Iraq Projects

Improving dryland crop production in Iraq (ACIAR-AusAID CIM2004/024, CIM/2008/027)

Overview of project and activities/achievements

Funded by ACIAR/AusAID

Australia

Colin Piggin
ICARDA
Jan 2010
Outline

• background
  – justification
  – special arrangements (Iraq, ICARDA, Australian partners)
• objectives
• achievements in demonstration/extension and research
  – for Ninevah/Iraq
  – for ICARDA/Syria
• achievements in training
  – at ICARDA
  – in Australia
Project justification

- dryland wheat and barley yields <1t/ha
- wheat prodn (1-2.5 M t) satisfies <50% of demand
- self-sufficiency (4-5 M t) requires doubling of yields
Middle Eastern cropping systems

- heavy cultivation
- burning of stubbles
- late sowing (Dec-Jan)

Syria

ICARDA
Greater understanding of WUE - wheat

Scatter plot of grain yield and seasonal evapo-transpiration in four mega-environments from 1974-2003 published data. The line uses French and Schultz (1984a) frontier concept, with x-intercept = 60 mm (Sadras and Roget 2004) and slope = 22 kg ha⁻¹ mm⁻¹ (Angus and van Herwaarden 2001).
Wheat yields (t/ha)
Factors contributing to yield increases:

- improved crop varieties (30%)
- improved crop management (70%)
  - low soil disturbance (zero tillage)
  - early sowing
  - stubble retention
  - wide cereal-legume-oilseed rotations
  - chemical weed control
  - matching NPK with crop demand
  - post-emergence N
  - increased plant populations
  - management of foliar/root pests/diseases
  - deep ripping/gypsum/lime (on compact/acid soils)

Conservation cropping
Good crop management
Zero tillage - key to conservation cropping
- minimum soil disturbance
- stubble retention

Widely adopted around the world
Largely absent from CWANA

**Strong benefits**
- early sowing
- higher yield potential
- savings - time, machinery, fuel
- better soil structure (OM)
- better soil-water dynamics (porosity)
- better nutrient recycling (NPK)
- improved trafficability
- less pollution
- less erosion
- C sequestration (1%C = 33t/ha)

Total ≈ 100m ha
First ACIAR-AusAID Iraq Project

CIM/2004/024 Better crop germplasm and management for improved production of wheat, barley and pulse and forage legumes in Iraq (May 2005 - June 08)
Review and planning meeting  Syria 13-17 April 08

Presentations

Field trip

ICARDA research inspections
Recommendations

- ACIAR classify the project as highly successful and favorably consider a proposed extension.

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

- ACIAR ensures that a continuing project provides a dedicated leader based at ICARDA.
Second ACIAR-AusAID Iraq Project

CIM/2008/027 Development of conservation cropping systems in the drylands of northern Iraq (July 08 – June 11)

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

Conservation cropping definition
- minimal soil disturbance
- stubble retention
- crop diversification
Zero tillage (ZT) and conventional cultivation (CC)

ZT system
• seeding into uncultivated soil under stubble

CC farmer system
• 1-3 cultivations – mouldboard, disc, chisel
• seeding – broadcast under disc, drilled
Focus in Ninevah Governorate
Hostile environment

Conflicts
- 1980-82 Iran-Iraq war
- 1990-91 Gulf war
- 2003-10+ Iraq war

Constraints
- on-going violence and insecurity
- destruction of infrastructure
- bureaucracy unable to function properly
- international isolation

Consequences
- disabling and uncertain environment for scientific enquiry
- impossible to visit Iraq
- necessitates special project management arrangements
ICARDA involvement

• leadership
  – expertise and facilities in dryland agriculture
  – good proximity, contacts, experience in Iraq
  – NARES collaborators in eastern Syria

• linked agronomy and germplasm program
  – secure controlled site for testing new technologies
  – balance weak R & D capacity in Iraq
  – essential because ICARDA-Australian collaborators cannot visit demo/research sites in Ninevah
  – essential for Iraqi training and visitors
  – manageable and scientifically valuable
  – useful spillovers to ICARDA/Syria
Australian involvement

• providing Iraqi training in Australia
• knowledge/expertise in environment/crop systems
• participation/guidance in planning-reporting meetings
• presenting major seminars (training)
• providing research seed
Key outcomes in Ninevah

• wide adoption of conservation cropping systems by farmers

• development of local village capacities to produce and market seed and ZT machinery

• improved technical capacity by agricultural agencies to plan, implement and monitor research and development programs
Objectives

1. Extension: demonstration/promotion of “best bet” varieties and crop management technologies

2/3. Research: evaluation of new
   - lines of wheat, barley, chickpea, lentil, fababean, forages
   - crop management systems

