

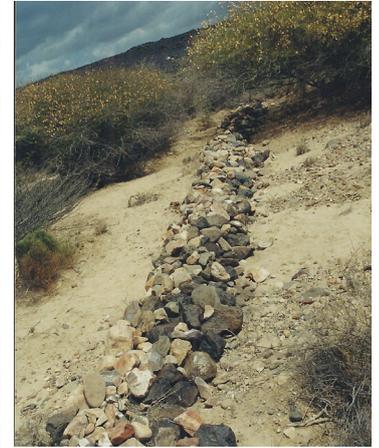
# R4D

## Initiatives

### Project Briefs

## In Arabian Peninsula

### Enhancing Rural Livelihoods and Efficient Use of Scarce Water Resources



*Rangeland rehabilitation with water harvesting techniques in Yemen*

### Challenges facing Arabian Peninsula (AP)

The Arabian Peninsula (AP) is a water-limited region with extreme aridity and limited renewable water resources. In most areas the annual precipitation is far below the potential crop water requirements. Hence, with the exception of a few areas in Yemen, all arable crop production requires irrigation. The renewable supply of water per capita is amongst the lowest in the world. In spite of the harsh environment, the economic blossom of the region has resulted to a rapid population increase which led to improving the requests for the food. As a result, the region countries have the highest annual population growth rate in the world while 90% of their food items are imported. Of the 3 million km<sup>2</sup> land area of the AP, about 50% is rangeland. Rangeland condition is very poor and in some areas well below the production potential. Large areas are classified as empty lands, and others have few species at very low densities. There are signs of deteri-

oration of both the soil and plant components of the rangeland ecosystem. Overgrazing is the main cause of rangeland deterioration, which is reflected in livestock feed shortages. In attempts to alleviate feed shortages, farmers have relied on growing exotic forages with high water requirements. Excessive use of groundwater has lowered water tables, increased salinity, and in severe cases led to croplands being abandoned. The AP is facing great challenges in developing more sustainable land use and efficient water usage, while preserving its environment and heritage with the current rate of population growth. The issues of water management, productivity, sustainability, and environment are closely interconnected. If current inefficient practices continue, there will be rapid depletion of water resources, extinction of native species and knowledge of them, and rapid environmental destruction.

### Background

*Smallholder farmers in the Arabian Peninsula region are severely constrained by the region's extreme aridity, scanty water resources and erratic rainfall. Conditions have become even more challenging as over 95% of the region's land area now faces some form of desertification from wind and water erosion, and salinization. The increasing population pressure is leading to excessive use of underground water and dangerous dependence on food import, threatening food security in the region.*

### About APRP

The Arabian Peninsula Regional Program (APRP) of the International Center for Agricultural Research in the Dry Areas (ICARDA) serves the seven countries of the Arabian Peninsula. The program addresses three priority themes: (i) rangelands, forage, and livestock; (ii) protected agriculture; and (iii) water resources management. These themes are supported by research in agro ecological characterization and stress physiology. Emphasis is also placed on institutional strengthening and capacity building, human resource development, and promotion of the use of information technology. APRP is financially supported by the Arab Fund for

Economic and Social Development (AFESD), and the International Fund for Agricultural Development (IFAD). In addition, the OPEC Fund for International Development (OFID) supported APRP until December 2013.

The project completed technology transfer phase from 2008-2013, successfully introducing a range of beneficial technologies to 80% more growers than was targeted. The project is now in scaling out phase from 2014- 2018, steadily moving toward wider and sustainable gains. For instance, with support of NARS, number of growers adopt the soilless production techniques in UAE passed 1000 in 2015.

