

# Agri-Horti-Forestry Development

## Technologies

- Tree based farming system with intercrops, border plantation of arid fooder trees.
- Soil and water conservation.
- Composting.
- Gravity based drip irrigation system.
- Vegetable cultivation
- Nursery.

## Practices

- Adaptation trials of different arid fruit crops Practices (Wadi).
- Scientific Plantation.
- After care.
- Water Supply.

## Practices (Intercrops)

- Introduction of improved varieties.
- Improved PoP.
- +
- Capacity building of participant for improved management practices.

## Technology benefits

- Under utilized land turned to productive land /assets for farmers.
- Adequate nutrient availability.
- Use of organic manure reduced cost of production.
- Sustainable livelihood option (Employment and Income).



## Tree based farming (diversification of fruit trees by considering arid specificity)

- **Fruit species - (Barmer)** - Ber (*Zizyphus mauritiana*) + Lasoda (*Cordia dichotoma*) + Pomegranate (*Punica granatum*) as one unit on 0.5 acre land.
- **Fruit species - (Kutch)** - Date palm (*Phonix dactylifera*) + Ber (*Zizyphus mauritiana*.) + Pomegranate (*Punica granatum*) as one unit on 0.5 acre land.
- **Inter crops** - Gaur (*Cyamopsis tetragonoloba*), Green gram (*Vigna radiata*), Mot (*Vigna aconitifolia*), Kachari (*Cucumismelo*), Watermelon (*Citrullus lanatus*), Musk melon (*Cucumismelo var.momordica*), Brinjal (*Solanum melongena*), chilly (*Capsicum annum*), Tomato (*Solanum lycopersicum*).
- **Forest Trees / Fodder Trees** - Subabul (*Leucaena leucocephala*), Khejri (*Prosopis cineraria*), Ardu (*Aiianthus excels*), Neem (*Azadirachta indica*), Anjan (*Hardwickia binate*), Sesbania (*Sesbania sesban*).



## Involvement of participants

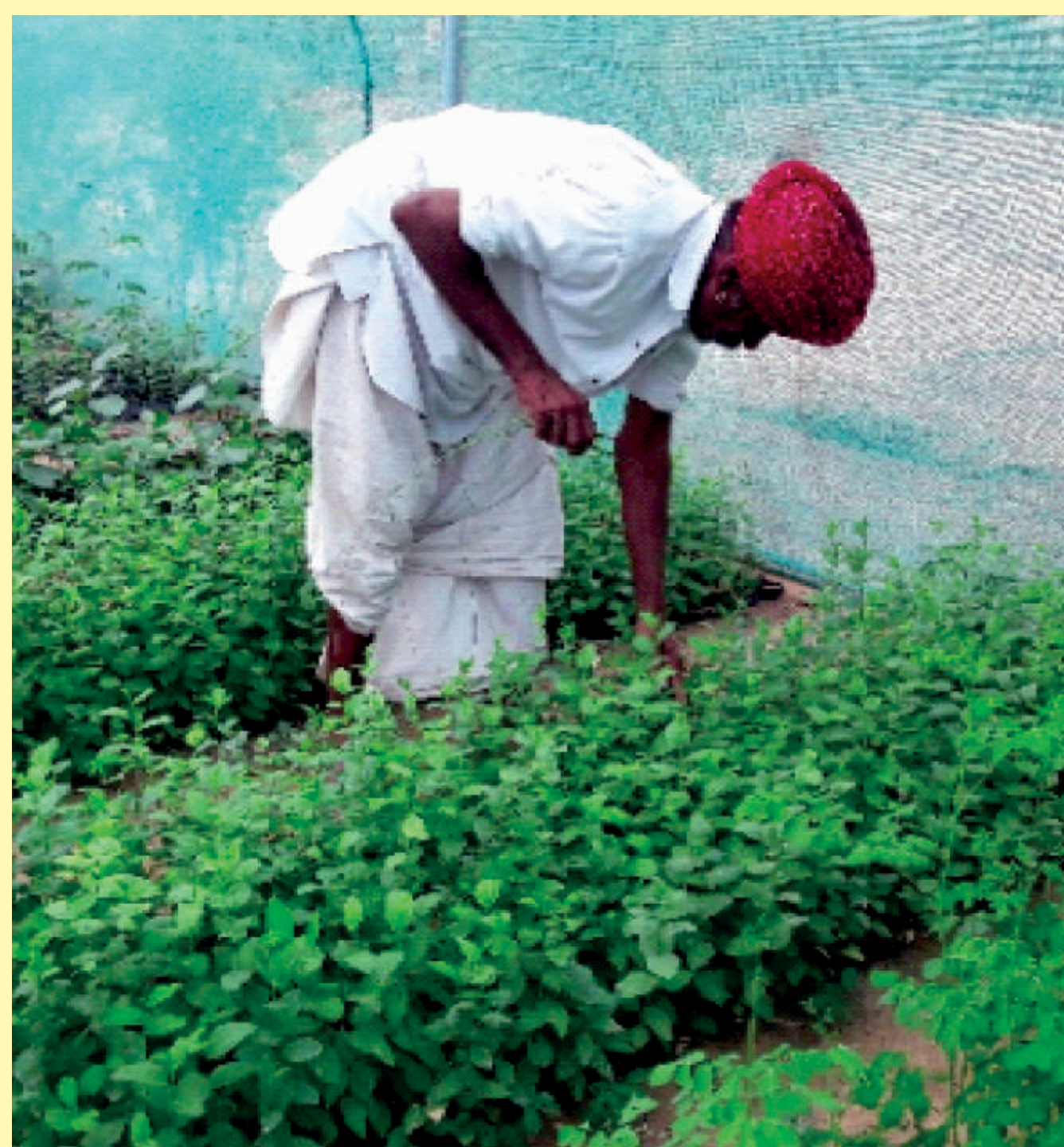
All activities are run by active involvement of farming communities and primary groups like farmers group and SHGs.