4. GIS-RS planning/evaluation

5. Seed production

6. Socioeconomic adoption/impact assessment

7. Training of Iraqi scientists in research and extension
Partners:
  Iraq
  MOA – State Board for Ag Research Baghdad/Mosul
  – Directorate of Agriculture Ninevah

  University of Mosul*

  ICARDA

  Australia
  AgWA, UniWA, UniAdelaide

Duration:
  1 May 2005 – 30 June 2008
  1 July 2008 – 30 June 2011

Funding:
  AusAID and ACIAR – A$1.2 million + $4.7 million

* added in 2007
Annual project reporting and work planning meetings
Activity in Iraq

Implementation managed/monitored by Ninevah Implementation Committee
# 2007-08 drought in Ninevah Zone

(Oct 07 – Mar 08)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Site</th>
<th>First rain ≥ 5mm</th>
<th>Total (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRA (200-350mm)</td>
<td>Al Hatra</td>
<td>24 Jan</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Tel Abta</td>
<td>23 Jan</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Mahalabia</td>
<td>30 Jan</td>
<td>58</td>
</tr>
<tr>
<td>MRA (350-450mm)</td>
<td>Tel Kief</td>
<td>29 Jan</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>Al Hamdania</td>
<td>5 Jan</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>Bashiqa</td>
<td>5 Jan</td>
<td>63</td>
</tr>
<tr>
<td>HRA (&gt;450mm)</td>
<td>Al Shykhan</td>
<td>23 Jan</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>Al Quuosh</td>
<td>28 Jan</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td>Rabiaa</td>
<td>30 Jan</td>
<td>60</td>
</tr>
<tr>
<td>SI (RF + ≤150mm)</td>
<td>Hamidat</td>
<td>30 Jan</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>Al Namroud</td>
<td>28 Jan</td>
<td>108</td>
</tr>
</tbody>
</table>
## 2008-09 drought in Ninevah

(1 Oct 08 - 30 April 09)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Site</th>
<th>Total (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRA (200-350mm)</td>
<td>Al Hatra</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Tel Abta</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Mahalabia</td>
<td>148</td>
</tr>
<tr>
<td>MRA (350-450mm)</td>
<td>Tel Kief</td>
<td>201</td>
</tr>
<tr>
<td></td>
<td>Al Hamdania</td>
<td>235</td>
</tr>
<tr>
<td></td>
<td>Bashiqa</td>
<td>146</td>
</tr>
<tr>
<td>HRA (&gt;450mm)</td>
<td>Al Shykhan</td>
<td>335</td>
</tr>
<tr>
<td></td>
<td>Al Quosh</td>
<td>212</td>
</tr>
<tr>
<td></td>
<td>Rabiaa</td>
<td>236</td>
</tr>
<tr>
<td>SI (RF + ≤150mm)</td>
<td>Al Shykhan</td>
<td>335</td>
</tr>
<tr>
<td></td>
<td>Al Namroud*</td>
<td>179</td>
</tr>
<tr>
<td></td>
<td>Tel Abta *</td>
<td>87</td>
</tr>
</tbody>
</table>

* harvests possible only in 4 sites
* irrigation unavailable
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‘Best bet’ demonstrations in Ninevah

2005/06
2006/07, 2007/08, 2008/09
2009/10

Compare combinations of:

1. germplasm
Varieties (2-3) of bread and durum wheat, barley, chickpea, lentil

2) sowing method
- farmer management (disc cultivation/broadcasting)
- improved crop management (chisel cultivation/seed drill)
- zero-tillage (direct drilling)

3) time of sowing
- early/late sowing (with 3 replications)
Demonstrations 2005/06 – 2009/10

Locations of on-farm demonstrations for varieties and establishment:

- **High Rainfall:**
  - Al Shikhan
  - Rabeea
  - Al Qush

- **Medium Rainfall:**
  - Al Hamdania
  - Tel Kief
  - Baashiqa

- **Low Rainfall:**
  - Tel Abta
  - Al Hatra
  - Al Mahalabya

- **Supplementary Irrigation:**
  - Rabeea (HRA)
  - Al Nimrud (MRA)
  - Hummaidat (LRA)
Tel Abta (LRA) and Shikan (HRA) 2005/06

tal abta30-11-2005

tal abta 29-11-2006

shikan 28-2-2006

shikan 28-2-2006
Al Nimrud (SI) 2005/06
2006-07 inclusion of zero-tillage

1) Outside Australian influence
   - Australian experience → potential in Iraq
   - Indian ZT seeders imported in 2006
   - demonstrated to DOA trainees in Aug 06

2) Ninevah collaborators skeptical for 2006/07
   - never tried in Iraq
   - can’t grow crops without cultivation
   - soils too hard to penetrate
   - machines will break
   - increased weeds, pests, diseases

3) convinced to try
   - research to evaluate innovative new possibilities
   - no responsibility for crop or machine failure
Baashika MRA planting

19 January 2007

2006-07
Fig(1)

Effect of planting methods on grains yields (Kg/hectare) of Barley in LRA location
Fig (8)

Effect of planting methods on grains yields (Kg/hectar) of durum wheat in SI location
SI bread wheat Al-Namroud 2007-08

- Control Tell - Affer/3 Bread Wheat
- Chisel Tell - Affer/3 Bread Wheat
- Z.T Tell - Affer/3 Bread Wheat

Grain Yield Kg/ha.

