Alternative Production Systems, Technology Transfer and Capacity Building

Growing salt-tolerant forage grasses such as Distichlis spicata, Sporobolus virginicus, S. arabicus *and* Paspalum vaginatum *provides alternatives for farmers in the UAE to sustain livestock production and rehabilitating salt-affected farms.*

Model farms established by ICBA and ADFSC in the Western Region of Abu Dhabi demonstrated the potential of salt-tolerant perennial forages in rehabilitating degraded farms, offering significant opportunities to diversify the incomes of farmers.

Thematic Area: Crop Productivity and Diversification

Purpose: Rehabilitate salt-affected farms by identifying and introducing salt-tolerant alternative forages and improved farm management practices

Geographic Scope: UAE

Timeline: 2009 - 2014

Funding Agency/Partner: Abu Dhabi Farmers' Services Centre (ADFSC)

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As part of the United Arab Emirates (UAE) strategy to rationalize the use of natural resources and save its sparse water wealth, the Abu Dhabi government banned the cultivation of Rhodes grass in the Western Region of the Abu Dhabi Emirate. Thus, identification and introduction of alternative salt-tolerant forages with low water requirements became imperative to sustain livestock farming in the region and help combat the rising threat to feed scarcity.

Rhodes grass grown on many farms in the Abu Dhabi Emirate, has low to moderate salinity tolerance and high water demand. Large-scale cultivation of this grass has resulted in drastic reduction in groundwater levels and an increase in salinity due to intrusion of seawater, especially in coastal areas. To mitigate the impacts of the government's ban on planting of Rhodes Grass, the International Center for Biosaline Agriculture (ICBA) along with Abu Dhabi Farmers' Services Centre (ADFSC) launched the "Alternative production systems, technology transfer and capacity building" project." This project, which builds on the results of a ten-year evaluation of several forage grasses and shrubs at ICBA aims to sustain farm productivity in the Western Region of Abu Dhabi by demonstrating to farmers:

- Alternative, salt-tolerant forage to Rhodes grass, including perennial grasses, shrubs and trees.
- Different irrigation systems and best management practices that can optimize forage production in the region while at the same time minimize salinity build up in the soil.

The project also included a study of some salt-tolerant annual field crops and an extensive capacity building component in biosaline agriculture technologies for staff and farmers.

Activities and Outcomes

Following a ten-year evaluation of the alternative forage grasses and shrubs at ICBA to determine productivity, different levels of salinity and the optimum production practices to obtain high yields, a technology transfer took place. Three model farms were established in Mezaira'a, Madinat Zayed and Ghayathi in the Western Region of Abu Dhabi Emirate to test and demonstrate the optimum production practices for efficient management of agricultural production systems to obtain high yields and determine the productivity of various species under different levels of salinity.

The salinity of irrigation water at the time of establishment of the model farms ranged from 15-19 dS/m which during

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Halophytic perennial grasses tolerate high levels of soil and water salinity besides being more water-use efficient than the commonly grown Rhodes grass.

course of time increased to 23-27 dS/m probably due to decreased rainfall, and over abstraction of groundwater from the surrounding farms leading to intrusion of seawater.

Four halophytic perennial grass species namely: *Distichlis spicata, Sporobolus virginicus, S. arabicus* and *Paspalum vaginatum* were planted in all the three farms. In Mezaira'a and Ghayathi, in addition to the grasses, forage shrubs (*Atriplex* species) and trees (*Acacia ampliceps*) were also planted. Besides the forages, salt-tolerant annual field crops such as barley, pearl millet, sorghum, mustard, quinoa, cowpea and guar were evaluated for their yield potential. Compatible irrigation systems were installed in the model farms mainly micro-sprinklers for grasses and drippers for shrubs and annuals. In Madinat Zayed and Ghayathi the mainline pipe of the irrigation system was fitted with flow meters to measure the irrigation volumes on a daily basis. An automatic weather station was installed in Ghayathi to provide the local estimates of ETo which in turn helped to determine the actual crop water requirements and fine tune the irrigation application that further led to saving of water.

Growth performance and biomass yields of all the forages were assessed over the three years. The green biomass yields of the new grasses ranged from 120-140 tons/ha per year while those of the halophytic shrubs ranged from 30-50 tons/ha per year, indicating their potential as sustainable forages. The seed yield of the annual field crops such as quinoa and mustard ranged between 5-10 tons/ha, highlighting their value for intercropping with date palm for sustainable crop intensification. In turn, this can contribute to efficient use of resources and income diversification. The new grasses and shrubs, besides being more water-use efficient, are also tolerant of high levels of soil and water salinity, thus providing options for rehabilitating the salt-affected/degraded farms that are currently unproductive to grow conventional crops.

Capacity Building and outreach activities were carried to compliment and build upon the technical activities and outputs. A total of 63 ADFSC staff and extension officers were trained on basic concepts of biosaline agriculture. Additionally, two 'Field Days' were organized to promote the use of salt-tolerant alternative forages among the farmers in the region. Several farmers participated and were highly interested in the materials. Several brochures, handouts, guidelines and posters covering a range of themes such as salt-tolerant alternative crops and forage production systems; soil and irrigation; nutrient deficiency symptoms; common diseases and pests; and irrigation management in saline areas, were published and distributed.

> **"ICBA experiments with alternative grasses demonstrated that 44% of water could be saved to produce the same amount of forage as Rhodes grass."**

Future Directions

In the coming period, ICBA will be pursuing scaling up the livestock integrated forage production systems for the alternative crops to all salt-affected farms in the Abu Dhabi emirate. Going forward, the aim will be to determine the feed quality and best feeding strategies for alternative forages grown in highly salinized farms of marginal environments as well as building capacity by reaching out to staff and farmers for the production, processing and storage of forage. Additionally, these integrated forage production systems could be replicated in other marginal environments in the Arabian Peninsula and beyond.

Acacia ampiliceps*: A salt-tolerant leguminous perennial forage shrub.*