements include the development of options to both increase and diversify the value of crop production and enhance feed/livestock production systems. The Project Manager will, thus, ensure that the project activities are undertaken with an integrated approach to cropping systems management and improvement.

The project will also link with planned activities in Nineveh Province within the next phase of the “Mashreq/Maghreb project” coordinated by ICARDA. Iraq is also participating in a project on *Community-based optimization of the management of scarce water resources in agriculture in West Asia and North Africa*, coordinated by ICARDA, which includes research on optimising the use of supplemental irrigation on wheat.

All ICARDA staff will contribute to providing germplasm and technical assistance in cropping system management; will participate fully in the planning of the project and the design, monitoring, and evaluation of demonstrations and research trials; and training and capacity building of Iraqi partners.

*Project Manager (to be appointed)*: will have extensive international experience in cropping systems management and improvement.

*Dr. Kamel Shideed* is a Senior Agricultural Economist at ICARDA and Director of ICARDA’s megaproject on Poverty and Livelihood Analysis. Of Iraqi nationality, he was formerly Director of the IPA research institution in Iraq. His key role will be in advising and training Iraqi staff in the implementation of the baseline surveys and in activities related to assessing the potential adoption and impact of improved agricultural technologies. He will be assisted by other socio-economists at ICARDA, including specialists in gender analysis.

*Dr. Mustafa Pala* is ICARDA’s Cropping Systems Agronomist. His role will be in assisting in the planning, design, implementation, and assessment of cropping systems management practices and in training in agronomic research and cropping systems management.

*Dr. Hanadi Dessougi* is a Post-doctoral Fellow in soil management and crop nutrition at ICARDA. Her current research includes participatory approaches to monitoring nutrient flows in farmers’ fields and at the household level. Her role in the project will be to work with the cropping systems agronomists in identifying and evaluating potential improved crop and soil management practices and providing training in soil management and crop nutrition.

*Dr. Osman S. Abdalla* is the Bread Wheat Breeder at ICARDA. His role in the project will include identification and dissemination of improved varieties, identification, evaluation and selection of new improved and adapted germplasm to Iraqi conditions in addition to contributing to training in the identification and evaluation of potentially valuable germplasm.

*Dr. Miloudi Nachit* is the Durum Wheat Breeder at ICARDA. His role will be to advise and assist the Iraqi program in testing durum cultivars with high grain productivity in combination with tolerance to drought, cold, and heat stresses; and improved grain qualities for durum wheat products (burghul and pasta) and training of Iraqi durum scientists in breeding, grain quality, and stress physiology at ICARDA.

*Dr. Stefania Grando* and *Dr. Salvatore Ceccarelli* are Barley Breeders at ICARDA. Their role in the project will include identifying available improved varieties for immediate dissemination; identifying, evaluating and selecting new improved germplasm adapted to specific agroclimatic conditions and end uses in Iraq; and contributing to training in farmer participatory plant breeding approaches and the evaluation of potentially valuable germplasm.

*Dr. R. S. Malhotra* is the Chickpea Breeder at ICARDA. His role will be in identifying and disseminating improved varieties; identifying, evaluating and selecting new improved

germplasm adapted to specific agroclimatic conditions and end uses in Iraq; and training in chickpea improvement, including germplasm evaluation and crop management practices.

*Dr. Ashutosh Sarker* is the Lentil Breeder at ICARDA. His role will be in identifying and disseminating improved varieties; identifying, evaluating and selecting new improved germplasm adapted to specific agroclimatic conditions and end uses in Iraq; and training in lentil improvement, including germplasm evaluation and crop management practices.

*Dr. Ali M Abd El-Moneim* is the Forage Legume Breeder at ICARDA. Research has focused on developing improved cultivars of forage legume species for use in crop rotations and for rehabilitating marginal lands, and for different end uses (grain/straw, hay-making, grazing) . His role in the project will include identifying available improved varieties of forage legume species for immediate dissemination; identifying, evaluating and selecting new improved material adapted to Iraqi conditions and end-uses; and contributing to training forage legume improvement and management within crop/livestock systems

*Dr. Amor Yahyaoui/Dr. Bassam Bayaa:* Dr. Yahyaoui is the Cereal Pathologist and Dr. Bayaa is the Legume Pathologist at ICARDA. Their roles will be advising and training Iraqi staff in the monitoring and assessment of the disease situation in northern Iraq, and the management of cereal and legume diseases, including training in disease resistance, epidemiology, and integrated pest management practices.