Planting Methods

<table>
<thead>
<tr>
<th>Planting Method</th>
<th>Grain Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1850</td>
</tr>
<tr>
<td>Chisel</td>
<td>1600</td>
</tr>
<tr>
<td>Z.T</td>
<td>1550</td>
</tr>
</tbody>
</table>
# Durum wheat Telkief MRA 2008-09

R/F = 201mm

<table>
<thead>
<tr>
<th>Crop</th>
<th>Cultivar</th>
<th>Sowing</th>
<th>Grain yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durum Wheat</td>
<td>Om Rabia /5</td>
<td>ZT</td>
<td>382</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chisel</td>
<td>413</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>406</td>
</tr>
<tr>
<td>Karonia</td>
<td></td>
<td>ZT</td>
<td>230</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chisel</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>233</td>
</tr>
</tbody>
</table>
Achievements 2006/09

Demonstration program - Ninevah

- agreed program well implemented (12 locations)
- yields:
  - zero-till ≥ farmer and cultivated treatments
  - improved and local varieties similar
- farmer field days/inspections held at sites which grew well
- strong interest by farmers in evaluating/adopting zero-tillage
Research Stations

Rashadiya RS (and University of Mosul from 2007-08) - functional
Tel Afer and Rabia – not functional (land disputes, destruction, insecurity)

Average annual rainfall in Iraq
Iraq 2008-09

- UniMosul and SBAR established 50 trials
  - 31 on evaluation of wheat, barley, chickpea, lentil, vetch, lathyrus, saltbush, safflower, oat, pea lines
  - 19 on crop management on mixtures, rotations, polymer gel, hardpan amelioration, IPM

- trials regularly inspected/evaluated
- due to drought, harvested only 12 trials in 4 sites in May/June 09
# Evaluation of field pea cultivars in Alqush (HRA) 2008-09

## Yield and yield components of field pea cultivars in Alqush (HRA)

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Traits</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Weight of 1000 seeds (gm)</td>
<td>Grain yield (kg/ha)</td>
<td>Straw yield (kg/ha)</td>
</tr>
<tr>
<td>Helena</td>
<td></td>
<td>136</td>
<td>b</td>
<td>188</td>
</tr>
<tr>
<td>Dunwa</td>
<td></td>
<td>119</td>
<td>bc</td>
<td>286</td>
</tr>
<tr>
<td>Local Syria</td>
<td></td>
<td>201</td>
<td>a</td>
<td>286</td>
</tr>
<tr>
<td>Kaspa</td>
<td></td>
<td>111</td>
<td>c</td>
<td>74</td>
</tr>
<tr>
<td>ICARDA Check</td>
<td></td>
<td>124</td>
<td>bc</td>
<td>212</td>
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</tbody>
</table>
# Evaluation of oat cultivars in Alqush (HRA) 2008-09

## Yield and yield components of oat cultivars in Alqush (HRA)

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Traits</th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grain yield (kg/ha)</td>
<td>Weight of 1000 grains (gm)</td>
<td>Straw yield (kg/ha)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitika</td>
<td>938</td>
<td>28</td>
<td>ab</td>
<td>1660 b</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possum</td>
<td>1060 a</td>
<td>26 b</td>
<td></td>
<td>1392 C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kangaroo</td>
<td>968 a</td>
<td>30 a</td>
<td></td>
<td>1882 a</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>ICARDA Short</td>
<td>563 b</td>
<td>31 a</td>
<td></td>
<td>1073 d</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>ICARDA Tall</td>
<td>512 b</td>
<td>29 ab</td>
<td></td>
<td>1367 c</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Achievements 2005/09

Research program - Ninevah

- research constrained by expertise, poor facilities and insecurity
- results severely limited by drought in 2007-08 and 2008-09
- no clear/consistent identification for wheat, barley, chickpea, lentil of:
  - higher-yielding lines/varieties
  - better crop management technologies
- oats and peas promising as rotation crops in 2008-09
Availability of ZT seeders in Iraq

Considered 2007-08

- local availability of ZT seeders constrains ZT adoption
- Indian ZT seeder unsuitable for extensive Ninevah conditions
- experimental program to construct/modify local seeders

Needs

1. wider seeders (4m+)
2. trailed not 3 P/L
3. spring not fixed tines
Fabrication of drill seeders for ZT in Ninevah 2007-08

