THEME:
NATURAL FOREST MANAGEMENT / BIODIVERSITY

Title of the technology

Mulching and weeding for conservation of soil moisture and enhancing plant growth

A. Nature of technology

Soil moisture conservation

B. Process in brief

Moisture conservation practices such as mulching with local under shrub like; *Crotalaria burhia*, soil tillage and intercultural operations in dry zones adequately demonstrate their utility in plantation establishment and early growth of trees by increasing plant height (24%) and collar circumference (27%) in *Azadirachta indica*. This impact is attributed to the prevention of evapo-transpiration losses and consequently high soil moisture regimes and moderation of thermal regimes (by 5 ^{0}C) in the vicinity of roots and consequently maintaining better microbial activities resulting in transformation and availability of nutrients.

Study on partitioning of water loss in a lysimeter study indicated that water losses from the *E. camaldulensis* plot (irrigated at the rate of 36.2 mm per irrigation) was 4.75 mm day^{-1} (19 lit day^{-1}) during summer as compared to 3.45 mm day^{-1} (13.8 lit day^{-1}) in *A. nilotica* and 2.62 mm day^{-1} (10.56 lit day^{-1}) in *D. sissoo* plot. The depletion in soil water from bare soil was 7.0 lit day^{-1} that contribute significant amount of water loss. Simple mulching with locally available *Crotalaria burhia* under shrub saved the water loss by 0.15 mm day^{-1}. In conclusion, surface evaporation contribute significant amount of water loss that can be reduced by weeding and surface mulching with locally available under-shrubs or grasses to enhance productivity.

The studies amply demonstrate the usefulness and scope of moisture conservation practice in improving tree growth in Indian Desert. *Crotolaria burhia*, which is available in abundance in agricultural fields as a weed and other waste lands, could be profitably utilized as mulch to improve initial development and growth of trees in arid region. Mulching is known to reduce evaporative loss of soil moisture, moderate root zone temperature and improve microbial activities and nutrient availability.

C. Beneficiaries of the technology

1. Prominent beneficiaries

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

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

This technology has been discussed at many forums such as workshop/conferences, meeting/ stakeholder meetings, public forum, etc. Six papers have been published in various journals.

Paper Published

1. 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.
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., 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, sizable amount of this scanty rainfall is subjected to losses through evaporation from soil. Adoption of moisture conservation techniques such as mulching, tillage, weeding, etc. have enormous potential to be used in afforestation activities to conserve soil available moisture which will be utilized by the plants. The findings are based on field experiments in arid condition which can be replicated in other arid areas, where water is the most limiting factor for plant establishment and growth.

D. Economic significance

1. Potential to address Livelihood issues and generate additional income

The additional cost of mulching is only 10% compared to no mulch, whereas the additional biomass produced is 35%. The study also highlights the necessity of weeding in arid zone plantations as it prevents unproductive loss of water and nutrients and allows their utilization by plantation thereby improving their growth. A simple mulching with locally available

material saved the water loss by 0.15 mm day^{-1} (1.5 tonnes of water ha^{-1} day^{-1}) which is a precious commodity in dry land areas.

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

Weed clearing was found to conserve 20% higher moisture, improve tree height by 26% and double the biomass production in *A. indica* as compared to the control.

3. Impact of the technology

The moisture conservation techniques like mulching and weeding in addition to micro-catchment rain water harvesting are very effective in boosting early establishment and growth of trees. Compared to control mulching improved the biomass accumulation by *Azadirachta indica* demonstrating its usefulness in arid climate. Weeding also enhanced biomass production in *A. indica*.

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

Dr. G. N. Gupta, Scientist- G and former Head, and Dr. G. Singh, Scientist – F and Head, Forest Ecology Division.