*Dr. Moustafa El-Bouhssini* is ICARDA's Entomologist. His roles will be advising and training Iraqi staff in the monitoring and assessment of the insect pest situation in northern Iraq, and in the management of insect pests (particularly Sunn Pest of wheat) including training in integrated pest management practices.

### **Australia:**

*Dr. K. Siddique* is Australia's leading pulse research scientist. He leads a major grain legume initiative in Australia and is a successful current producer of new cultivars with colleagues of WADA. Professor Siddique and Dr Peter White have wide experience in the region having worked with ICARDA. Dr White is a widely experienced pulse agronomist with emphasis on production agronomy. Dr Khan leads the DAWA Chick pea and field pea program, which is linked, closely with CLIMA. All are well skilled in the management and reporting on ACIAR projects.

*Keith Alcock:* Keith Alcock is the manager of General Breeding in DAWA and manages the wheat, barley and oat breeding programs. His background is in crop protection. He is an acknowledged expert in integrated pesticide resistance. He established the WA Herbicide Resistance Imperative (WAHRI) which is Australian's leading research group in Integrated Weed Management. He will contribute to project planing and design, and provide technical assistance and training in integrated pest and weed management. His key role will be in Project management and training in integrated pest and weed management.

*Dr. Wal Anderson:* Dr. Anderson is a renowned farming systems agronomist with wide experience in Middle East agriculture. He has worked in Iraq in different FAO projects over many years. In DAWA he leads the Agronomy Group in farming systems and crop specific agronomy and has expertise in minimum and optimum crop establishment. He will contribute to project planing and design, and technical assistance and training in farming systems and crop agronomy; minimum tillage.

*Dr. Reg Lance:* Dr. Lance is the Senior Barley Breeder in WADA, the program responsibility for the leading malting barley venture across the major barley production areas of Australia. He has background of post graduate training and supervision in Adelaide University and in WA and is an expert in the theoretical and practical aspects of plant breeding. His key role will be Project management and training in crop improvement.

*Professor David Coventry:* Dr. Coventry is Professor of Soil and Land Systems in the School of Earth and Environment Sciences, Faculty of Sciences, University of Adelaide. He will be responsible for the overall input of the University of Adelaide. His specific responsibilities will be to contribute to planning for the crop management demonstrations and research experiments and the training of Iraqi MOA personnel in Australia.

*Dr Gurjeet Gill:* Dr. Gill is a Senior Lecturer with the University of Adelaide. He is an experienced weed scientist and is working on cropping systems (including tillage system development), weed ecology, and herbicide resistance. Dr Gill is an accomplished teacher and communicator, postgraduate supervisor and scientific writer (40 research publications). Dr Gill also has extensive experience with system development based on strategic research in India as part of the successful ACIAR project (CS1/96/13). This farming systems research project has resulted in significant crop practice change particularly relating to tillage, time of sowing and resource management on small farm holdings. Dr Gill will contribute in the identification of best-bet strategies and capacity training.

*Dr Ian Nuberg:* Dr. Nuberg is a Senior Lecturer with the University of Adelaide. He teaches and undertakes research in communication and extension strategies and Farming System Research methodology. D Nuberg has extensive experience working with international students from a wide background base. He also has research experience in Sri Lanka and Cambodia. Dr Nuberg will provide input in the training period that the Iraqi scientists spend in Australia. For this he will liaise with key staff from the South Australia No Till Farmers Association and Rural Solutions (SA), for the visitors to gain first-hand experience in farmer participation and on-farm research.

*Dr Jason Eglinton:* Dr Eglinton is the Leader of the University of Adelaide Barley Program. Dr Eglinton has a successful track record in breeding and commercial release of feed, hull-less and malting barley varieties, has been responsible for the development and supervision of the Australian low rainfall barley program, and is involved in extensive collaboration with ICARDA through projects supported by the GRDC, Molecular Plant Breeding CRC, and the GENERATION Challenge Program. Dr Eglinton contributes expertise in trial site selection, the agronomic, technical and logistics management of field trial programs, and the identification of best bet varieties and germplasm suited to the Iraq production environment.