Farmer innovation - Rama (John Shearer) ZT seeder

Mosul Engineering Company
- ZT seeder with press wheels
Farmer modification of drill seeder tines/points for ZT in Ninevah 2008-09

Testing soil throw from points

Fabricating and testing tines and points

Lead farmers
- Sinan Jalili
- Yasser Abdullah Fathi
- Gazee H Fatehi
Modification of disc seeders for ZT in Ninevah

PhD study by Zakar M. Khudur, Mosul Uni
## Iraq – outcomes and impacts

### ZT farmers, area and seeders

<table>
<thead>
<tr>
<th></th>
<th>2006-07</th>
<th>2007-08</th>
<th>2008-09</th>
<th>2009-10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Iraq</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers</td>
<td>12</td>
<td>12 + 4</td>
<td>12 + 6</td>
<td>12 + 50</td>
</tr>
<tr>
<td>Area (ha)</td>
<td>52</td>
<td>52 + 200</td>
<td>52 + 440</td>
<td>52 + 3,000</td>
</tr>
<tr>
<td>Seeders</td>
<td>Manufactured</td>
<td>3 India</td>
<td>2 Iraq</td>
<td>4 Syria</td>
</tr>
<tr>
<td></td>
<td>Farmer modified</td>
<td>3</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td><strong>Syria</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers</td>
<td>3</td>
<td>6</td>
<td>43</td>
<td>250</td>
</tr>
<tr>
<td>Area (ha)</td>
<td>15</td>
<td>30</td>
<td>2075</td>
<td>10,000</td>
</tr>
<tr>
<td>Seeders</td>
<td>Manufactured – for ICARDA</td>
<td>1 India</td>
<td>3 Syria</td>
<td>6 Syria</td>
</tr>
<tr>
<td></td>
<td>Manufactured – for farmers</td>
<td></td>
<td>4 Syria</td>
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<tr>
<td></td>
<td>Farmer modified</td>
<td>2</td>
<td>3</td>
<td></td>
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Linked ICARDA agronomy R&D 2005/06, 06/07, 07/08, 08/09

Focus on conservation cropping
- minimum soil disturbance (zero-till)
- stubble mulching
- diverse rotations (alternative crops)

Brassica juncea 82NO00-98

Kaspa peas

Possum oats

Zero-till
Some basic ZT approaches and questions

- verification and adaptation research
  - does ZT work?
  - what are benefits of early sowing?
  - how do varieties respond?

- addressing constraints
  - local ZT seeder availability

- promoting awareness, experience and uptake
  - demonstrations and evaluation by farmers on-farm

Collaborators
Colin Piggin, Atef Haddad, Yaseen Khalil, Rolf Sommer, Shukri Ismail, Colin Norwood
Does ZT work

ZT research
2006/07, 07/08, 08/09

8 trials comparing ZT and CC
(wheat, barley, oats, chickpea, lentil)

• total biomass and yield always ZT ≥CC
Does ZT work?

Long term Trial (commenced 2006-07)

Cereal-legume rotation (C16)
- 06-07 wheat (after lentil)
- 07-08 lentil
- 08-09 barley
- 09-10 wheat

Treatments (1ha plots)

Establishment
- conventional cultivation
- zero-till/stubble retained

Time of sowing
- early
- late

Stubble
- retained
- removed (30-40%)
Zero-tillage
Wheat on lentil stubble

Conventional till

Zero-till

Glyphosate 9 Nov 2006
Sowing 10-12 Nov 2006
Harvest 17 June 2007
Zero-tillage
Wheat on lentil stubble

Conventional till
8 Jan 2007

Zero-till
7 Mar 2007

Zero-till

Conventional till
Zero-tillage Wheat on lentil stubble

Wheat productivity under ZT and CT systems (C16, 2006-2007, TH)

<table>
<thead>
<tr>
<th>Harvest Method</th>
<th>Conventional Till</th>
<th>Zero Till</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling</td>
<td>1.39</td>
<td>1.48</td>
</tr>
<tr>
<td>Total field</td>
<td>1.37</td>
<td>1.42</td>
</tr>
</tbody>
</table>

NS LSD 5% = 0.51

Potential yield: Wheat = (315 mm – 60 mm) x 20 kg/mm = 5.1 t/ha
Lentil on wheat stubble – C16

Zero-till

Early sowing
28-29 Nov 07

29 April 08

Conventional till

Late sowing
23 Dec 07

2007-08
Lentil on wheat stubble - C16

29 Apr 08

18 May 08

2007-08
For straw and grain yield
ZT > CC (P<0.05)
Early > late planting (P<0.01)

Response/ha to ZT and early sowing
Grain
Straw
615kg
1227kg
$716
$261

Potential yield lentil = (222 – 115mm) x 15kg/mm = 1.6 t/ha
Barley on lentil stubble - C16

2008-09

Early sowing
22 Oct 08

Zero-till

Late sowing
6 Dec 08

Zero-till

Conventional cultivation
Barley on lentil stubble - C16

Zero-till

Late sowing
6 Dec 08

Early sowing
22 Oct 08

Late sowing
6 Dec 08

Early sowing
22 Oct 08
Barley harvest - C16

Grain harvest
2-3 June 09
Barley harvest - C16

Stubble removal
4 June 09

Straw biomass 4.55 t/ha
Stubble removed 1.49 t/ha (35%)
Does ZT work?