## Actual reach

These technologies successfully demonstrated with more than 2500 families in arid / desert area Barmer & Kutch.

## Outcome :

- \* Crop diversification.
- \* Improved agriculture practices adopted by 3500 families.
- \* Arid species of fruit crops established on 1900 acre.
- \* Improvement in yield by 28% & average net income Rs. 60,000/- per acre per annum.



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# Water Resource Development

## Appropriate technologies - Barmer, Rajasthan

- Tanka with Agor (Capacity of 30000 liters)
- To collect rain water.
- Inter linking of Tanka.
- Collection of roof top rain water in Tanka

## Technology benefits

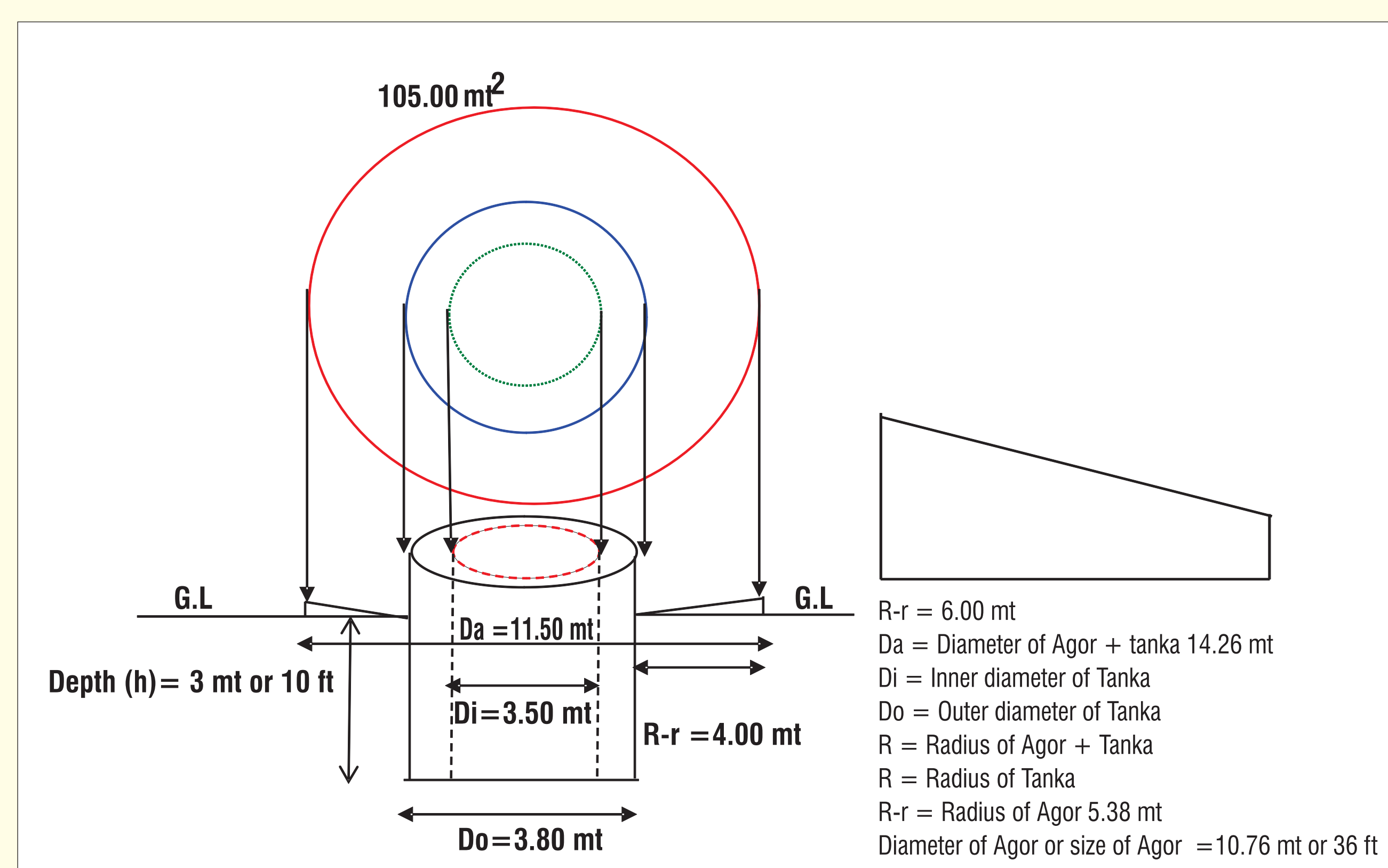
- Increase in
  - Water storage and availability.
  - Area under irrigation.
  - Area under cultivation.
- Improved health and hygiene status of families.

## Involvement of participants

- Involvement in planning and execution.
- Contribution for material and labour.

## Outcome

- Employment / workdays generated.



## Appropriate technologies - Kutch, Gujarat

- Well and Bore well recharge.
- Construction of farm pond.

Low-yielding wells and bore well recharged with rainwater collected in 1.5 x 1.5 x 1 mt structures.

## Technology benefits

- Increase in ground water level.
- Area under cultivation has increased.
- Salinity of water reduced.

## Involvement of participants

- Involvement in planning and execution.
- Contribution for material and labour.

# Livestock Development Interventions

## Cattle and Buffaloes

### Technologies

- Breed improvement.
- Improved feeding practices.
- Fodder production.
- Fodder seed production.



### Services

- Capacity building of livestock keepers for improved management practices.
- Door step AI for large ruminants.
- Fodder development programme for availability of quality fodder.
- Mineral Mixture support through linkages.
- Fecal samples examination.
- De-worming, vaccination and health monitoring.

### Technology benefits

- Conservation of native breeds of region.
- Services reached up to farmers.
- Improved fodder cultivation practices.
- Availability of nutritious fodder through out the year.
- Upgradation of local breeds of cattle - Gir, Kankrej and Banni Buffaloes.
- Availability of quality fodder seeds.



**Forward Linkages :**  
Milk marketing through dairy cooperatives.



### Fodder development programme :

Kharif – Sorghum + Cowpea + Napier  
Rabi – Lucerne + Oat + Barley  
Summer – Bajra + Lucerne  
Silvipasture development –  
Fodder trees + Grasses : Dhaman / Sevan.

### Actual reach

These technological interventions successfully demonstrated in 52 villages with more than 5000 families in Kutch region.

### Involvement of participants

All activities are run by active involvement of livestock keepers and their SHGs.

