

Review

Integration of trees in orchards: Opportunities to increase tree cover in Punjab

W. S. Dhillon*, H. V. Srinidhi, Chaturjeet Singh and Navjot

Department of Horticulture, Punjab Agricultural University, Ludhiana, -141004. India.

Accepted 8 February, 2011

Farming in Punjab has been the predominantly economic activity managing food production system. Integration of trees on agriculture land is increasingly appreciated as an important strategy for secured additional economic income. This is demonstrated by the 0.37% cropping area being under Wheat-poplar system. The extension of this strategy is the integration of trees in orchards in the state. Various fruits like Guava, Kinnow, Pear, Peach, and Plum are being grown on 47087 hectares in the state. Integration of short rotation woody perennials in this land use system definitely contributes to the increased income and other intangible ecological benefits. This could also be one of the potential strategies towards diversification of farming system in the state. There is a wide gap between the operational area and potential areas which can be bought under combination of fruits and trees. Moreover, little understanding on the interaction between trees and fruit trees and many areas such as nutrient cycling, water and soil moisture conservation, melioration of microclimate which tender resilience to the complex system still remains untouched. Accurate, concise and clear information facilitates the recommendations on choice between alternatives and promoting the horti- silvi models. The deficiency of reliable yield data based on empirical work calls for efforts in the research and development through which site specific technology packages can be disseminated. The existing operational models include integration of eucalyptus and poplar trees in orchards. Several other short rotation tree species such as *Gmelina arborea*, *Anthocephalus cadamba*, *Ailanthus excelsa*, *Melia azedarach* are known to be performing equally well. This paper attempts to focus on reviewing the role of trees in orchards, supporting evidences from existing system and strategies for reducing the gap for further recommendations.

Key words: Peach, pear, plum, poplar.

INTRODUCTION

Efforts in the direction of preventing the dwindling forest resources are under way since independence. Right from the enunciation of National Forest Policies of 1952 followed by another in 1988, various measures are being taken to improve the forest cover in the country. In National Commission' of Agriculture (1974) the emphasis was on to extend tree lands outside reserves, through Social Forestry and Farm forestry programmes which aimed to bring forest production closer to the people. However, forests are continually being degraded at an alarming rate due to anthropogenic pressure and anthropocentric activities. The remarkable and significant

categorical shift to focus on the ecological role of forests was emphasized in the National Forest Policy in 1988. There was strong enforcement to bring 20% area in plains under forest cover, while achieving one-third of total geographical area of the country under forest cover. In Punjab, which is a plain land, the area under forest cover presently is around 6.33%. Clearly this may not be sufficient to cater the diverse tangible needs of the growing population on one hand and the other seems to be in deficit to sustain ecological functional benefits on long run. In parallel, the agro ecosystem is burden with extensive mono cropping through rice-wheat system resulting in undesirable effect not only on environment but also on equity which calls for critical attention (Sidhu and Byerlee, 2001). The great visionary and eminent philanthropist Dr SS Johl, recognized the need to increase the forest cover in the state to secure ecological

*Corresponding author. E-mail: wasakhasingh@yahoo.com.

benefits for sustained growth and development. This diversification of agriculture in the state has long been recognized as panacea for these maladies. The initiative by the state level policy makers in this direction has been laid out by Johl committee report. Agro-forestry was recognized as a potential strategy towards diversification and ensures socio-economic productivity in the state. Agro-forestry is definitely an unmatched alternate where dynamic productions as well as ecological protection are secured. Moreover, this technology being comprehensive in term of integrating different forms of land use combining trees, agricultural crops and/or live stock component spatially or temporarily is acclaimed and accepted in many parts of the country for its ecological and economic viability. The technology has been globally recognized as pathway to increase on farm food production and income. Even in Punjab state, agro-forestry practiced in wheat and rice farms with integration of short rotation woody species such as poplar, eucalyptus has brightly colored the scenario of agro-forestry. The extension of this strategy is integration of trees in fruit orchards. This practice termed as 'horti-silvicultural system' has its own potential role to play in the sphere of sustainability of production, economic and social dimensions. Numerous interrelationships exist between trees and human wellbeing. The manifold environmental benefits of trees are unmatched in terms that some of its role cannot be replaced by any technology. The integration of trees in farming landscape is not a new concept. Paradoxically, nature and ecological significance is attached only to intact forest system while single tree growing outside the forest lands are overlooked. In this context there is a need to revive the concept of growing trees in orchards for its role securing food security and ecological benefits.