Yield effects: D**; Tx D**

LSD: Within T = 0.156; T x D = 0.281

**Grain yield**

ZT-early sowing > other treatments

Farmer practice (CT, late sowing) 3.35t/ha
Improved practice (ZT, early sowing) 3.74t/ha
Increase: 390kg (US$80) /ha

Potential wheat yield (291 – 100mm) x 20kg/mm = 3.8 t/ha
Yields over 3 years - C16

Effect of tillage and date of sowing on grain yield 2006-09 (C16)

Generally
- ZT ≥ CC
- early ≥ late planting
Importance of early sowing

Yield responses to time of sowing in lentil and barley under zero-till and conventional cultivation

C16 long-term trial

<table>
<thead>
<tr>
<th>Tillage</th>
<th>Early</th>
<th>Late</th>
<th>Period/loss</th>
<th>Loss/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentil 2007-08</td>
<td>28 Nov 07</td>
<td>23 Dec 07</td>
<td>24 days</td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>1077 kg</td>
<td>670 kg</td>
<td>407 kg</td>
<td>17.0 kg</td>
</tr>
<tr>
<td>ZT</td>
<td>1285 kg</td>
<td>810 kg</td>
<td>475 kg</td>
<td>19.8 kg</td>
</tr>
<tr>
<td>Barley 2008-09</td>
<td>22 Oct 08</td>
<td>6 Dec 08</td>
<td>45 days</td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>3406 kg</td>
<td>3346 kg</td>
<td>60 kg</td>
<td>1.3 kg</td>
</tr>
<tr>
<td>ZT</td>
<td>3737 kg</td>
<td>3373 kg</td>
<td>364 kg</td>
<td>8.1 kg</td>
</tr>
</tbody>
</table>
## How do varieties respond?

<table>
<thead>
<tr>
<th>Trial/crop</th>
<th>Varieties</th>
<th>Sowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bread wheat</td>
<td>6</td>
<td>27 Nov 08</td>
</tr>
<tr>
<td>2. Durum wheat</td>
<td>6</td>
<td>26 Nov 08</td>
</tr>
<tr>
<td>3. Barley</td>
<td>10</td>
<td>1 Dec 08</td>
</tr>
<tr>
<td>4. Chickpea</td>
<td>6</td>
<td>26 Nov 08</td>
</tr>
<tr>
<td>5. Lentil</td>
<td>10</td>
<td>26 Nov 08</td>
</tr>
</tbody>
</table>

**Crop variety x tillage (CC/ZT) 2008-09**

- **New ZT plot seeder Oct09**

- **New ZT plot seeder Oct09**
Yield of bread wheat varieties under CC and ZT

Cham 6

Sown: 27 Nov 08
Photo: 9 April 09

Kafzeh 19

Sown: 27 Nov 08
Photo: 9 April 09
Yield of bread wheat varieties under CC and ZT
Yield of lentil varieties under CC and ZT

Sown: 26 Nov 08
Photo: 9 April 09
Yield of lentil varieties under CC and ZT
Local ZT seeder availability
Construction of ZT seeders in Syria

Local availability of ZT seeders constrains ZT adoption

- exchange visits with ICARDA and 4 manufacturers in Syria in Mar/Apr 08
- experimental manufacture of local ZT seeders
Local construction of ZT seeders

Excellent progress with Kamishley, El Bab and Qabassin manufacturers

Local ZT seeders – first made in Syria in 2008

Amazon – imported ($60000)

Indian – imported ($2500)

Local seeders (2m)
- price ≈ $1400 - 2500
ZT seeder demos at ICARDA - Sept 2008 meeting
Local ZT seeders in Syria - advances in 2009

New seeders
- wider tine spacing
- press wheels
- 4m trailed and 3PL
- $4000 - 6000

Kamishley 14 Sept 09

El Bab 13 Sept 09

Qabbasin
13 Sept 09
ZT seeders - outputs to outcomes to impacts
Mar 08 – Oct 09

● 2009 sales of ZT seeders
  El Bab - 2
  Qabbaasin - 2

● 2008-09 farmer conversions
  SYLICO - 3
  Ali Alewi - 2

● MOA including ZT seeders in loan scheme

● manufacturers now ZT seeder specialists

Damascus Agricultural Exhibition 18 Oct 09
ZT seeder comparisons 2008-09

Treatments

Four trials (wheat, barley, chickpea, lentil):