## **SECTION 4: Project Outcomes and Adoption**

### **4.1 Communication and dissemination strategies**

Uptake of project outputs (improved varieties and soil/crop management) will be promoted directly through the project under Objective 1. It is expected that demonstrations will be established and field days will be held regularly around the Nineveh (Rabia Research Station), and perhaps more widely depending on resource and security issues. It is planned to take a farmer-participatory approach to regional trials, demonstrations and promotion of new varieties and crop/soil management technologies, so there is feedback on desired attributes in the

distributed material. Seed production will be promoted through rehabilitation of national and community-based seed systems to enable distribution of quality seed to farmers.

Publications will be prepared by in both Arabic and English outlining features of the research program. Attractive leaflets for the participatory farmers to distribute will back the farmer participatory research. These brochures will contain crop management recommendations as well as recommended cultivars.

The farmer participatory approach being adapted by ICARDA is a sound strategy for ensuring rapid uptake of successful technology provided it has the backing of extension officers and the farmers can see a direct benefit. Workshops will be a feature of the project. These will be of a technical nature and where required will call upon expertise from outside the project partners if strategic to do so. Workshop proceeding will be published without delay. The workshops will feature both extension and scientific staff and administrators in an effort to coordinate the development of organizational strategies in Iraq. For the purpose of the project the direct linkages with the Ministry in Baghdad and Research station staff in the target regions will be specific targets for improved communications and email and phone systems up graded. Technologies will also be promoted through ICARDA networks and projects in Iraq, including the Mashreq/Mahgreb Project mentioned above.

#### **4.2 Enhancement of research capacity**

Capacity building is also a component of the project, with international and local training provided on methodologies and practice of identification and promotion of new crop varieties and better crop management technologies under Objective 4. Researchers and extension officers will take part in active improvement and extension training programs in ICARDA and Australia, and also attend courses in modern extension theory and practice. Annual training programs will be agreed at the annual planning meetings, and care will be taken to ensure that equal importance is given to the training of extension personnel as well as research staff.

As soon as possible in the project, research and extension staff will have an active role in the selection of the material to be tested in the genotype x environment studies and the establishment of trials/demonstrations in the field. Extension officers will be responsible for organising farmer visits to the sites and farmer evaluation of accessions and technologies being tested and promoted. The project will also provide an avenue for Iraqi scientists to re-establish international collaborative linkages with the wider scientific community through scientific exchanges and attendance at relevant conferences and workshops.

#### **4.3 Economic benefit**

The area, production and yield of target crops in Nineveh Province have been estimated based on ICARDA information on national crop areas, production and yield and the percentage of wheat and barley in Nineveh Province, as shown in the table below.

Current yields of barley and wheat are low (<1 t/ha) and it is likely they could be doubled through the joint development of appropriate cultivars and better crop management. Reliable figures on the value of pulses (lentils and chickpea) are not available, so average export prices in Syria have been used. It is likely that similar yield improvements are possible and additional benefits would accrue from nitrogen fixation, improved soil fertility, and better human and livestock nutrition through high-protein legumes in the diet. The value of promoting forage legume production would be realized primarily through livestock production, and has not been estimated in the table below.

### Estimated crop areas, yields and production in Nineveh Province

	Area (000 ha)	Production (000MT)	Yield (kg/ha)	Price (US\$ /MT)	Price (AUD/MT)
Cereals					
Wheat	430	273	636	150	200
Barley	490	242	495	110	147
Pulses	-				
Lentils	2.26	1.83	808	350	467
Chickpea	1.69	1.14	675	300	400

### Estimated economic benefits (AUS\$ '000)

Year	Project costs	Associated Costs	Project Benefits	Gross value
Year 1	638	506		
Year 2	281	506		
Year 3	281	506	10% improvement in wheat and barley production on 25% of area	2,257
			10% improvement in pulse production on 25% of area	33
Year 10			50% improvement in wheat and barley production on 50% of area	20,311
			50% improvement in pulse production on 50% of area	
Total	1340	2,180		22,895
Total net benefit				<b>19,177</b>

The likelihood of achieving a substantial proportion of these benefits is high but will depend greatly on political stability and other funds being furnished as recommended to upgrade research stations and equipment for farmers. Farmers everywhere are keen to adopt new cultivars, and much of the benefit comes from the seeds, especially where better crop and soil management allow better varieties to perform to their potential. Political stability is essential, as is the development of more commercial marketing arrangements and pricing to enhance benefits, especially to poor farmers. Neither factor is under the immediate influence of the project.

