THEME:
NATURAL FOREST MANAGEMENT / BIODIVERSITY

Title of the technology

Micro-catchments for plantation establishment

A. Nature of technology

Rainwater harvesting and conservation

B. Process in brief

Effects of different micro-catchment structures viz. saucer of 2.5 m diameter, ring pit, ridge and furrow, trench cum mound and deep ploughing and pitting, on growth and establishment of plants in arid zone, were studied at AFRI. The results demonstrate a dramatic impact of micro-catchments rain water harvesting technology on tree growth, which improved by 4 to 5 folds on micro-catchments, when compared with control in case of *Azadirachta indica*, *Prosopis cineraria* and *Tecomella undulata*. The micro-catchment structures; ring pits, big saucers and have been found beneficial.

The study amply demonstrates the usefulness and scope of rain water harvesting and conservation practice in improving tree growth in Indian Desert. The ridge and furrow technique, trench cum mound, ring pit and saucer of 3 m diameter were very effective and enhanced the soil moisture storage by as much as 42% in the upper 75 cm layer alone after mild shower of 27.5 mm in January. Enhancement in moisture storage was much higher in monsoon season, particularly in deeper soil layers. This resulted a several-fold increase in biomass, profusely spreading and deeper root system (penetrating through the CaCO3 layer which, due to better moisture condition, was less hard) and continuance of tree growth in the period of acute moisture deficiency (June). Trees in the treated plots experienced less moisture stress in terms of severity and length of period, with the result that the trees were taller, thicker and had straighter bole, denser and wider crown than in the control plot.

Ring pit

Trench cum mound

Saucer of 3.0 m diameter

C. Beneficiaries of the technology

1. Prominent beneficiaries

State Forest departments of Rajasthan and Gujarat, non-government organization working in the area and farmers are the main beneficiaries.

2. No. of clients to whom technology has been transferred

Demonstration of this technology was carried out in farmer's field (at Jasol, Barmer district), experimental field of AFRI, in community land (at Rohat in Pali district) and forest lands in Palanpur district, Gujarat and Nagaur in Rjasthan. The results were extended for other species like, *Dalbergia sissoo*, *Eucalyptus camaldulensis* and *Zizyphus mauritiana* etc.

Besides this, the technology has been discussed at many forums such as workshop/conferences, meeting/ stakeholder meetings, public forum, Seven peer reviewed papers have been published based on the research findings.

Paper Published

1. Gupta, G. N. and Meena, J. N. (1993). Tillage practices for tee establishment in arid region. *Annals of Arid Zone*, 32(2): 91-93.
2. Gupta, G.N. 1994. Influence of rainwater harvesting and conservation practices on growth and biomass production of *Azadirachta indica* in Indian desert. *Forest Ecology and Management*, 70: 329-339
3. Gupta G. N. (1995). Rain water management for tree planting in Indian desert. *J. Arid Environment*, 31 :219-235.
4. Gupta, G. N., Bala, N. & Choudhary, K. R. 1995. Growth and biomass production of *Tecomella undulata* as affected by rainwater harvesting and conservation practices in arid zone. *International tree Crops Journal*, 8:163-176.
5. Gupta, G. N., Bala, N. and Choudhary, K. R. 1995. Growth and biomass production of *Prosopis cineraria* using run-off harvesting and conservation techniques. *Indian Forester*, 121(8): 702-710.
6. Gupta, G. N., Choudhary, K. R., Singh, B. and Mishra A. K. (1993). Neem establishment in arid zone as influenced by different techniques of rainwater harvesting. *Indian Forester*, 119(11):914-919.
7. Gupta, G. N., Limba, N. K. and Gupta, P. K. (1995). Micro-catchment water harvesting for raising neem in arid region. *Indian Forester*, 121(11):1022-1032.

3. Potential for further dissemination

Water is the prime constraint in desert afforstation. In Indian arid zone afforstation activities are mainly dependent on rain water, which is scanty and erratic in nature. Moreover, this scanty rainfall is received in a few heavy showers resulting in sizable amount of runoff losses.

In Rajasthan, runoff losses have been reported as high as 50%. These constraints emphasise the importance and potential of for further dissemination the technology in large scale.

D. Economic significance

1. Potential to address Livelihood issues and generate additional income

The technique is labour intensive, thus generating additional employment of 85 man-days ha^{-1}. In Indian desert famine relief works are quite frequent under Desert Development Programme, where forestry is the core activity. Therefore, this technology not only economically viable, but beneficial socially and more importantly, it will help towards economic stability by reducing uncertainty of livelihood in arid ecosystem.

Types of benefits associated with this practice:

Environmental	**Economic**	**Social**
Increase in production per unit area.	Increased landscape value.	Economic and social stability to famine struck desert region by not only overcoming the risk of plantation failures, but also by generating employment for the desert dwellers and reduce nomadism.
Improvement in soil status.	Increased land value.	
Increase in carbon stock both in soil and tree.	Increased fuel wood supply.	

2. Productivity enhancement and economic benefits over replaced technology

The cost of preparing the micro-catchment rain water harvesting structures is about 21-50% higher, whereas gain in biomass accumulation was 3 to 4 fold, just in an initial period of 26 months.

Based on growth, cost benefit analysis, employment and social conditions trench and mound and saucers of 2.5 m diameter have been recommended. The water harvesting techniques prevent runoff losses (30-50 %), maintain higher soil moisture regime and facilitate better tree establishment and growth owing to better development of root system, improved water use efficiency, improved nutrient use efficiency (4-7 times), thus give a good start to young plantations.

There was enhancement in moisture storage particularly, in deeper soil layers because of water harvesting and conservation measures. This resulted a several-fold increase in biomass, profusely spreading and deeper root system (penetrating through the $CaCO_3$ layer which, due to better moisture condition, was less hard) and continuance of tree growth in the period of acute moisture deficiency (June).

E. Developed by {Name *of Scientist(s)/ Officer (s)*}

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