*“The Arabian Peninsula Pro-gram (project) has played a clear role in transferring efficient and applicable technologies to the region. These technologies certainly help resource poor growers to enhance their livelihood»*

Dr. Mansour M. Al-Aqil,  
Chairman Agricultural  
Research  
& Extension Authority,  
Yemen,  
December 2013

## Innovations at Work

- Indigenous forages with high water use efficiency can provide ideal solutions as they are adapted to the harsh environmental conditions of the region. Based on collection missions and screening of hundreds of accessions of native forages a pioneering undertaking in the region the project identified indigenous Buffel grass for its high water-use efficiency and superior feed quality, and validated technologies for its open field production. With less than half average annual water requirement compared to the commonly grown Rhodes grass, the project is promoting adoption of Buffel grass by farmers.
- Spineless cactus, requiring minimum water to grow, can be combined with on-farm and agro-industry by products to obtain quality alternative animal feed resources (feed blocks) even under drought conditions. The project introduced the new species into the region with 38 accessions from Tunisia and established a mother nursery in Oman. The project is now adapting and spreading it to the different agroecologies in Arabian Peninsula.
- Protected agriculture is helping farmers effectively overcome the region's harsh growing conditions. The project developed a suite of innovations, and adapted and optimized them into an integrated production and protection management (IPPM) system based in soilless culture to deliver higher yields of quality cash crops while reducing the use of water, fertilizers and pesticides. These innovations include improved greenhouse design tailored to the region's high temperatures; integrated pest management practices that reduce harmful pesticide use; and hydroponics production (soilless) systems with controlled water and plant nutrients for maximum productivity per unit water and land.
- Rehabilitating degraded rangelands through a combination of natural resource management methods such as water harvesting, re-seeding and protection is being implemented at research sites in Yemen, Oman, Saudi Arabia, Kuwait and Qatar. The project screened a number of native forages and pastoral plant varieties and uses GIS to monitor performance in restoring degraded lands. constructed check stone dams and contour stones have demonstrated reserving water run-off and soil conservation in Saudi Arabia and Yemen, creating a better environment around the vegetation.



*Spineless cactus, a desert-friendly plant that makes nutritious feed for livestock, adopted by a pilot grower in Qatar*

## Project Impacts for Pilot Farmers

The pilot farmers continue to receive technical backstopping from NARES researchers, extension agents and ICAR-DA scientists, encouraging further innovation to fine tune and improve on introduced technologies for added value. Although the project support directly limited number of pilot growers but, as a result of NARES support, the actual number of growers accept the project targeted technology are significantly increasing. The technologies introduced are bringing a range of benefits for the participating farmers in the seven countries:

- Substantial water saving and increased fodder production from the adoption of Buffel grass: The forage can be harvested 10 times a year and is steadily gaining ground over the popular Rhodes grass. In UAE, large number of growers adopted Buffel grass are saving roughly 850 m3 of water for each ton of dry matter produced compared to Rhodes grass, translating to an average annual increase of USD 545/ha. In oman, farmers are saving 55% water by adopting Buffel grass over the popular Rhodes grass.
- Water saving, reduced use of pesticides and increased yields and income from the use of integrated production and protection management techniques: The validated production management practices have been adopted by a large number of growers. In fact, most of the greenhouses in the region are using all of at least some IPPM techniques such as double doors, or insect proof net covering greenhouse ventilations. With substantial gains in water productivity from soilless method, total number of greenhouses using the soilless system are increasing rapidly. In UAE, farmers enjoyed seven-fold increase in water productivity growing tomatoes in soilless culture compared to conventional soil culture. The

*Soilless systems double the net income for Yemeni farmers over conventional soil system*



*“With Hydroponics my production increased by 3 folds and I am saving about 80 percentage of irrigation water compared with soil systems”*

*Mohamed Bin Nahila, Grower, UAE*

*«Animals like Buffel grass more than Rhodes grass. Buffel grass use %50 less water compare to Rhodes grass.»*

*Mr. Manik Mahi, Farm manager, Qatar*



cost benefit analysis demonstrated an average of 200% increase in annual profit/m<sup>2</sup>/year from soilless culture in protected agriculture. These substantial gains have led to a 2.7-fold increase in the number of greenhouses being used in the Emirates. In Oman, farmers adopting the closed soilless system growing cucumbers reaped 40% higher yield than when using the soilless open system. The installation of automated water and nutrient management system further significantly increased the production by 50% over the manual control.

