

DROUGHT MITIGATION AND ADAPTATIONS IN AGRICULTURE



Pakistan Agricultural Research Council

PAKISTAN

PARC Establishments



- ★ PARC
- NARC
- BARDC
- AZRIs (2)
- ▲ SARC
- NSTCRI
- NTHRI
- ▲ MARC
- SSRIs (6)
- PRTS
- AZRC
- ★ CARI
- ★ ARI
- ★ HRI

Adaptation and Mitigation Measures

PARC has successfully tested and introduced a number of varieties of different crops/grasses/plants, which are of short duration, consume less water and are resistant to water/heat stress.

PARC and other organizations like PCRWR have developed and demonstrated drought/desertification control technologies in the Cholistan, Ummrkot, D I Khan, Quetta and other areas:

- Grassland development
- Rainwater harvesting
- Range management
- Arid horticulture
- Livestock production
- Afforestation
- Saline agriculture
- Agriculture with good quality rain water stored in the ponds

Grasses for Livestock

Wado Dhaman: Can be used as direct feed/grazing and also mix with any other hay. It can give 5-6 cuttings per year.

Water Requirement: Two irrigations, optimum rainfall about 200 to 250 mm/ year. This withstand up to 3500 TDS water on sandy soils

Acho Dhaman (*Cenchrus ciliaris*)

Can be used as direct feed/grazing and also mix with any other hay. It can give 6-7 cuttings per year.

Water Requirement: Two irrigations, optimum rainfall about 150 to 225 mm/ year. This withstand up to 3500 TDS water on sandy soils



Adaptation and Mitigation Measures

Panicum Tanzania: Can be used as direct feed/grazing and also mix with any other hay. It can give 8- cuttings per year.

Water Requirement: 3-5 irrigations, optimum rainfall about 150 to 250 mm/ year. High sat tolerant

Panicum maximum: Can be used as direct feed/grazing and also mix with any other hay. It can give 4-5 cuttings per year.

Water Requirement: 3-4 irrigations, optimum rainfall about 200 to 225 mm/ year.



Grasses for Livestock

Rhode grass (Sabri)



Rhode grass Kambro



Steria grass



Atriplex canescens



Atriplex lentiformis



Development of Low-delta, Heat and Drought Resistant and Salt Tolerant Crop Varieties

Kharif crops: Millet (08), Sorghum, Mungbean (08), Guar, Castor, Cluster bean (42), Sesame (08), Moth (02)

Rabi crops: Barley, Rape, Mustard, lucerne, cowpea, horsegram, sunhemp, Lentil (Shir-AZ-96), chickpea, mashbean, safflower, seasmum and cereals

Forage: Legume (Kuhak-96) in Quetta

Fruits: Pomegranate, Fig, Olive in *Balochistan*, Dhaki date palm in *DI Khan*, Ber, Guava, Date-palm, Fig, Pomegranate and falsa at *Umerkot and Bahawalpur*

Arid horticulture Plants



Fruit plants like Moringa, Grafted Ber, Date palm, Olive, Falsa, Chiku and Lemon are tested and found best to grow in Thar Desert with 3000-3500 TDS saline water

Soil and Water Conservation and Management

- Drip, mini and micro sprinkler irrigation
- Pitcher irrigation
- Rainwater harvesting and efficient utilization
- Soil moisture conservation through mulching and zero tillage

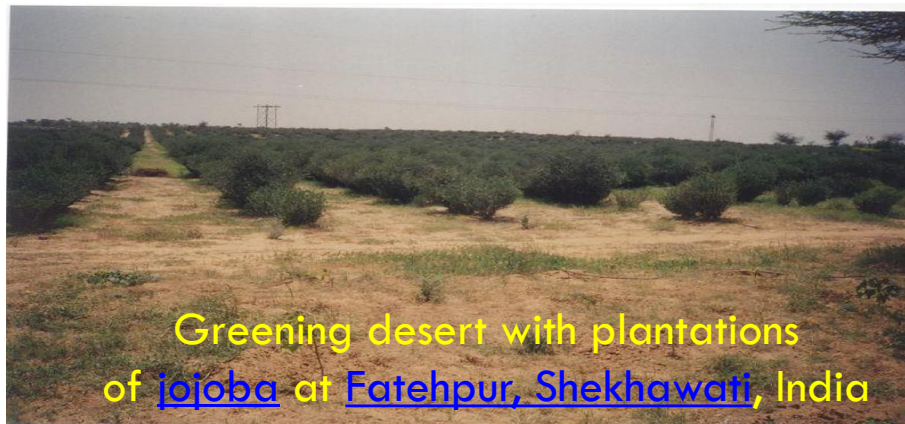


Figure 4. Adaptive approach for local *toba*



Soil and Water Conservation and Management

- Construction of water ponds and storage tanks for stockwater use
- Development and promotion of shelterbelt technology in desert areas to control wind erosion
- Introduction of skimming wells and dugwells in areas with shallow thickness of fresh groundwater