- seeders (6)
- date of seeding (100kg/ha)
  - early (17-24 Nov 09)
  - late (14-18 Dec 09)
ZT seeder comparisons 2008-09

Wheat Seed Depth Along Different ZT Seeder Tines TH2009

Wheat Seed Distribution Along Different ZT Seeder Tines TH 2009
ZT seeder comparisons 2008-09

Lentil Seed Depth Along Different ZT Seeder Tines
TH 2009

Lentil Seed Distribution Along Different ZT Seeder Tines
TH 2009
ZT seeders comparisons 2008-09

Significant effects:
Seeders NS
Early > late for barley, wheat and chickpea
Demonstrations and evaluation by farmers on-farm
Syria on-farm ZT testing 2008-09
Syria on-farm ZT testing 2008-09

- 2075ha of ZT crops established by 43 farmers using locally-made ZT seeders

- resource for field visits (12/9 farmers and 12/8 scientists from Iraq/Syria)
Comparison of ZT and CC Grain Yields in Farmer Demonstrations Syria 2008-09

Grain Yield t/ha

- university Farm
- Roubel Sharoo
- Roubel Sharoo
- Moh Ebrahim Basha
- Basem Ebrahim Basha
- Abo Nadim
- Ali A. Elewi
- Ali A. Elewi
- Toma Khano

Crop:
- Barley
- Chickpea
- Lentil
- Wheat
Syria on-farm ZT testing 2008-09

Survey of experiences/opinions of 43 farmers about ZT – questions were:

1. costs (SL/ha) for growing a crop with ZT or CT
2. advantages of ZT
3. comments on ZT
4. plans to try ZT next year
5. yield (t/ha) compared with CT neighbor

Responses were:

1. 100 % of farmers saved US$30-40/ha using ZT instead of CC
2. 100 % of farmers saw many advantages of ZT such as:
   • saving time, seed, soil moisture and money
   • early and good germination.
   • increasing yield
3. 5 % of farmers had comments such as:
   • the seeder should be wider and/or stronger
   • crop residues loaded
4. 100 % of farmers will continue ZT with drill access and some may buy/modify a drill
5. 100 % of farmers who used ZT got a high yield compared with neighbor
Development and dissemination of conservation cropping in Syria 2009-10

- ACIAR-ICARDA Iraq Project
- NARES
  - GCSAR
  - Directorate of Extension
  - Aleppo University
- NGOs
  - Aga Khan Foundation
- Private sector
  - farmers
  - seeder manufacturers
  - Syrian Libyan Company (SYLICO)
  - Syrian Co for Industry and Agric

Stakeholder meeting
6 August 2009
Working groups

Map showing rainfall in mm and extension units in different areas.
## Allocation and arrangements for ZT seeders for 2009-10 planting season

<table>
<thead>
<tr>
<th>Origin</th>
<th>Width</th>
<th>Position</th>
<th>Allocation</th>
<th>Group</th>
<th>Institute</th>
<th>Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kamishly</td>
<td>2.3 m</td>
<td>3 PL</td>
<td>Kamishly</td>
<td>1</td>
<td>GCSAR-Himo</td>
<td>Omran Yousef</td>
</tr>
<tr>
<td>IRAU</td>
<td>4 m</td>
<td>Trailing</td>
<td>Hassakeh</td>
<td>2</td>
<td>Extension</td>
<td>Daniel Yohanna, Hosien Sheikh</td>
</tr>
<tr>
<td>IRAUS</td>
<td>4 m</td>
<td>Trailing</td>
<td>Hassakeh</td>
<td>3</td>
<td>SYLCO</td>
<td>I. Awwad</td>
</tr>
<tr>
<td>Qabbaseen</td>
<td>2.3 m</td>
<td>3 PL</td>
<td>Al Bab</td>
<td>4</td>
<td>GCSAR</td>
<td>S. Khoja, Ghassan Zeiadeh</td>
</tr>
<tr>
<td>Rasheed</td>
<td>2.3 m</td>
<td>3 PL</td>
<td>Idleb</td>
<td>5</td>
<td>GCSAR-Harran</td>
<td>A. Ghani Twaini, Eid Al Issa</td>
</tr>
<tr>
<td>Qabbaseen</td>
<td>2.3 m</td>
<td>3 PL</td>
<td>Salamiyeh</td>
<td>6</td>
<td>GCSAR</td>
<td>Y. Mousa, R. Khatib, B. Bunni</td>
</tr>
<tr>
<td>Qabbaseen</td>
<td>4 m</td>
<td>Trailing</td>
<td></td>
<td>7</td>
<td></td>
<td>ICARDA</td>
</tr>
</tbody>
</table>
### Syria – outcomes and impacts