### Organisation of trainings, exposure visits and health camps



### Outcome

- Capacity of large ruminant keepers has been increased.
- Reduction in mortality up to 9%.
- Milk production increase, farmers sale milk to the cooperative.
- Increased milk consumption at home @ 500 ml. per person per day and surplus milk sale in market.
- Productivity enhancement of milch animal.



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# Livestock Development Interventions

## Small Ruminants

### Technologies

- Breed improvement.
- Feeding practices.



### Induction of standard management practices :

- Capacity building of small ruminant keepers.
- Introduction of Elite Ram and Buck.
- Improvement in feeding standards - Leaf Meal production and Lopping practices.
- Cactus as a fodder.
- Fecal samples examination.
- De-worming, vaccination and health monitoring.
- Body weight monitoring & record keeping.

### Technology benefits

- Conservation of native breeds of region.
- Genetic improvement in local breeds.
- Increase in body weights.

### Involvement of participants

Small ruminants groups are established and activity run by active involvement of small ruminant keepers.

**Actual reach:** These technological interventions demonstrated more than 500 families in arid most region.



### Organisation of training, exposure visits and health camps.



### Outcome :

- Capacity of small ruminant keepers has been increased.
- Up gradation of local breed of small ruminants 4462 new kids / lambing.
- Productivity enhancement in milk, meat and wool.
- Mortality rate is decreased upto 5%.
- Good management practices have been adopted by small ruminant keepers.
- Increased in financial status of small ruminant keepers.



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# Introduction of Suitable Technologies in Arid / Desert Region of India

## Desert Context

- Scanty and irregular rainfall, recurrent droughts, severe water shortage, harsh climate and physical environment.
- Poor soil condition, low content of organic matter in soil, salinity, hence low productivity.
- Practice of rain fed agriculture and limited efforts of crop diversification.
- Less productive and mixed / non-descript breeds of livestock, fodder scarcity and absence of practice of scientific management.
- Degrading base of natural resources, adding to the hardship of women, scattered settlements and men mostly migrate in search of better livelihoods opportunities.

## Issues and Suggested Technologies

Before and After



Tree based farming system arid specific fruit crops with intercrops.



Water resources development Tanka with agor for availability of water.



Low cost gravity based drip irrigation system for wadi.

## Outcomes

- Participant in Barmer gets additional average net income of Rs. 14,280/- per acre / yr. through intercrops and Rs. 33,000/- per acre per season from vegetable and Rs. 60,000/- per acre per annum from fruit trees
- Kutch participants are getting income of Rs. 18,630/- per acre additional income through intercrops and Rs. 22,000/- per acre per season from vegetable and Rs. 55,000/- per acre per annum from fruit trees
- From fodder cultivation getting Rs. 22,000/- per acre per season
- Superior breed of small and large ruminant born
- Drinking water available for longer time
- Increased availability of quality fodder by introduction of improved fodder crops
- Drudgery reduction technology reduced hardship of women
- Technologies demonstrated in DST programme, taken up in NABARD and CSR sponsored project in arid/desert areas.

## Approach

Participatory analysis of contextual need, followed by promotion of technologies and processes at the household land community levels for sustainable increasing returns from agriculture and animal husbandry, increasing availability of water, biomass, and reducing drudgery of women. The farming system is seen as a whole with agriculture, horticulture, livestock, fodder and water resource components integrated at the household level.

## Issues and Suggested Technologies

Before and After



Upgradation of local breed.



Introduction of Elite ram of Marwari breed in Sheep.



Introduction of improved stove reduce drudgery of a women.



Introduction of solar dome.



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# Sustainable Livelihoods Development Model for Arid Region of Western India

## Programme Approach

- Participatory analysis of contextual needs, followed by promotion of technologies and processes at the house and community levels for sustainable increase return from agriculture and animal husbandry, increase availability of

water, increase biomass and reducing drudgery of women .The farming system is seen as whole, with agriculture, horticulture, livestock, fodder and water resource components integrated at the house hold level.



