

# Towards Sustainable Food Production for Marginal Lands in Aral and Caspian Sea Basins



*Afforestation efforts of local community are helping to rehabilitate salt affected desert lands.*

**Thematic Area:** Crop Productivity and Diversification

**Purpose:** Improve agricultural production under saline conditions in the Aral and Caspian Sea Basin

**Geographic Scope:** Uzbekistan, Kyrgyzstan & Azerbaijan

**Timeline:** 2013 - 2014

**Partners:**

- Ministry of Agriculture and Water Resources of the Republic of Uzbekistan
- Karalpak Branch of Forestry Station, Scientific and Production Center of Decorative Horticulture and Forestry of the Republic of Uzbekistan
- Institute of Botany, National Academy of Sciences of the Republic of Azerbaijan
- Innovation Center of Phytotechnologies of National Academy of Sciences of Kyrgyzstan
- Eurasian Food Security Center, Russia

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The Aralo-Caspian lowlands, a prime example of marginal and saline environments, face serious threats to sustaining the ever-growing population and the livelihoods of local farmer groups. Water scarcity and variable climatic conditions have resulted in the use of low-quality, mineralized water for irrigation which has adversely affected agricultural output and farmer incomes, further threatening the fragile balance. Given that most of the commonly cultivated crops, like cotton, wheat, and corn are sensitive to salinity, identifying drought- and heat-tolerant as well as water-use efficient alternative crops is imperative. This will improve agricultural production and sustain the livelihood of farmers and agropastoralists – especially those dependent on marginal quality land and water resources.

The International Center for Biosaline Agriculture (ICBA) launched the integrated, interdisciplinary “Towards Sustainable Food Production for Marginal Lands in Aral and Caspian Sea Basin” project which involved extensive research in the drylands regions in upper stream Kyrgyzstan and downstream Uzbekistan countries and Caspian Sea Basin, especially the saline prone areas in the Shirvan plain of the Kur-Araz lowlands in Azerbaijan, where irrigated agriculture has a long history of soil and water salinization concerns.

## Activities and Outcomes

Among the numerous project successes is the development of an inventory of existing practices which resulted in an “ideas” book. Furthermore, the novel methods and innovative approaches applied by the project helped to identify new sources of feed/ food consumption by using marginal resources and helped change local farmers’ and agropastoralists’ perceptions regarding marginal, even degraded croplands and land improvement options which in turn helped to raise awareness on pasture improvement and afforestation. Finally, special focus was given to institutional set-up and policy instruments for optimum utilization of marginal lands.

Field, laboratory, and lysimeter experiments were performed on several species of halophytes and salt tolerant crops by using different irrigation management techniques to reduce soil salinity and increase crop production. The crops included sorghum



*Utilizing artesian source of saline water to produce halophytes - plants which grow under saline conditions.*

(3 varieties); pearl millet (2), sesame (1), fodder beet (1), maize (2) forage and vegetable legumes (6), topinambur (2), indigofera (1), kenaf (1), atriplex (3), kochia (2).

This was followed by experiments on marginal lands in different agro-ecological system (foothills, plains, irrigated croplands, degraded desert rangelands) in all three countries with the local community fully involved in order to determine growth and salt uptake characteristics, as well as to identify food production potential for livestock and humans.

This required testing the interaction of salinity of shallow groundwater and nearby surface water in order to understand salinity dynamics in marginal croplands. In Uzbekistan, for example, it was found that the moderately saline (1.20-2.38 dS/m) groundwater was the largest contributor to soil salinization. Pre-season leaching is customarily used in this region to ameliorate saline soils, but the shallow groundwater table and the insufficient drainage make salt removal from the soil root zone ineffective, thereby negatively impacting agricultural productivity by as much as 30%.

Taking testing a step further involved the analysis of growth performance and yield productivity in the downstream arid zone of the Aral Sea Basin at two soil salinity levels: low salinity (< 0.58 dS/m), and medium salinity (> 1.26 dS/ml). Ground water salinity varied between 2.92 dS/m and 5.96 dS/m from spring to summer, and irrigation water salinity varied between 1.02 dS/m and 1.98 dS/m with sulphate as the predominant anion and sodium as the predominant cation in both ground and irrigation water.

All crops achieved good production at salinity levels where wheat production is commercially non-profitable, particularly when grown in soils with clay texture ranging from light to high. Sorghum, pearl millet, triticale, sesame, quinoa, amaranth, cow pea, mung bean, atriplex and others in pure or mixed farming based systems can also be suggested as alternative crops for saline agriculture. The results showed insignificant differences between

crop varieties in seed germination rate, plant height, and accumulation of green biomass when cultivated on soils with light clay texture and low level of soil salinity. A sharp decrease (by about 2.6 times) in plant density and survival rate was observed for maize and for traditional legumes grown on medium saline soil with heavy texture.

A key outcome of the project included three field training seminars for local young men and women at farmer-level on technology of cultivation and seed production of selected new valuable crops adapted to the local environment. In addition, three farmer/community-based seed multiplication units on salt-tolerant cereals, legumes and forage perennial plants were set up. Approximately 5% of female farmers were involved in "Self-Help Groups" activities on agroforestry trials, cultivation of dual-purpose crops and halophyte on farmer and household lands. At least 15 women were trained in seed quality legumes, fodder shrubs and cereals production, specifically sorghum and pearl millet.

### Future Directions

The development of an information database is planned to include crop suitability, crops calendar, and diversification maps to inform stakeholders about best practices for strengthening food and water security in marginal lands. ICBA along with partner institutions will further promote biosaline technologies based on utilization of halophytes as well as water and land management in the area. This will help define improved strategies and carry out field experiments, training of trainers, capacity building for farmers and pastoralists, and support events such workshops and farm-fairs.



*New mungbean (Durdona) variety grown in rice fallow in Karakalpakstan nearly doubled yields and incomes of local farmers, while making soils healthier.*