The status of ICARDA program for the Arabian Peninsula (APRP)

Summary Activities and Achievements
Arabian Peninsula

1) Bahrain
2) Emirates
3) Kuwait
4) Oman
5) Qatar
6) Saudi Arabia
7) Yemen
Constrains Facing Arabian Peninsula

- Extreme aridity
- Over grazing & degraded Rangeland
- Higher demand for food as a result of increasing population
- Ltd. renewable water resources
Renewable water resources per capita (m³/person/year)
All countries use imports, to varying extents, to satisfy the quantity and diversity of the food demands of their populations. For poor countries where food imports are a large share of a country’s total trade, food security is conditioned by the capacity to obtain food through imports.
GCC is the world's biggest importer of food (WTO, 2010)
High vulnerability to Global Climate Change
Develop technology 1995-2006

Strengthening Agricultural Research and Human Resource Development in the AP.
AFESD, IFAD

Technology Transfer 2008-2013

Sustainable Management of Natural Resources and Improvement of Major Production Systems of the AP.
AFESD, IFAD, OFID

Up-scaling 2014-2017

Improving food security and sustainable natural resources management through enhancing integrated agricultural production systems in the Arabian Peninsula
AFESD, IFAD

1995-2000

2000-2006

2008-2013

2014-2017

Technology Transfer to Enhance Rural Livelihoods and Natural Resource Management in the Arabian Peninsula
AFESD, IFAD, OFID

ICARDA in AP
Technology Transfer to Enhance Rural Livelihoods and Natural Resource Management in the Arabian Peninsula (2008-2013)
Technology Transfer to Enhance Rural Livelihoods and Natural Resource Management in the Arabian Peninsula

Adaptive Research

- Irrigated Forages & Rangeland Rehabilitation
- Protected Agriculture
- On-Farm Water Management

ICARDA
Science for Better Livelihoods in Dry Areas
Technology Transfer to Enhance Rural Livelihoods and Natural Resource Management in the Arabian Peninsula

- Indigenous Forages
- Spineless Cactus
- Rangeland Rehabilitation
- Seed Technology Unit
- IPPM
- Soilless systems
Rangeland Rehabilitation & Irrigated Forages

Exploit the well adapted genetic variability of indigenous forage species

9 collection missions conducted in 6 AP countries for indigenous plant and shrub species

190 indigenous plant and shrub species were collected and identified in all AP countries

23 priority range and forage species have been identified in AP countries after joint research activities
Dry matter production of six forages (t/ha) under deficit irrigation (4 L/m²)

<table>
<thead>
<tr>
<th>Forage</th>
<th>Dry Matter Production (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicago sativa</td>
<td>0.05</td>
</tr>
<tr>
<td>Choelachyrum pierrei</td>
<td>0.30</td>
</tr>
<tr>
<td>Lasiurus scindicus</td>
<td>0.33</td>
</tr>
<tr>
<td>Chloris gayana</td>
<td>0.39</td>
</tr>
<tr>
<td>Panicum turgidum</td>
<td>0.56</td>
</tr>
<tr>
<td>Cenchrus ciliaris</td>
<td>0.61</td>
</tr>
</tbody>
</table>

- 56% improvement in productivity

**Buffel Grass**

- In 2011, Oman growers produced 418,366 ton Green Rhodes grass, which required about 228 million m³ of water.
- For producing the same amount of forage with Buffel grass, only 116 million m³ of water was required.

**Save 112 million m³ of water annually in Oman**

If all Rhodes grass production changed to Buffel grass...
134 growers adopted Buffel grass in all Arabian Peninsula

By December 2013
Improved indigenous forage and seed multiplication methods

Seed multiplication fields for indigenous grass established in Emirates, Oman, Yemen and Qatar. While shrub seeds were produced in large quantities in Saudi Arabia.
Enhanced quality forage seed production by establishing Seed Technology Units

Seed Technology Units (STU) established in Emirates, Oman, Qatar, Yemen and Saudi Arabia.