#### ZT farmers, area and seeders

<table>
<thead>
<tr>
<th></th>
<th>2006-07</th>
<th>2007-08</th>
<th>2008-09</th>
<th>2009-10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Iraq</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers</td>
<td>12</td>
<td>12 + 4</td>
<td>12 + 6</td>
<td>12 + 50</td>
</tr>
<tr>
<td>Area (ha)</td>
<td>52</td>
<td>52 + 200</td>
<td>52 + 440</td>
<td>52 + 3,000</td>
</tr>
<tr>
<td>Seeders</td>
<td>Manufactured</td>
<td>3 India</td>
<td>2 Iraq</td>
<td>4 Syria</td>
</tr>
<tr>
<td></td>
<td>Farmer modified</td>
<td>3</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td><strong>Syria</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers</td>
<td>3</td>
<td>6</td>
<td>43</td>
<td>250</td>
</tr>
<tr>
<td>Area (ha)</td>
<td>15</td>
<td>30</td>
<td>2075</td>
<td>10,000</td>
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<tr>
<td>Seeders</td>
<td>Manufactured – for ICARDA</td>
<td>1 India</td>
<td>3 Syria</td>
<td>6 Syria</td>
</tr>
<tr>
<td></td>
<td>Manufactured – for farmers</td>
<td></td>
<td></td>
<td>4 Syria</td>
</tr>
<tr>
<td></td>
<td>Farmer modified</td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Testing of alternative crops

Objective: To evaluate alternative dryland crops for Mediterranean environments

- Oats
- Oilseeds
- Legumes

1 December 2005
Oats 2005-08
Total dry matter and grain yield of oat varieties Tel Hadya Syria 2006

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>Total</th>
<th>Grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possum</td>
<td>2256</td>
<td>1018</td>
</tr>
<tr>
<td>ICARDA Check</td>
<td>2184</td>
<td>948</td>
</tr>
<tr>
<td>Carrolop</td>
<td>2180</td>
<td>976</td>
</tr>
<tr>
<td>Euro</td>
<td>2045</td>
<td>840</td>
</tr>
<tr>
<td>Brusher</td>
<td>1992</td>
<td>805</td>
</tr>
<tr>
<td>Wintaroo</td>
<td>1946</td>
<td>827</td>
</tr>
<tr>
<td>Mitika</td>
<td>1768</td>
<td>693</td>
</tr>
<tr>
<td>Kangaroo</td>
<td>1580</td>
<td>629</td>
</tr>
</tbody>
</table>

Total DM NS (LSD 2178)
Grain yield NS (LSD 538)
Peas 2005-06

Total biomass and grain yield (kg/ha) of pea varieties Tel Hadya, Syria 2006

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Production KG/HA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dunwa</td>
<td>3426</td>
</tr>
<tr>
<td>Helena</td>
<td>3631</td>
</tr>
<tr>
<td>Kaspa</td>
<td>3197</td>
</tr>
<tr>
<td>ICARDA Check</td>
<td>3321</td>
</tr>
<tr>
<td>Local check</td>
<td>4005</td>
</tr>
</tbody>
</table>

Dunwa, Helena, Kaspa, ICARDA Check, and Local check.
Oilseeds 2005-08

10 May 2006

Brassica juncea 82NO00-98

Brassica juncea Sel21

Sinapus alba Tliney

6 April 2006
Oilseeds 2005-06

Biomass and seed yield of oilseed crops
Tel Hadya Syria 2006

Total DM LSD 1175 (5%)
Grain yield LSD 303 (5%)
ICARDA agronomy studies
- excellent training and discussion facility with Iraqi scientists, students, farmers
Outline

• background
  – justification
  – special arrangements (Iraq, ICARDA, Australian partners)

• objectives

• achievements in demonstration/extension and research
  – for Ninevah/Iraq
  – for ICARDA/Syria

• achievements in training
  – at ICARDA
  – in Australia
Capacity building program 2005-08

- ICARDA training courses
  - 62 trainees in 14 courses

- Australian study tours
  - 4 study tours (May 2008)

- Conferences
  - 1 IPM scientist to 9th Arab Cong Plant Protection (2006)

- Planning and reporting meetings
  - 83 Iraqi participants in 5 reporting/planning meetings

- Australian technical seminars
  - 11 seminars on advanced crop R & D in Australia

- Farmer visits and field days
Australian training

May/June 2008

Trainees

- Dr Saleh Bader, DG Research, MOA Baghdad (1-18 May 08)
  - R&D management (AusAID, ACIAR, GRDC, CSIRO, University of Adelaide, SARDI, PIRSA, UWA, DAFWA, Murdoch University, Muresk-Curtin UNI, WANTFA)

- Dr AbdulSattar Al-Rijabu, Agronomy lecturer, Uni Mosul (1 May–12 June 08)
  - conservation cropping (University of Adelaide, SARDI)