#### 4.4 Social benefit

Seven million Iraqis live in rural areas, with their wellbeing largely influenced by the status of agriculture. The transition from the subsidised input/guaranteed price system previously in place to a free and competitive market system will undoubtedly be difficult for farmers and dependent communities. Improving crop yields and international competitiveness are considered to be essential components of that transition, and will be assisted by this project.

#### 4.5 Environmental benefit and possible negative environmental outcomes

The introduction, evaluation, promotion and uptake of better-adapted germplasm of currently grown crops are not expected to have negative environmental effects. The pulse and forage legumes introduced and promoted in the project should have a positive impact on the sustainability of the cropping systems by increasing water use efficiency, soil fertility and providing a disease-break through better crop/legume rotations. The introduction of reduced tillage systems and better crop/soil management technologies is likely to result in significant water savings and in a reduction in soil erosion, representing a positive environmental impact.

<b>SECTION 5: Budget</b>
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The budget provides for:

- (a) Funds to be sent to Iraq and utilized for expenditures within Iraq
- (b) Funds expended by ICARDA for activities to support the Iraqi partners (e.g., travel of Iraqis to ICARDA, training, provision of materials and supplies sent to Iraq, etc)
- (c) Funds expended by Australian partners to support the Iraqi partners (e.g. travel to participate in project meetings and workshops; training; provision of materials sent to Iraq).

ICARDA and the collaborating Australian partners will also contribute to the project through the in-kind contribution of their staff time, overheads and infrastructure.

## SECTION 6: Additional Documentation

This section applies to **full proposals only**. The following are required to be attached:

- **Letters of support** from each national research institution and/or government planning agency of the partner country/ies, IARCs (if involved in the project) and the Australian institution/s should be attached if possible, although in some cases these are not obtainable until the proposal is approved by ACIAR. Letters of support should include a statement confirming that the project leader will be available for the percentage of his/her time indicated, and will not be absent from the project for significant times (usually greater than 2 months) during the project without prior agreement with ACIAR.
- **Letters of approval for use of Genetically Modified Organisms, and/or experimental animals** if relevant. Document procedures required in all countries where such experiments will be undertaken and attach copies of approvals obtained.
- Any letters confirming **compliance with regulations related to germplasm transfer, quarantine on plant, soil and animal movement, biosafety, recombinant DNA release, animal rights**, etc as addressed in subsection 3.4
- Short (half-page) **curricula vitae** (resumes, biodata) of the key project staff for the Australian commissioned organisation, collaborating organisations and the partner country/ies and IARCs (if involved in the project). CV for the leaders and one key researcher from each collaborating institution would usually be sufficient. Publication lists need not be included.

### Privacy Statement

ACIAR, as a Commonwealth government agency, is required to comply with the eleven Information Privacy Principles as set out in section 14 of the *Privacy Act 1988* ([www.privacy.gov.au/publications/ipps.html](http://www.privacy.gov.au/publications/ipps.html)). These are based on the 1980 OECD guidelines governing the protection of privacy and trans-border flows of personal data. The personal information provided in this project proposal, including CVs, is stored in hard copy and electronic format in ACIAR. The information is reproduced internally for the purpose of meetings to consider project proposals. It is reproduced for restricted external purposes as part of the contractual documentation exchanged with the commissioned organisation, collaborating institution(s) and partner country government(s). Personal information (individuals' contact details) is also stored in ACIAR's project information system. ACIAR endeavours to keep this information as up to date as possible, with the assistance of the individuals whose details are recorded. The names and contact details of Project Leaders may be listed with project details on the ACIAR web site and provided to other databases and media in the context of briefings and publicity on the ACIAR project portfolio. ACIAR does not divulge any other personal information to third parties for any other purpose.