## Seeding a Stronger National Agriculture Sector

To ensure sustainable outcomes from research programs, ICARDA is particularly invested in addressing the two most fundamental needs for enabling a stronger national agricultural sector capacity building and an adequate seed system. The following activities were conducted to address the needs of the seven countries over the past five years:

- Some 25 specialized training courses, 11 workshops and 30 field days helped impart skills to over 1000 farmers, extension agents and researchers across the project countries.
- To address the constraint of seed availability for indigenous forage species, the project established seed units in Emirates, Yemen, Saudi Arabia, Qatar and Oman, and added seed health units in the latter three.

## Scaling up the Outcomes

The initiative is building on its successes to strategically deliver technology ‘packages’ suited to the production potential and constraints of the two broad agro-ecosystems in the region:

- In higher potential areas, sustainable intensification and diversifying production using protected agriculture technologies for higher and varied sources of incomes for smallholder farmers
- In marginal lands, building resilience in smallholder livelihoods.

consolidating technology packages along these two pathways will deliver enhanced and wider range of impacts for both the farmers and the environment.

The total number of direct beneficiaries for the entire project is expected to be 6,000 (1,200 rural families) while the total number of indirect beneficiaries is expected to reach 27,500 (5500 households).

*“The project is important to the region as growers in Oman have greatly benefited from its technologies, such as those for protected agriculture and the use of water-efficient indigenous forages species.”*

Dr. Ahmed Al Bakri, Under Secretary for Agriculture, Ministry of Agriculture and Fisheries, Oman December 2013

*In a field day moderated by ICARDA scientists in a private farm in Lahej (Yemen),*

*“I am very happy with Al-Zila (Buffel grass) which has significantly increased the production of meat and milk”,*

*said Mr Ali Nasser Taisir, the grower.*



## New initiatives

Going forward, the program is concentrating on new horizons to enhance agricultural development in the region. However, the focus remains on enhancing the water use efficacy and productivity. Some of new initiatives includes:

- Developed new formula for feed block based on available by-products in the region. establishment of new feed block demonstration unit in Oman and UAE resulted in developing number of feed block formula based on available by-product in the region specially date palm.
- Enhance greenhouse cooling system efficiency to reduce water consumption while adopting renewable energy resources such as solar energy. At the moment the water which is used for greenhouse cooling is far greater than water used for the crop production. In addition, the energy consumption for cooling systems increase the cost of production as well as greenhouses carbon foot print. New design is under study in collaboration with American University of Ras Al Khaimed, UAE.



## Policy Impacts Toward Nationwide Scaling Up

The remarkable results in increasing water productivity and profitability has encouraged three out of seven countries to incentivize and facilitate adoption of the technologies by the farmers.

- The Oman government and Abu Dhabi Farmers' Services Center in UAE are supporting and educating growers to replace Rhodes grass the widely used forage species in the past with the more beneficial and less water consuming Buzel grass.
- Oman, UAE, and Bahrain governments have instituted incentives such as grants, technical assistance and financial aid to encourage growers to adopt soilless greenhouses.

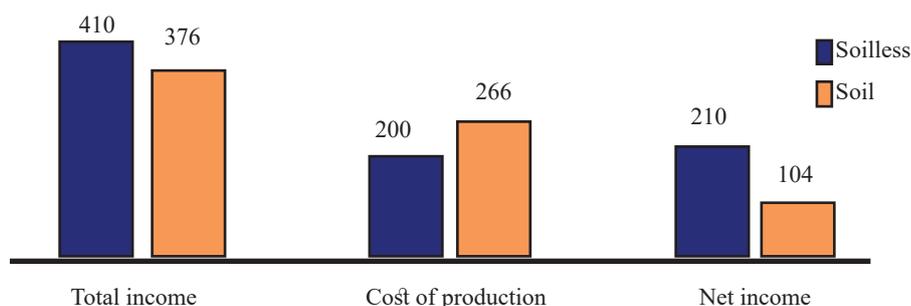
*A woman researcher receives training on growing spineless cactus in Oman*



*Women researchers from Yemen receive training on production of feed block from agricultural by products*

### Total income, cost of production and net income (1000 Yemeni Rials) for cucumber soilless production system in Yemen

*One Greenhouse size 360m<sup>2</sup>*



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**ICARDA**  
Science for Better Livelihoods in Dry Areas