POTENTIALS OF HORTI- SILVICULTURAL SYSTEM FOR SUSTAINED PRODUCTION

Horticulture is being appreciated by the farming community due to many advantages it offers. Presently, the area under fruit tree in Punjab is around 0.47% of cropping area. The geographical location and favorable climatic factors of the state is quite suitable for growing wide variety of fruit crops with appreciable expert potentials. Fruit crops occupy around 47,087 hectare area in the state. The integration of short rotation woody crops can definitely contribute towards not only increasing the tree cover but also secure ecological and economic benefits of the same. Apparently, horti-silvicultural system has its prominent role in five key domain areas of water, energy, health, agriculture and biodiversity which are centre initiative taken by United Nation towards achieving Millennium Development Goals (Garrity, 2004). Water is an important natural resource. During the last two decades major shift in ground water

level have taken place in some parts of the country. For instance, the water table in central zone of Punjab state is receding at an estimated rate of 1 to 1.5 feet every year. This may disrupt the normal life style as well as agriculture production. The association of man with fruits can be traced since evolutionary time scales. It is known fact that the importance of fruits in terms of nutritional diet is being appreciated since long time while the cereals are new; in food habits. The role of fruits as nutritional supplement in terms of good health: is overwhelming.

Plantation of fruit trees along with short rotation trees like eucalyptus poplar, shivan can be a potential alternative to solve many of the dramatic problems. Plethora of evidence can be drawn from studies worldwide, where the role of trees in water recharge and check against rising ground water is well established. Studies in Australia have proved that eucalyptus can transpire much more water than cereal crops (Singh, 1999). Tree can also solve the problem of increasing water table in some parts of the country due to canal irrigation system. Trees, shrubs and perennial grasses we known to have greater transpiration capacity, thus can be exploited for solving canal seepage problem.

Ecological benefits

Farm land suffers from continuous depletion of nutrients. This is more pronounced in developing countries. The inability of farmers to add adequate quantities of fertilizers in accordance with the recommended dose is the root cause of the problem. The incorporation of green manure trees in farmland can be an alternative. The addition of green manure brought about by alley cropping is valuable, where majority of the soils are deficit in organic matter. Integrating tree species with desirable characteristics like rapid growth rate, N₂ fixing ability, vigorous coppicing ability, ability to withstand repeated pruning's, multipurpose nature of use of products is an appealing solution. Species like *Leucaena*, *Gliricidia*, *Sesbania* are acknowledged world wide as green manuring trees. Roughly one quarter of the farmland in developing countries has been degraded. The risks of land degradation due to over cultivation, desertification, and loss of biodiversity are well evident. These constraints are threat to food security. The potential of trees especially in agro-forestry system to rehabilitate degraded land, soil and water conservation and other benefits have been recognized. Trees like *Sesbania*, *Gliricidia* and *Leucaena* are known to provide 50 to 200 kg N ha⁻¹ to the associated crops (Kang et al., 1990). The maintenance of all the physio-chemical and biological function intact is the key issue in soil health. The deep root system of tree may be important in retrieving nutrients that had previously been lost through leaching.

With the expansion of irrigation system, thousands of hectares of fertilizers in command areas of several

irrigation projects are predicted to be suffering from salinisation. Vast expanse of sandy wastes and dunes over nearly 31 million ha, in Northwestern part of India remains unutilized due to many constructs. Intervention through agro-forestry approach can be potential remediation in these areas.

In addition, the role of fruit trees in providing ecosystem services is of immense importance. For instance, close relationship exists between diversity of frugivorous fauna and fruit trees which contribute to their energy and thus survival. Plethora of evidences can be cited on role of such fauna in ecosystem functioning and indirect services they offer. In this context, it seems apposite to hypothesize that increasing wild fruit trees such as Jamun, harad, behara, amla etc population would not only provide food for rapidly dwindling fauna population but also can help perceive other benefits.

Economic benefits

Agro-forestry land use system is appreciated in economic terms because, when compared to non-agro-forestry land use systems will have a higher output value at same resources cost and/or have same output at lower resource cost. Moreover, under resource protection as central theme, it offers financial incentives to landowners.