WADI Tree based Farming



Nurturing of fruit trees

## Activities

- Promotion of tree based farming system – suitable arid specific fruit crop as main crop.
- Border plantation of multipurpose arid forestry and fodder species.
- Intercropping of legumes and vegetable crops cultivation using improved methods and Introduction of improved short duration drought tolerant varieties.
- Tapping of rain water -innovative storage structure Tanka with agor, water harvesting through well and bore well recharge measure and roof top rain water harvesting.
- An innovative technique like low cost gravity based drip irrigation with mulching.
- Improve the genetic potential of local large and small ruminants by introducing Artificial insemination in cattle and buffalo and introduction of Elite rams and buck with scientific management practices.
- Drudgery reduction measures, including S&T tools to reduce the hardship of arid women in daily activities
- Training and capacity building.
- Promotion and nurturing village institutions and people's organizations.



## Target

- Arid and desert area of Little run of Kutch, Nanodra farm Gujarat and Barmer districts of Rajasthan.
- No of participant families : 3500.
- Crops diversification .



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# Cactus (*Opuntia ficus indica*) an Emerging Fodder Crop of Arid and semi Arid India

**Areas :** Cactus is a well-known crop for arid climate. Efforts have been made to introduce this crop at farmer's level by BAIF in arid and semi-arid regions of India. Cactus has high water use efficiency which makes it an excellent crop species suitable in water stressed condition.

Keeping in view the potential of Cactus crop in arid and semi-arid climate, a research study was undertaken at BAIF, to standardize the nursery and production technology of the cactus for fodder, evaluate the nutritional status of different accessions and performance of the cactus feeding in small ruminant (goat).

## Rationale for introduction of Cactus in Arid and semi Arid India

- Has capacity to produce good biomass throughout year using minimum water.
- Multipurpose plant, drought tolerant, easy to establish
- Potential for rangeland and pastureland management, helps in soil and water conservation.

## Research Recommendations

**Cactus Germplasm:** Developed cactus arboretum with 90 accessions collected from various research institutes and local collections.

**Propagation :** The cactus cladode of 6 months of age and above may be selected for nursery propagation. The survival and growth was influenced by cladode pieces and single cladode gave maximum survival, sprouting and growth. However the 1/8th piece of cladode may be multiplied into a new plant under limited availability of the elite planting material.

**Cultivation :** Cactus can be established and grown under very poor degraded type of soil. All the four accessions 1270, 1271, 1280 and 1308 have showed potential for fresh biomass production and any accession may be selected for

planting as a fodder. The application of 60:30:30 kg NPK/ha during planting enhanced the fresh biomass yield. The regular irrigation at 15 days interval has boosted the biomass yield and maximum biomass may be obtained under irrigated condition.

**Adaptation :** The cactus has well adapted under arid and semi arid conditions and satisfactory plant growth was observed at Nanodara (Gujarat) and at Barmer (Rajasthan). Therefore cactus plantation may be promoted which could be substituted as green fodder for feeding livestock during scarcity period.

**Nutritional Status :** The nutritional evaluation of cactus accessions indicated its richness in minerals and moderate level of protein content and the best accessions may be promoted for plantation as a source of green fodder in arid and semi arid regions.

**Goat Feed :** Cactus feeding in Osmanabadi goats and kids enhances the performance in terms body weight gain without any adverse effect. Cactus exhibited its high palatability, on an average 3 kg cactus per day per goat can be fed to maintain the body weight without any adverse effect on health. Cactus can be used as a fodder for replacement of 25% dry matter with their regular grazing without any adverse effect on their health.



Thorn less cactus (1270)



Thorn less cactus (1308)



Field experimentation in Cactus



Nursery techniques standardization



Cactus arboretum



Chaffing cactus for feeding



Cactus feeding in goats



Fruiting in cactus

Accessions/Parameters	Dry matter (%)	Crude protein (%)	Crude fiber (%)	Ash (%)	Silica (%)	Ca (%)	P (%)	K (%)	Mg (%)	Na (%)	NDF (%)	ADF (%)
1270	7.51	6.09	11.57	13.11	1.23	0.53	0.36	0.27	0.11	0.20	26.34	17.66
1271	7.95	5.48	13.73	18.05	1.01	0.47	0.41	0.26	0.10	0.19	26.52	18.24
1280	11.44	5.45	17.22	12.10	1.65	0.50	0.38	0.29	0.09	0.22	26.43	17.42
1308	11.15	5.33	20.66	12.95	0.96	0.53	0.37	0.30	0.10	0.21	25.26	17.16



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