Desalination of Brackish Water

- PARC introduced this technology of house-hold scale solar desalination units in Tharparkar and Bahawalpur. .
- It can clean up to 20,000 ppm of brackish water in drinkable limit less than 500 ppm and desalinate about 25 liters in 8 hours of sunshine.
- The desalinated water can be used solely or in conjunction with brackish water to grow high-value fruits/vegetables crops in pots/kitchen gardening to secure food deficiency and improve livelihoods at household level.



Bio-saline Agriculture/Agro-forestry

- PARC has done some pioneer work on introduction of energy crops/plants in marginal conditions
- Four species of indigenous cultivars of energy plants (Pongamia, Jojoba, Castor, Jatropha) were tested in DI Khan, Bahawalpur, Umerkot and Karachi
- Adoption of these crops in drought prone areas can improve farmers' livelihoods and resilience against drought
- Recently, PARC-AZRI Umerkot has demonstrated cultivation of arid horticulture (dates, grafted ber, Guava) using brackish water coupled with drip irrigation

Energy and Medicinal Plants

Energy Plants Four species of indigenous energy plants (Pongamia, Jojoba, Castor, Jatropha) were tested in DI Khan, Bahawalpur, Umerkot and Karachi and found successful in marginal conditions

Medicinal plants: Fifty-five exotic species of medicinal plants have been raised at Quetta. Some of the indigenous aromatic/medicinal herb plants include German Chamomile, Lavender, Rosemary, Mint, Thyme, Marjoram, Oregano, Basil, Dill, Sage, Funnel, Ispaghul, and Tarragon.

Recommendations

- **To designate some agency/institution for carrying out drought management with clear role and responsibilities which presently completely lacks.**
- **Our focus has been responsive whereas proactive drought management approach is cheaper and effective**
- **Improvement of linkages between research and line agriculture, irrigation and NGOs for upscaling and outscaling tested innovations**
- **Awareness raising of line departments, NGOs and communities for household adoption of tested technologies**
- **Provision of tested intervention through development projects on subsidy**

Recommendations

- **Promote “low delta crops” and research on drought and pest resistant crops**
- **More coordinated focus on drought reseach**
- **Provision of solar desalination and RO plants , solar pumps, drip for drinking, kitchen gardening, tunnel farming and arid horticulture**
- **Provision of seed of potential grasses/crops/fruit cultivars**

Recommendations

Short term Actions

Promote “low delta crops” and research on drought and pest resistant crops

Undertake development of drought resistant shrubs, fodder crops and grasses for pastures and oasis for livestock

Ensure sustainable harvesting of indigenous dry land tree species

Recommendations

Short term Actions

Deployment of water filtration plants / water tankering

Construction of more water storage facilities as well as construct of additional small retention ponds throughout the watershed

Find technological breakthrough for irrigation systems, to raise vegetative cover in extremely difficult and harsh areas of arid zone

Livestock emergency extrication plan from the worst affected areas towards the traditional relief zones.

Encourage development of technological innovations for improved water efficiency for crops, including artificial groundwater recharge

Recommendations

Medium term Interventions

Promote water harvesting at regional as well as household level

Parallel interventions should promote awareness and reinforce local emergency response coping capacities.

Mapping of vulnerable human population, mainly from the food security, nutrition, access to potable water perspective

Mapping of the vulnerable livestock from inadequate access to water, fodder and time required for extrication to the relief zones perspective

Recommendations

Long Term Policy Initiative

Drought Mitigation Strategy (DMS) is essential for the drought prone areas which may address; i. Water ii. Food and agriculture iii. Health iv. Livestock and range management v. Climate change adaptation

**Drought mitigation activities are by and large, managed on an ad hoc basis
Contrary to well established flood control mitigation with adequate institutional arrangements**

Designate agencies and stakeholders responsible for carrying out drought mitigation and response actions, and require regular review of, and progress reports on, their implementation.

The farmers should be trained in adoption of efficient water use technologies such as sprinkler and drip irrigation, rain water harvesting, water storages etc.

THANKS