- Dr Sa’ad Mohamed, Socio-economist, MOA Baghdad (1 May–22 June 08)
  - conservation agriculture and socio-economics (UWA, DAFWA)

- Mr Raad Hameed, Cereal breeder, MOA Ninevah (1 May-22 June 08)
  - conservation agriculture and plant breeding (DAFWA, UWA)

Budgeted – 3; Achieved - 4
ICARDA training

Eleven events involving total 70 scientists and 15 farmers from Iraq; 12 scientists and 10 farmers from Syria; and 2 ICARDA scientists on:

1. **Poverty, livelihoods, adoption and impact analysis**, 16-27Nov08 - 2 Iraqi scientists

2. **IPM workplanning**, 18-20Nov09 - 3 Iraqi scientists

3. **CropSyst Simulation Modeling**, 11-15Jan09 - 3 Iraqi scientists

4. **Seed multiplication/marketing in Ninevah**, 15-19Feb09 - 9 scientists and 3 farmers from Iraq

5. **Experimental methods and statistics**, 19-30April09 - 9 Iraqi + 2 ICARDA scientists (Dr Jens Berger, CSIRO/UniWA)

6. **ZT seeder principles, fabrication and operation**, 19-23April09 - 12 scientists and 1 farmer from Iraqi + 7 GCSAR, 1 commercial scientist and 1 farmer from Syria (Dr Jack Desbiolles, UniSA/UniAdel)

7. **Variety description and maintenance in seed production**, 26Apr-7 May09 - 2 Iraqi scientists

8. **GIS/Remote sensing**, 3-21May09 - 3 Iraqi scientists

9. **Germplasm improvement - breeding (on-the-job)**, 3 - 28May09 - 4 Iraqi scientists

10. **Farmer inspection of ZT R&D at ICARDA and in Syria**, 23-28May09 - 11 Iraqi farmers + 8 Syrian farmers

11. **Participatory extension methodology/practice**, 14-18June09 - 11 Iraqi and 5 DOE Syria scientists (Drs Jay Cummins and Jim Fortune, Rural Solutions SA/UniAdel)
Capacity building program  2008-09

Australian training

6 post-graduate students and 5 study visits in late 2009/early 2010 as follows:

**MSc (4)**
1. Mahmoud Ahmed Hassan Al Ardeny DOA: GIS/remote sensing - UniWA
3. Ayman Taher Mohsen Al Hobaity DOA : agronomy - UniWA

**PhD (2)**
1. Mohammed Amin Hajy Ahmed University of Mosul: conservation cropping - UniWA
2. Jamal Abufattah Yousuf SBAR Mosul: cereal breeding - UniAdelaide

**6-months study visits (10)**
1. Dr Kassim Khalil Kasim SBAR; Mr Jaffar Sedeeq Saeed DOA; Dr. Saad Abdul Jabbar Samir UniMosul: conservation cropping, forages and seed production - UniAdelaide
2. Dr. Saad Daoud Taha Al-Malk SBAR: soil science – AgWA (Crawford WA support)
3. Dr. Maan Mohammed Salih SBAR Mosul: legume breeding - UniWA
4. Dr Ahmed Mohammad Sultan Ahmad UniMosul : weed science- UniAdelaide
5. Dr Salim Himmade Anter UniMosul : weed science – UniAdelaide
Capacity building program  2008-09

Special training (outside funding)

• economist Dr. Saad Mohammed - ACIAR-sponsored Crawford Fund Master Class "Impact assessment" provided by ACIAR and ICRISAT, India. 18-27 Mar 09

• breeders Dr Maan Salih (legumes), Jamal Al-Hazza (wheat), Dr Mohammed Hammed (barley) - AusAID-supported training (8 weeks) on plant breeding, seed production and seed quality and conservation cropping study tour (4 weeks), South Australia – UniAdelaide, 30 May-31 Aug 09

Conference - 4th World Congress on Conservation Agric, India (4-7 Feb 09)

Six project collaborators (Drs Bader, AlRijabo, Piggin, Haddad, Coventry, Cummins):

• attended/presented project poster

• undertook study tour of ACIAR wheat quality project to inspect conservation cropping, ZT seeder manufacture and participatory extension R&D, 7-16 Feb 09
Conservation cropping R, D and T

Conclusions 2005-09

- ZT confirmed as more productive, profitable and sustainable than CC
- early planting important in achieving high yields - facilitated by ZT
- no special varieties indicated for ZT (no VxT interaction for any crops)
- local ZT seeders very effective and affordable
- excellent start and prospects for ZT adoption in Iraq (and Syria)
- peas and oats show good potential as rotation crops
- extensive training enhanced conservation cropping awareness and experience of scientists and farmers in Iraq (and Syria)
Key outcomes in Ninevah

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