Seed Health Units in Qatar, Saudi Arabia and Oman
38 Spineless cactus accessions were introduced in Oman by APRP in 2005

- To select the well adapted accessions to the different agro ecological conditions of the AP
- Water requirement
- Possible introduction in animal feed diet
Rehabilitation of Rangeland

In Yemen, rehabilitation activities continued at the Wadi Al-Khun (Hadhramout)
Rehabilitation of Rangeland

Protection from grazing was very effective on plant cover & plant regeneration in desert rangelands Sulyabiah and Sabah Alahmad locations.

Using Pits and Contour lines for rain water harvesting and rehabilitation in Saudi Arabia
Integrated Production & Protection Management (IPPM)

Improved integrated production and protection Management (IPPM) practices that ensure strong healthy plants with adequate protection from pests and diseases, using safe control practices with minimal use of chemicals.

Components of greenhouse IPPM packages:

- GH climate management
- Irrigation and fertilization management
- Agro-management practices
- Mechanical protection
- Biological control
- Chemical control

Applying IPPM techniques

Yemen Cucumber 2012 winter season

Number of sprays
Soilless Culture

Increased yield per unit of water, space and energy
Simplified the technology to transfer to Growers
Adoption of Soilless production system increase yield and water productivity by average 50%
Yield and Water productivity of cucumber under conventional soil and soilless production systems – Bahrain, 2013

Increase yield and Water use efficiency by about **5 times** in soilless systems compared to soil under protected agriculture.
Project targeted pilot sites and achievements by Dec 2013 (accumulative)

- Indigenous forage (pilot grower): Target 80, Achieved 134
- Spineless cactus (pilot grower): Target 8, Achieved 32
- Rangeland rehabilitation (ha): Target 50, Achieved 71
- Integrated Production & Protection Management - IPPM (pilot grower): Target 75, Achieved 127
- Soilless culture (pilot grower): Target 70, Achieved 120
Capacity Building

From Jul 2008 to Dec 2013 ICARDA-APRP organized 20 regional and 19 on the job training courses where 307 and 450 participants attended.

<table>
<thead>
<tr>
<th>Country</th>
<th>Number</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Emirates</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Kuwait</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Oman</td>
<td>111</td>
<td></td>
</tr>
<tr>
<td>Qatar</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Yemen</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Training Type</th>
<th>Number</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional training</td>
<td>20</td>
<td>307</td>
</tr>
<tr>
<td>On job training and Field days</td>
<td>19</td>
<td>450</td>
</tr>
</tbody>
</table>
Impact Assessment of Technologies (Project external Review)

increased water productivity

Buffel Grass versus Rhodes Grass

• 1.52 kg of dry matter /m3 of water for Buffel grass versus 0.36 kg of dry matter/m3 of water for Rhodes grass in Oman: 5 fold increase

Protected agriculture

• 48 kg of tomatoes /m3 water in soilless culture versus 7 Kg/m3 in soil based protected culture in UAE: 7 fold increase

• Increased water productivity by 60 to 100 % of cucumber per m3 of water in soilless closed System

reduced use of pesticides in IPPM

• Reduced number of pesticide sprays by 40 to 60% in greenhouses where IPPM technology is applied
Impact Assessment of Technologies (Project external Review)

yield increase in protected agriculture

• Increased yield of tomatoes by **192%** in soilless culture compared to soil based protected culture in UAE

• Increased yield of cucumber by **40%** in soilless closed system in addition to water saving and reduced fertilizer and pesticide use compared to soilless open system in Oman

• Increased yield of cucumber by **50%** in soilless closed system with automated nutrient management compared with closed system with manual nutrient management in Oman

Farmer’s income

• The increased water productivity and yields and cost reduction from water saving and reduced pesticide use resulted in higher income to farmers.
CONCLUSIONS by External Review

• The APRP research work is of high return

• Given its proven capacity as water saving irrigated forage crop, the indigenous Buffel grass is a low cost/high return alternative to replace the water demanding Rhodes grass in the Arabian Peninsula

• Both the open system soilless culture as well the closed system with automatic control of nutrients are the way forward for the intensification and diversification of protected agriculture production systems for high return cash crops in the context of increasing water shortage and salinity in the Arabian Peninsula
Abu Dhabi Farmers' Services Centre has determined that Buffel grass is a more sensible alternative to Rhodes grass, and the organization has begun educating farmers about proper cultivation methods.

