On-Farm Water Husbandry in West Asia and North Africa (WANA)
An Ecoregional Initiative

A. SUMMARY

Title: On-Farm Water Husbandry In West Asia and North Africa (OFWH)
Duration: Three years to date
Objectives: To improve the efficiency of rain water use in dry environments through the integration of appropriate water-harvesting techniques and the conjunctive use of rain and other available water resources in the farming systems of these areas.

Activities: Research on the indigenous water harvesting systems in their respective countries, underlining their past, present, and potential future use.

Area: Natural Resource Management
Region: West Asia and North Africa

B. Stakeholders

Beneficiaries: Small-scale resource users, Farmers
Research Partners: The OFWH program includes national teams in Algeria, Egypt, Iraq, Jordan, Libya, Morocco, Pakistan, Syria, and Tunisia and ICARDA.
Donors: This program has been supported by grants from BMZ, Germany, and the African Development Bank.

C. Project Results and Impact

Algeria
The Algerian team joined the project in 1999. They have initiated a comprehensive research program in the region of the Haut-Cheleff, 140 km southwest of Alger. Annual rainfall in this area rarely exceeds 350 mm. The research objectives are to improve the production of durum wheat in the Haut-Cheleff region through (i) the combined use of surface and ground water resources, (ii) the development of simple and economic irrigation and salinity control techniques; and (iii) the assessment of the potential for surface runoff collection in the foot-hills of the mountains.

Egypt
The Egyptian team has developed an efficient greenhouse water-harvesting system, with which 80% of the annual rainfall was captured. The water collected at three greenhouses was sufficient to produce one greenhouse of tomatoes grown using a hydroponic nutrient film technique (NFT). Compared with conventional cultivation, the use of this hydroponic system increased the water-use efficiency, fruit quality, and total yield for tomatoes, cucumber, and cantaloupe.

The Egyptian team is also evaluating the water-use efficiency of underground cisterns, and micro-catchment size and shape in Egypt’s northwest coast, an area with a long-term annual rainfall of 140 mm. Rainfall analysis indicated that runoff water collected in fall can be used for supplemental irrigation before the rain refills the cisterns during the winter season. Observations in 240 cleared and compacted micro-catchments indicated that the catchment size (40, 60, 80, and 100 m) did not affect the growth of the olive trees. Semi-circular plots were less effective than square plots with the same catchment area.
Iraq
The Iraqi team has conducted various experimental activities in farmers’ fields, including micro-catchments for forage shrubs and olive trees, strip cultivation of barley, and the development of large reservoirs for supplemental irrigation of wheat. The team is also involved in the monitoring and estimation of wadi runoff for large catchment areas in the western desert to divert water for irrigation. A paraffin wax emulsion, developed to induce runoff, was accepted for a patent. Strip cultivation of barley, using the paraffin emulsion as catchment treatment, improved yields of the planted area by 41%.

Jordan
The Jordanian team developed a table for water-harvesting application criteria in Jordan. Experimental micro-catchment water-harvesting activities, including the monitoring of runoff and soil moisture, were implemented at four sites. Application of improved practices for the catchment area, i.e., minimum surface disturbance and no manual weed control, reduced the infiltration rates of the runoff area by 42%.

Libya
Research activities in Libya include runoff plot measurements, water-harvesting contour strips for barley and water-harvesting contour ridges and trapezoidal plots for Atriplex. For the 1998-99 season, which had a few heavy rainstorms, runoff coefficients (runoff/rain) varied from 0.0 to 0.10 for the untreated runoff plots and from 0.31 to 0.99 for the plastic covered plots.

Morocco
The on-farm water husbandry research in Morocco has multiple components and objectives. The scientists have implemented various field trials on station and in farmers’ fields, focused on the size and surface treatment of micro-catchment water-harvesting systems and on soil moisture conservation. A GIS was used to assess runoff at the watershed level. The effect of catchment area size on wheat production was tested at two locations with an average annual rainfall less than 300 mm, and another two locations with an average annual rainfall less than 350 mm. At the dryer sites the highest grain yields were obtained under water harvesting. At the shallow soils of the dry site grain yield for the cultivated area increased with an increase in catchment area.

Pakistan
The Pakistani team selected two settlements in the province of Balochistan for their research activities. The annual precipitation in the target area is 100-200 mm in winter and 100-150 mm in summer. Semi-circular micro-catchments were established in cooperation with local farmers for newly planted forest and fruit trees and to improve water storage and growth of the existing native vegetation. To improve the quality of the water of small ponds for domestic and livestock use, a sand filter was developed. An economic irrigation system, using small-diameter concrete pipes, was implemented at a site with a dug well. The Pakistani team also used GIS and Landsat-TM image analysis to prepare agro-ecological maps at the district and province level.

Syria
The Syrian team has developed a large area with various micro-catchments to improve the production of fodder shrubs in the Syrian steppe. The growth of the shrubs generally increased with the increase in surface slope and catchment area. Measurements of runoff at plots with different slopes (5, 7, 12%), lengths (5, 10, 15, 20 m) and surface treatments indicated that runoff coefficients (runoff/rain) increased with the slope and decreased with the length of the plots.

Tunisia
The objective of the Tunisian research is the sustainable use of soil and water throughout the watershed. This includes soil and water conservation measures and water-harvesting techniques in the catchment area and the efficient use of water collected in hill reservoirs for irrigation. Soils, slopes and land-use data have been collected in the Kamech watershed in the Cap Bon region and in the Oued Oum Zessar in the south of Tunisia and mapped using a GIS. The water use from the reservoir
in the Kamech watershed has been monitored for four seasons (1995-1999). Both tomato yield (ton/ha) and water-use efficiency (kg/m³) were higher for the drip-irrigated than for the furrow-irrigated fields. Yields varied between 23 (furrow) and 75 (drip) ton/ha. Water-use efficiency for the fresh product varied between 3.9 and 12.3 kg/m³. The advice from the project has helped the farmers to increase the water use efficiency.

D. Partnership

**Respective Roles of different stakeholders and Added Value of the partnership**

The national teams with the assistance of ICARDA scientists developed their research work on the improvement of rain water-use efficiency in the dry environments according to local conditions and national priorities. Thus, the research program has combined the complementary strengths of all partners in strategic and applied research throughout the region.

E. Conclusion

The national teams have researched the indigenous water harvesting systems in their respective countries, underlining their past, present, and potential future use. The country papers are being compiled in a comprehensive document, which is scheduled to be published shortly. Very promising research activities on water harvesting and water use efficiency have been conducted under the umbrella of the On-Farm Water Husbandry program. In particular the water harvesting research, which is new to a number of the participating countries, is gaining momentum by attracting favorable attention from both decision makers and farmers, who appreciate the potential benefits for crop production.