

Farming System in Sustainable Agriculture

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Sustainable agriculture is the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources (TAC/CGIAR 1988). Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources which is environmentally non-degrading, technically appropriate, economically viable and socially acceptable (FAO, 1988).

Role of integrated farming systems in sustainable agriculture

Integrated Farming System is a resource management strategy to achieve economic and sustained agricultural production to meet the diverse requirements of the farm household while preserving the resource base and maintaining high environmental quality.

One of the main objectives in IFS is recycling of produces/wastes among the components involved. A judicious mixture of one or more enterprises with cropping complements each enterprise through effective recycling of waste/residues and in addition, when carefully chosen keeping in view the soil and environmental conditions, users in greater dividends. Most commonly integrated enterprises are dairying, poultry, aquaculture, sericulture, agroforestry, biogas units and agro based industries using the farm produces. Examples of the agro based industries are mushroom culture, coir making, production of parasites for biological control of pests and diseases and processed food.

Alternate land use systems (ALUS) for sustainable agriculture

1. Agro forestry systems of land use

Agro forestry is a collective term for a land use system in which woody perennials (trees or shrubs) are deliberately mixed on the same land management

unit as crop or animals either in some forms of spatial arrangement or in time sequence. An ideal agro forestry system should result in a sustainable increase in overall production using management practices compatible with social cultural and economic status of the local population.

In agro forestry land use systems, there are three basic sets of elements of components that are managed by man viz. tree, the herb (agricultural crops including pasture species) and the animal. This leads to a simple classification of agro forestry systems as given below.

- Agri-silvi cultural: Crops and trees including shrubs / vines / tress
- Silvi pastoral: Pastures/ animals and trees
- Agro-silvo pastoral: Crops / pastures/ animals/ trees
- Agri-horticulture: Crops / fruits species
- Silvi - horticulture: Trees/fruit species
- Silvi - horti pastoral: - Trees / fruit species/ animal/pastures

Agri-silvi system

Agri-silvi cultural system could be practiced in areas where wood lands can be created. The planting consists of both annual crops and perennial trees. This type of approach is most commonly observed in the cultivated areas. The perennial tree species are planted in a single row or multiple of rows in a strip at an interspaces distance of 15 - 40 m between two strips. The interspaces are utilized for growing annual / seasonal crops. The preference of choice for tree selection may lie in *Acacia* spp. *Azadirachta indica*, *Dalbergia sissoo*; *Eucalyptus* spp; *Casuarinas* spp; *Albizia* spp; and *Leucaena leucocephala*, *Prosopis* spp and *caliandra* spp. Growing of perennial tree species on bunds / strips may also act as wind breaks in areas where high wind velocity is a problem resulting in wind erosion and desiccation of soil moisture. Certain tree species offer the possibility of providing at least a portion of optimum crop nutrients by natural leaf drop of by lopping for purposes of green leaf manuring. This includes both fixed nitrogen as well as other nutrients recycled from the deeper soil depth. This is especially true with *Acacia albida* which when matures (after 3 years) is said to be deciduous in the

Kharif season. As such it offers less competition for light and moisture at the time when crops need them most.

In India agriculture and forestry have co-existed for many years in close proximity. Agroforestry systems of land use are not new to our rich heritage. Farmers from time immemorial have been growing useful tree species with agricultural crops which used to supply fodder, fuel and small timber for himself and his live stock. The best examples available are; growing of *Prosopis cineraria* (Khajri) with agricultural crops in Rajasthan and in black soils of Northern Karnataka and the other parts of the country. The other practices then prevailing where growing of perennial tree species such as Acacia, neem, mango, tamarind on farm boundaries.

Silvi pastoral system

In such land use systems, ideal species of woody perennials should be fast growing, hardy, with wide ecological aptitude, tight crown with multilayer branching and leaf orientation and of multiple use to the rural population. The forage component need to be very hard, easily colonising, palatable, nutritious and with strong establishment through roots or self-sown seeds. For arid and semiarid areas species like *Hardiwickia binata*, *Lecaena leucocephala* with *Cenchrus ciliaris*, *Cenchrus setigerus*, *Dichanthium annuifatum*, *Chesopogon fulvus*, *Sehima nervosum* etc find greater adaptability. Legume species such as *Stylosanthes* spp. have been found very versatile.

Silvi - horti / Agro - horti system

The concept of silvi horti / agro horti or combination of agricultural crops, perennial tree and fruit species could profitably be adopted in both arable and non-arable marginal and sub-marginal lands. Semi wild but useful fruit species such as cashew, ber, mango, sapota, guava, tamarind and jack fruit trees are planted in regular strips or interplanted with silvi component. In areas receiving higher rainfall of 1000mm and above coconut can be planted as in being practiced in coastal Karnataka and Kerala. In the agro Horti-silvi system of land use the distance between the two horticultural plants within the strip may be quite apart to avoid competition. The inters trip space between the two horticultural plants can be used for planting fast growing economic silvi-cultural species such as *Leucaena*, *Casuarinas*, *Dalbergia*, teak and *Albizia*. The tree plants are cut for wood after 4-6 years so that the competition could be minimized. The idea behind planting tree species as an intercrop with horticultural plants is to obtain biomass production before horticultural plants attain full growth, and later to

obtain fodder or green manure material by frequent cutting and create thicker vegetation for better soil and water conservation.

Need-based alternate land use systems

Among the several needs of a farmer food always remains the first priority item, although fodder requirement is more as compared to food. Some of the need-based alternate land use systems matching the land capability classes are discussed below.

Sl. no	Food (arable land) II, III	Fodder (non-arable land) IV, V	fuel/timber/fibre (marginal degraded land) VI, VII
1	Alley cropping agro horticulture	Horti-pastural, silvi pastoral	Tree farming timber cum fibre
2	Agro horticulture	Silvi pastoral	
3	Intercropping	Ley farming Pasture management	

Ley farming

A rotation is a cropping system in which two or more crops are grown in a fixed sequence. If the rotation includes a period of pasture (a lay) which is used for grazing and conservation the system is sometimes called "Alternate husbandry" or mixed farming. The term Ley-farming denotes a system where a farm or a group of fields is cropped entirely with leys which are reseeded at regular intervals some people described any cropping system which includes leys as "Ley Farming"

Example of ley farming

If a farmer has say 4 hectares land in which he want to grow sorghum and castor then he can plan four year rotation as follows.

Unit	Year 1	Year 2	Year 3	Year 4
A	Stylo	Stylo	Sorghum	Castor
B	Stylo	Sorghum	Castor	Stylo
C	Sorghum	Castor	Stylo	Stylo
D	Castor	Stylo	Stylo	Sorghum

Conclusion

The efficiency of sustainability was evaluated predominantly on the basis of productivity, its income

and employment generation with the possibility of utilizing recycled organic wastes as nutrient to enrich the soil fertility. The recycled organic residues/wastes of crop and allied activities could supplement the chemical fertilizers. Moreover, this will also provide opportunity to reduce the environmental pollution by

way of burning the fossil fuel in the process of manufacturing the chemicals. The soil health problem by way of dumping more and more quantities of inorganic can also be solved to greater extent by proper utilization of organics and achieves the sustainability in agriculture.

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