In Oman, Ministry of Agriculture and Fisheries supporting growers to replace Rhodes to Buffel Grass.

The Oman Government supports farmers by providing infrastructure, credit, technical advice, and financial assistance.

In UAE, Ministry of Environment and Water covers 50% of cost for greenhouse structure with soilless production system;

In Bahrain, government allocated a large grant to support growers for adopting greenhouse and soilless production systems.

Abu Dhabi Farmers' Services Centre has determined that Buffel grass is a more sensible alternative to Rhodes grass, and the organization has begun educating farmers about proper cultivation methods.

In Oman, Ministry of Agriculture and Fisheries supporting growers to replace Rhodes to Buffel Grass.
APRP new project: 2014-2017

Improving food security and sustainable natural resources management through enhancing integrated agricultural production systems in the Arabian Peninsula

Move toward sustainability through scaling-up

Focus on three important themes:
• Sustainable intensification of the production systems
• Production systems and livelihood resilience
• Capacity building and impact assessment
Project Partners

Bahrain
United Arab Emirates Ministry of Environment and Water
Kuwait
Oman
Qatar
Saudi Arabia
Yemen

Project Donors

AFESD
IFAD
**Project Components**

**Dissemination and Adoption of Technology Packages to Sustainable intensification of the production system**
- irrigated indigenous forage species and spineless cactus
- irrigated forages using Treated Waste Water
- agricultural and agro-industrial products as alternative animal feed resources;
- rangeland management and rehabilitation,
- protected agriculture using soilless production systems, renewable energy and IPPM;

**Problem solving and research activities to resilience and enhance production systems and livelihood**
- Utilize and improve efficiency of TWW for irrigating the forages and animals’ health and productivity
- Develop suitable formula using agricultural by products for animal feed calendar
- Develop participatory management and rehabilitation techniques of degraded natural rangelands.
- improve efficiency of cooling system through utilization of renewable energy.
- Improve water use efficiency and productivity of vegetable crops under protected agriculture

**Capacity Building and socio-economic study**
- Training Courses, Workshops & Expert Consultation Meetings;
- Publication, Information Dissemination and Networking
- Study the impact of the project targeted technologies on growers’ livelihoods and natural resources.

**Project monitoring, evaluation and impact assessment**
- Monitoring and evaluation the impacts of the project targeted technology on pilot growers and community’s livelihood as well as natural resources.
- Conduct annual Technical Coordination (TC) and Steering Committee (SC) meetings.
Progress report January to December 2014

Number of pilot activities targeted in participating countries in 2014 and achievements by Nov 2014 based on country reports

1. Manage indigenous forages at grower’s farm including use of modern irrigation systems, sowing/planting, harvesting for maximum water use efficiency.
   - Achieved: 18
   - Targeted: 25

2. Introduction and adaption of soilless and IPPM packages to NARES and pilot growers
   - Achieved: 29
   - Targeted: 35
Comparison of Total income, cost of production and net income (Yemeni Rials) for cucumber soilless production system in Yemen.

<table>
<thead>
<tr>
<th></th>
<th>Soilless</th>
<th>Soil</th>
</tr>
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<tbody>
<tr>
<td><strong>Total income</strong></td>
<td>410000</td>
<td>371600</td>
</tr>
<tr>
<td><strong>Cost of production</strong></td>
<td>200250</td>
<td>267187</td>
</tr>
<tr>
<td><strong>Net income</strong></td>
<td>209750</td>
<td>104412</td>
</tr>
</tbody>
</table>

Net income in soilless system is higher than conventional soil system by 65%.
Greenhouse vegetables Post harvest

Growers point of view on suitability of plastic basket for packing greenhouse crop in UAE