## Appendix A: Intellectual Property Register

### Intellectual Property Details

#### 1. Administrative Details

<b>Project ID</b>	CIM/2004/024
<b>Project Title</b>	Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq
<b>Assessment provided by</b>	Dr Liz Bailey
<b>Date of assessment</b>	Project Officer ICARDA 22 March 2005

#### 2. Categories of Intellectual Property and brief description

##### 2.1 Plant or Animal germplasm exchange

Does the project involve:

- |  |     |
|--|-----|
| • provision of germplasm by Australia to a partner country?                                    | Yes |
| • provision of germplasm from a partner country to Australia?                                  | No  |
| • provision of germplasm from or to an IARC or another organisation and a project participant? | Yes |
| • use of germplasm from a third party  | No  |
| • material subject to Plant Breeders/Variety rights in Australia or another country?           | No  |

If "yes" to any of the above, provide brief details of the material to be exchanged, indicating the applicable country/ies.

- ACIAR requires a Materials Transfer Agreement covering germplasm exchange to be finalised before the project can commence.
- In some cases the specific germplasm to be exchanged cannot be identified until after the project has commenced. In this case, indicate the type of material likely to be exchanged.

**Country: Iraq**

**Details: All germplasm from Australia and Iraq will be provided freely for experimental and commercial use in Iraq. Use will not be restricted. MTAs will be completed for each exchange.**

##### 2.2 Proprietary materials, techniques and information

Does the project involve provision (from one party to another) of:

- |  |    |
|--|----|
| • research materials or reagents (eg enzymes, molecular markers, promoters)? | No |
| • proprietary techniques or procedures?                                      | No |
| • proprietary computer software?   | No |

If "yes" to any of the above, describe the materials or information, identify the organisation providing and the organisation receiving the materials, indicating the applicable country/ies.

- A copy of any formal contract between the parties should be provided to ACIAR

**Country:**

**Details:**

### 2.3 Other agreements

Is any aspect of the project work subject to, or dependent upon:

- other materials transfer agreements entered into by any project participant? No
- confidentiality agreements entered into by any project participant? No

If "yes" to either of the above, describe the agreements and their conditions, indicating the applicable country/ies.

- Provide a copy of such agreement to ACIAR prior to project commencement.

**Country:**

**Details:**

### 3. Foreground, background and third party Intellectual Property

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

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

- Is it expected that there will be Foreground IP? No

If "yes", briefly describe the IP, indicating the applicable country/ies, and who will have rights to use the IP (e.g. Commissioned Organisation, Australian collaborating organisation/s partner countries).

- In the case of patents, patent status (provisional, application, granted), priority date and designated countries must be shown.
- Ownership of or rights to Foreground IP other than as detailed in the ACIAR Standard Conditions must be approved by ACIAR.

**Country:**

**Details:**

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

- Is there Background IP? No

If "yes":

- are there any restrictions on the project's ability to use the Background IP? Yes / No
- would there be any restriction on ACIAR or the overseas collaborator claiming their rights to IP for the project based on the Background IP (refer ACIAR Standard Conditions)? Yes / No

If "yes", briefly describe the source of the Background IP, indicating the applicable country/ies, whether the Commissioned Organisation and/or Australian collaborators and/or developing country collaborators own it, and any conditions or restrictions on its use.

- Note that any agreements in place regarding Background IP should be provided to ACIAR prior to project commencement.

**Country:**

**Details:**

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

- Is there any relevant Third Party IP that is essential to the project? No

If "yes":

- would there be any restriction on ACIAR claiming its rights to IP for the project (refer ACIAR Standard Conditions)? Yes / No

If "yes", briefly describe the source of the Third Party IP, indicating the applicable country/ies, the circumstances/agreement/arrangement under which the IP is to be obtained or used by the project partners (for example, material transfer agreement, germplasm acquisition agreement, confidentiality agreement, research agreement or other arrangements), and any conditions or restrictions on its use.

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

**Country:**

**Details:**

**3.4 Other contracts, licences or legal arrangements**

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

If "yes", provide details, indicating the applicable country/ies.

**Country:**

**Details:**

**Inquiries concerning completion of this form or related documents should be directed to [contracts@aciar.gov.au](mailto:contracts@aciar.gov.au).**