HORTI- SILVICULTURAL SYSTEM: A FEW OPERATIONAL MODELS

Many examples can be drawn from existing operational models. In Northwestern parts of India, with the rows of mango, litchi, pear and guava or ber, the short rotation trees such as poplar and dek are integrated as fillers or shelterbelt are popular systems. By the time, the fruit trees come into commercial bearing, the trees will be ready for harvest. Apart from generating extra income, these trees will definitely improve physico-chemical health of soil. Intercropping of Casuarinas trees is successfully taken in Mandarin orange orchard in North-eastern parts of Karnataka (Alloli et al., 1991). In Western Himalayas, horticulture is the major source of livelihood due to edapho-climatic constraints. In between trees of Santa Rosa plum, poplars (*Populus deltoides*) are grown and also as wind break by farmers. The soft wood of poplar trees is utilized to prepare packaging boxes for fruit marketing. Integration of *Leucaena leucocephala* in kinnow mandarin at 5 × 5 m in foot hills of western Himalaya in form of hedge row is a popular system. This is due to better economic yield apart from ecological sustainability (Khosla and Toky, 1999). Wind breaks and close planting of trees are practiced to minimize the impact of high velocity winds on fruit trees. The wind break also protects orchard trees from hot winds and cold waves. Some fruit trees like mango, Jamun and mulberry

can also be grown as wind break in three rows, besides tall trees like eucalyptus, neem, arjuna, silver oak etc. This not only enhances the strength of wind break but also contribute to income of farmers.

FRUIT TREES IN AGRICULTURAL FIELDS

Since ages, fruit trees are being grown in agricultural fields for multiple uses. Some of practices are very extensive and adopted by farmers. Among the fruit crops; growing of mango, jamun, mulberry, amla, ber, bael, etc is popular in Punjab state. Sometimes, these serve special purpose, like boundary demarcation of farm and field boundaries. In arid tracts of lower shivaliks, the edapho- climatic condition limits successful agriculture. It can be suggested that growing hardy trees like jamun, harad, behara, ber, amla in these areas, apart from providing nutritional diets, other benefits like fuel, fodder and timber can be secured.

GAP AREAS

Translating the perceived desirable benefits to adaptation and transforming technology into realities demands research, communication, institutional and policy support. Many factors limit the integration of trees in orchards. The lacuna lies at both operational as well as policy decisions. The efforts in the direction of extending the concept calls for research needs in several areas of timber tree- fruit crop interaction, which can generate sufficient information to put in the hands of policy-makers as well as farmers. For instance, the compatibility of MPTs with fruit crops is an important area of research in agro-forestry. The interaction between tree based systems for resources may be competitive, spatially or temporally complementary. The selection of MPTs as well as fruit crops depends on prevailing biophysical conditions. It should also match with the marketing potentials. The choices being dynamic may result in increased or decreased value and are also influenced by site variability, management practices, etc. The evaluation of these effects is of primary concern when assessing the viability of land use systems. The efficiency of reliable yield data based on empirical work necessitates the efforts in research development with range of technology packages for extension.

The effect of trees on microclimate modification especially on fruit trees remains untouched. For instance, spring frost is constraint for plum and peach cultivation in Northern slopes of hilly areas of the Himalayas. The delayed blooming saves the crop from frost damages. Moreover, the extent of quality of flower development in post initiation period is governed by factors like temperature, humidity, winter chilling, wind etc. Desiccating winds during summer damage the pear and

peach plantations. Opportunities to evade these abiotic stresses through appropriate design of microclimatic modifications by trees can be a viable alternative. Some of the priority areas that need an urgent attention are listed.

PRIORITIES

Identification of suitable production technologies

1. To facilitate reaping of benefits in terms of both ecological as well as direct economic benefit.
2. Generating yield data and multispatial evaluation trials.

Management practices

1. Multiple-use management of the woody perennials for products and service functions.
2. Special silvicultural treatments or horticultural manipulations that would promote economic yields.

Recommendation for optimization of inputs

1. Towards optimizing the inputs to reduce cost of cultivation.

Marketing issues

1. Developing a market information monitoring system.
2. Resort to a support price in case of a price slump of both fruits as well as timber.
3. Analysis of economic viability of technology.
4. Value addition in fruit as well as wood produced in the system.

REFERENCE

- Alloli TB, Nalwadi UK, Patil CV (1991). Casaurina enhances fruit tree production on an arid site in India. *Agrofor. Today* 3(4): 12.
- Garrity DP (2004). Agroforestry and the achievement of the millennium development goals. *Agroforestry Syst.* 61: 5-17.
- Kang BT, Reynold L, Attah KA (1990). Alley Farming. *Ad. Agronomy* 43: 315-339.
- Khosla PK, Toky OP (1999). Patterns and processes in agroforestry systems of western Himalayas. *Indian J. Agroforestry* 1(1):37-80.
- National Commission' of Agriculture (1974). Ministry of Agriculture, Govt. of India.
- Sidhu DS, Byerlee D (2001). Technical change and wheat production in post green revolution in Punjab. In: *Dynamics of Agriculture Development*. Dhindsa KS, Sharma AK (eds.). 3:50-69.
- Singh GB (1999). Agroforestry research in India- issues and strategies. *Indian J. Agroforestry* 1(1): 1-4.