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight for local market</td>
<td>52</td>
<td>8</td>
</tr>
<tr>
<td>Weight for export</td>
<td>92</td>
<td>8</td>
</tr>
<tr>
<td>Size for local market</td>
<td>58</td>
<td>42</td>
</tr>
<tr>
<td>Size for export</td>
<td>93</td>
<td>8</td>
</tr>
<tr>
<td>Material for local market</td>
<td>88</td>
<td>52</td>
</tr>
<tr>
<td>Material for export</td>
<td>48</td>
<td>79</td>
</tr>
<tr>
<td>Design for local market</td>
<td>79</td>
<td>21</td>
</tr>
<tr>
<td>Design for export</td>
<td>93</td>
<td>7</td>
</tr>
</tbody>
</table>
Response of Buffel and Rhodes grasses to different irrigation levels using line source sprinkler irrigation system (Oman)

Total dry weight (ton/ha) for Buffel and Rhodes grasses under different irrigation levels using line-source experiment at Rumais Research Station in Oman for 2013/2014 growing season.
Study the yield of three Buffel grass varieties

Yield (t/ha) dry matter of four varieties of Buffel grass in Qatar

Local: 20.0 t/ha
Gayandah: 15.0 t/ha
USA: 18.3 t/ha
Biloela: 21.5 t/ha
Crop residues and agro-industrial by-products in Oman

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUANTITY (1000 TONS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. CROP RESIDUES</strong></td>
<td></td>
</tr>
<tr>
<td>WHEAT STRAW</td>
<td>2.126</td>
</tr>
<tr>
<td>BARLEY STRAW</td>
<td>2.871</td>
</tr>
<tr>
<td>CORN STALK</td>
<td>40.245</td>
</tr>
<tr>
<td>OTHERS</td>
<td>11.153</td>
</tr>
<tr>
<td>VEGETABLE CROP RESIDUES</td>
<td>44096</td>
</tr>
<tr>
<td>BANANA CROP RESIDUES</td>
<td>24.633</td>
</tr>
<tr>
<td>COCONUT FRUITS BY-PRODUCTS</td>
<td>3.500</td>
</tr>
<tr>
<td>PRUNING BRANCHES OF ORNAMENTAL TREES</td>
<td>10.000</td>
</tr>
<tr>
<td>DATE FROND LEAVES</td>
<td>150.000</td>
</tr>
<tr>
<td><strong>II. AGRO-INDUSTRIAL BY-PRODUCT</strong></td>
<td></td>
</tr>
<tr>
<td>WHEAT BRAN</td>
<td>120</td>
</tr>
<tr>
<td>DATE PULP</td>
<td>5.000</td>
</tr>
<tr>
<td>DATE STONE</td>
<td>5.000</td>
</tr>
<tr>
<td>DATES NOT SUITABLE TO HUMAN CONSUMPTION</td>
<td>27.000</td>
</tr>
<tr>
<td>DRIED SARDINES FISH</td>
<td>25.000</td>
</tr>
</tbody>
</table>
Develop and introduce suitable alternative animal feed resources in the Arabian Peninsula, the case of Oman
Capacity Building

During the reporting period APRP organized
• 2 training courses
• 5 field day and on the job training
• Co-organized 3 regional workshops
Specialized training course:
**Greenhouse high value vegetable crops post-harvest**
27-29 April 2014

Thirty five participants.
The training workshop aims to enhance knowledge and capacity of NARES on:
- The principles of good postharvest handling
- Crop maturity and Harvesting
- Pack house Operations
- Cooling and Storage
- Packaging and transportation
- Pathology and Disorders
Specialized training course:  
*Modern techniques for seed production & multiplication of native species*

27-29 October 2014

The event, which was attended by 10 researchers, cover the following topics:

- Native Seed Collection, Handling, Extraction, Processing and Storage,
- Fundamentals of Native Seed Germination
- Health, Safety and Environment for Seed Collection And Propagation
- Database Management For Seed Collection And Storage
- Greenhouse and Shade House Management and Mass Propagation of Native Species
- Seed Processing Techniques
- Seed Quality testing (Purity, Moisture and Germination testing)
- Growth assessment of field ground of native plants
Thank you