

Agroforestry: A multifunctional system

for livelihood and environmental security

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Planting trees in agricultural landscape not only generates income in the form of timber and non-timber produce, but also performs valuable ecosystem services. Agroforestry has an important role in reducing vulnerability, increasing resilience of farming systems and buffering households against climate related risks. It can also maintain or increase the supply of ecosystem services—water, soil health and biodiversity— especially under a changing climate, that will continue to support social, industrial and ecosystem services needs. There is an urgent need to have appropriate marketing interventions and capacity-building programmes for post-harvest technology with value addition in these areas to provide better economic returns and to check the migration of rural youth towards urban areas. The potential and role of agroforestry in providing livelihood and environmental securities in India is immense.

Key words: Agroforestry system, Arid zone, Khejri-based system

INDIA faces a critical imbalance in its natural resource base with about 18% human and 15% livestock population of the world being supported only by 2.4% geographical area, 1.5% forest and pasture lands and 4.2% water resources. The increasing deforestation for human habitation, developmental activities and intensive agriculture resulted in ecological imbalance. Therefore, need has been realized for conservation of natural resources and protection of the deteriorating environment so that the required growth in agriculture is maintained with sustainability. For supporting a worldwide sustainable agricultural system, tree-mediated ecosystem services are recognised as key features of more sustainable agroecosystem as well as for fulfilling the requirement of ever-increasing demand of food for the growing population.

In several studies the valuable contributions of forest trees under agroforestry (AF) have been highlighted for improving ecological and environmental services in forms

of agricultural intensification. The article brings together some of the important information of suitable agroforestry practices in the country that deal with a number of ecosystem and environmental services as well as livelihood security.

Khejri-based agroforestry system in arid region

The khejri tree (*Prosopis cineraria*) is also called as the King of Desert due its multiple benefits in conserving the fragile desert ecosystem. This tree provides all



Prosopis cineraria based agroforestry system at farmers field in Pali, Rajasthan



Poplar based agroforestry system in Haryana



Melia dubia based agroforestry system in Haryana

types of ecosystem services (food, fodder, shade, shelter, fuel, aesthetic value, improving soil fertility etc.). Khejri is a slow-growing species in its early stage, with low fodder production and limited soil beneficial effects in the initial years. Under agroforestry system (AFS), khejri trees are maintained in a scattered way (sometimes on boundaries) in association with cereals and pulses at a density of 5 to 80 trees/ha. In dry areas of Rajasthan, associated khejri trees improve the understorey microclimate, which can ultimately reduce the soil and water loss.

The economic analysis of khejri based AFS revealed that maximum returns were obtained when fodder crops were grown in association with khejri based AFS as compared to sole crop (devoid of tree). In khejri based AFS the maximum net returns (₹ 15,197/ha) and benefit-cost ratio (3.73) was obtained when pearl millet was grown during *kharif* season followed by toria (*Brassica tournefortii*) in *rabi* as compared to sole crop. The higher profitability in *Prosopis cineraria* based AFS may be attributed to increased productivity of crops in this system and additional value of fuel and fodder from the allied khejri trees.

Populus deltoides based agroforestry system in Indo-Gangetic region of India

To check land degradation and achieve biological production on a

sustainable basis, *Populus deltoides* is recognized as an important tree component in agroforestry system. Due to its speedy augmentation, high price, less competition with allied crops and pruning tolerant nature this species has been widely grown by farmers of North India, especially in the states of Punjab, Haryana and Uttar Pradesh as boundary or block plantation along with agricultural crops. In poplar based AFS the soil is enriched through the addition of leaf litter in large quantities by this species, which ultimately improves the fertility in terms of soil organic carbon (SOC), available N, P and K also provides alternate sources of revenue and employment to the rural population. Being a winter deciduous tree, it produces 3-5 tonnes of litter fall in the winter season from second year onwards. In one of the study, the highest available soil N (366.3 kg/ha), P (21.4 kg/ha) and K (355.3 kg/ha) were recorded under eight year old poplar based AFS at 5 × 4 m spacing. The higher decomposition of leaf litter favours higher nutrient status of the soil. The higher available nutrient content in poplar-based agroforestry system over the agriculture system may be attributed to litter fall from poplar trees as well as addition of root residues of crops and trees.

Melia dubia based agroforestry system

Melia dubia is a fast growing,

indigenous and economically important multipurpose tree species in India. Due to its manifold utilization, it has been found as a suitable agroforestry tree under AF not only for improving ecology and environment, but also to increase livelihood security of the farmers on a sustainable basis. For adoption of *Melia* based AFS it is important to select appropriate agricultural crops for block plantation. Agricultural crops can be raised fruitfully for the initial few years in block plantations of *Melia* which mainly depends on the canopy of this tree. *Melia dubia* did not have any negative effect on growth and yield of crops grown in agroforestry system.

SUMMARY

Agroforestry provides livelihood as well as environmental securities through multifunctional benefits at farm level. The various region specific systems such as poplar in IGP region, khejri in arid region and *Melia* in southern India are adopting at larger scale to fulfil not only industrial but also environmental requirements. In the era of agricultural intensification and climate change, agroforestry systems are important means of sustainable crop production to enhance food security.

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