In the current Issue of WA we publish a fascinating and informative account of agroforestry in India by Handa, Toky *et al*.

In this paper are listed various tree-based products: gums, resins, floss, fibres, fodder, brooms, fruits and many others for the use of the subsistence farmer. Hence, these various agroforestry systems are considered to be the backbone of marginal farming for a self-reliant and sustainable agriculture, which also forms a strong feasible option to counter climate change.

The achievement of food security, environmental security and social benefit is a prime objective of these subsistence farming systems.

For Indian commercial production woodland is a source of apiculture (honey bees), sericulture (silk worms), lac cultivation (commercial products e.g. shellac), gum, resin, and medicinal, aromatic and flavouring plants *(e.g.* the spices, cardamon, black pepper, coffee, mustard and chilli). The wood, itself is sold for paper pulp, building structures and furniture and in India one must not forget the cricket bat industry. 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 to urban areas.

Trees can be used as wind breaks and to raise the organic matter content of the upper soil horizons, so benefiting agricultural crops, and the appropriate tree species, which are listed, known as phreatophytes (deep rooted plants which obtain water from a permanent ground supply of the water table, often found in arid environments) draw water from well below the agricultural layer.

Handa *et al.* provide evidence from the Khejri (a phreatophyte)-based agroforestry systems in Rajasthan that the availability of soil N, P and K is increased in all of their reported systems (remember that the there is a finite supply of soil P in the world(1)).

This Khejri agroforestry also increases:

1) free-living nitrogen fixers (Azotobacter spp.),

2) organic C, microbial biomass, soil myccorrhyzal spore count, hyphal density and fungal biomass (all measures of similar soil activity) and

3) soil moisture content in both the rainy and rainless seasons.

The increase in soil fertility from the Khejri system has led to increases in agricultural productivity of crops ranging from cow peas, cluster and mung beans to pearl millet, taramira and mustard.

It is surprising to me that this list includes nitrogen-fixing crops; but it excludes wheat, for which shade from the trees presumably reduces yield even on this relatively poor soil, deficient in moisture.

In their final table they show that the benefit/cost ratio is well over one in all 21 areas in which agroforestry is practiced.

This is very largely on land unsuitable for agricultural crops, but also on land for which its fertility for those crops would benefit in the longer term. We shall in the next Issue publish a paper in which the Chinese Government has recently recognized the value of woodland as an extended “fallow” period for land, the fertility of which has become exhausted.

Likewise India launched a much-needed National Agroforestry Policy in 2014 – the first of its kind in the world. This new policy is a path-breaker in making it an instrument for transforming lives of the rural farming population, protecting the ecosystem and ensuring food security through sustainable means.

It has established an Institutional organization at the national level to promote agroforestry under a mandate of the Ministry of Agriculture with a simplification of regulations related to harvesting, felling and transportation of trees grown on farmland; ensuring security of land tenure and creating a sound base of land records and data for developing a Market Information System (MIS) for agroforestry; investing in research, extension and capacity building and related services; improving access to quality planting material; provision of institutional credit and insurance cover to agroforestry practitioners; increasing participation of industries

dealing with agroforestry produce and strengthening the marketing information system for tree products. Initially twenty important multipurpose tree species have been identified nationally to be exempted from all restrictions related to harvesting, transportation, marketing and of course grown under agroforestry systems.

Agroforestry produces edible foodstuffs for Man and animals.

Nevertheless, on good quality land,

where proven methods of crop production are used, it is the case that agricultural crops produce more digestible energy and protein per unit area that does agroforestry. One hopes that the Indian population does not exceed the ability of their existing farmland to produce adequate digestible energy and protein to give their population an adequate diet.

If the population does grow disproportionately, then there will be pressure to encroach on or replace forests by energy-yielding crops.

That would disrupt a carefully tuned balance and lead to an inevitable and eventual decline in both productivity of crops and in biodiversity.

This is the general case for the adoption of currently developed and proven methods of plant breeding which lead to greater and more assured production from a given area of crops(2).

Moreover, it is my view that individual trees and forests have characters and characteristics for which there are no substitutes and forests are the home of a wide range of wildlife!

References

1. Cornish, P.S. (2011) World Agriculture, **2**, No.2, 21-27. Peak phosphorus: implications for agriculture.

(2) Murphy, D.J. and Virgin, I (2016) World Agriculture, **6**, Issue 1, 8-15. **Has agricultural biotechnology finally turned a corner? Report of FAO Symposium on genetic manipulation as used in agriculture, Rome, February, 2016.**

David Frape

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Dr David Frape

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Comments