# Lec.5 AGRISILVICULTURAL SYSTEMS- SUB SYSTEMS

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**AGRISILVICULTURAL SYSTEM involves the conscious and deliberate use of land for the concurrent production of agricultural crops including tree crops.**

**Based on the nature of the components this system can be grouped into various forms.**

(i) Improved fallow species in shifting cultivation

(ii) The Taungya system

(iii) Multispecies tree gardens

(iv) Alley cropping (Hedgerow intercropping)

(v) Multipurpose trees and shrubs on farmlands

(vi) Crop combinations with plantation crops

(vii) Agroforestry fuelwood production

(viii) Shelterbelts

(ix) Windbreaks

(x) Soil Conservation hedges

## i)Improved Fallow Species in Shifting Cultivation

Fallows are cropland left without crops for periods ranging from one season to several years. The objective of improved fallow species in shifting cultivation is to recover depleted soil nutrients. Once the soil has recovered, crops are reintroduced for one or more seasons.

Shifting cultivation is a pattern of land use and a system of production of crops under which plots of land are cleared ,cultivated for a short period for raising one, two or three crops, after which the land is allowed to rest longer than the period of cultivation. However, during the period of rest the land reverts to some modified form of its original cover

This system is practised extensively in the north-eastern hill region comprising the states of Assam, Meghalaya, Manipur, Nagaland and Tripura and the two Union territories of Arunachal Pradesh and Mizoram and to some extent Andhra Pradesh, Bihar, Madhya Pradesh, Orissa and Karnataka states. It is called '**jhum**' in the north-eastern hill region and '**podu**' in AP and Orissa states and considered most destructive for forest areas.

The main feature of the improved fallow system of agroforestry is that trees and shrubs are not grown with crops on the same plot at the same time. The fallow periods vary from region

to region but are presently becoming shorter due to an increasingly acute land shortage. The best species for the fallow system should induce good nitrogen fixation in the soil.

***Species:*** While the main function of the fallow is to maintain or restore soil fertility and reduce erosion, some plants can be introduced primarily for their economic value. Species choice should not be exclusively confined to **'soil improvers';** plants with marketable products should also be considered. Plants included in improved fallows should be compatible with future crops, free of any negative physical or chemical effects on the soil and not in competition with the crops to be planted later on the same site.

***Establishment:*** Improved fallows can be established in a variety of ways and at various stages of the fallow. Methods might include:

- ✓ Direct seeding of clean tilled, harvested plots;
- ✓ Selective cutting of bush, followed by enrichment planting with tall seedlings;
- ✓ Introducing tall seedlings and cuttings into poor-quality fallows on degraded land;
- ✓ Planting tree seedlings in closely spaced, deep planting holes or furrows within blocks of cleared cropland.

The exact techniques vary with the previous land use, value of the fallow vegetation condition of the land and expected duration of the fallow.

(ii) Taungya System:

The taungya (taung = hill, ya = cultivation) is a Burmese word coined in Burma in 1850s. The taungya system was introduced into India by Brandis in 1890 and the first taungya plantations were raised in 1896 in North Bengal. It is practised in the states of Kerala, West Bengal and Uttar Pradesh and to a lesser extent in Tamil Nadu, Andhra Pradesh, Orissa, Karnataka and the north-eastern hill region. In southern India, the system is called **'kumri'**. It is practised in areas with an assured annual rainfall of over 1200-1500 mm.

This is a modified form of shifting cultivation in which the labour is permitted to raise crops in an area but only side by side with the forest species planted by it. This labour is responsible for the upkeep of a plantation. The practice consists of land preparation, tree planting, growing agricultural crops for 1-3 years, until shade becomes too dense, and then moving on to repeat the cycle in a different area. In some cases crops may be grown one year before the trees are planted. A large variety of crops and trees, depending on the soil and climatic conditions.

**Crops and trees grown in Tamil Nadu**

**a)Trees**

*Tectona grandis*

Bamboo

*Santalum album*

*Tamarindus indica*

*Acacia nilotica*

*Acacia mearnsii*

*Ceiba pentandra*

Cashew, Rubber

**b) Crops**

Millet, pulses, groundnut,cotton

Types of Taungya systems

**Taungya systems are of three types:**

**(a) *Departmental Taungya*** : Under this, agricultural crops and plantation are raised by the forest department by employing a number of labourers on daily wages. The main aim of raising crops along with the plantation is to keep down weed growth.

**(b) *Leased Taungya***: The plantation land is given on lease to the person who offers the highest money for raising crops for a specified number of years and ensures care of tree plantation.

**(c) *Village Taungya***: This is the most successful of the three taungya systems. In this, crops are raised by the people who have settled down in a village inside the forest for this purpose. Usually each family has about 0.8 to 1.7 ha of land to raise trees and cultivate crops for 3 to 4 years.

Advantages offered by the taungya system are:

(i) Artificial regeneration of the forest is obtained cheaply

(ii) Problems of unemployment are solved

(iii) Helps towards maximum utilisation of the site

(iv) Low cost method of forest plantation establishment

(v) In every case highly remunerative to the forest departments

(vi) Provision of food crops from forest land

(vii) Weed, climber growth etc. is eliminated.

**Disadvantages of the taungya system**

(i) Loss of soil fertility and exposure of soil

(ii) Danger of epidemics

(iii) Legal problems created

(iv) Susceptibility of land to accelerated erosion increases

(v) It is a form of exploitation of human labour.

**The taungya farmers are given the following concessions as a part and parcel of success of the system**

(i) Free grazing for animals;

(i) Free timber for house construction and agricultural implements

(ii) Schooling facilities for children

(iii) Monitory loan at nominal interest

(iv) Water supply through excavation of wells and construction of ponds.

**iii) Multispecies Tree Gardens:**

In this system of agroforestry, various kinds of tree species are grown mixed.The major function of this system is production of food, fodder and wood products for home consumption and sale for cash. Major woody species involved in this system are: *Acacia catechu, Areca catechu, Phoenix dactilifera, Artocarpus* spp., Cocos *nucifera, Mangifera indica, Syzygium aromaticum* etc

**(iv) Alley Cropping (Hedgerow Intercropping):**

Alley cropping, also known as hedgerow intercropping, involves managing rows of closely planted (within row) woody plants with annual crops planted in alleys in between hedges. The woody plants are cut regularly and leaves and twigs are used as mulch on the cropped alleys in order to reduce evaporation from the soil surface, suppress weeds and/or add nutrients and organic matter to the top soil. Where nitrogen is required for crop production, nitrogen-fixing plants are the main components of the hedgerows.

The primary purpose of alley cropping is to maintain or increase crop yields by improvement of the soil and microclimate and weed control. Farmers may also obtain tree products from the hedgerows, including fuelwood, building poles, food, medicine and fodder and on sloping land, the hedgerows and prunings may help to control erosion. Alley cropping usually works best in places where people feel a need to intensify crop production but face soil fertility

problems. This situation is often characteristic of crowded, densely populated areas, but may also occur wherever some farmers wish or forced to increase production on a plot of limited size.

***Design:*** Woody plants are introduced as hedgerows in farm fields to maximise the positive and minimise the negative effects of trees on crop management and yields. Without doubt, trees compete with farm crops for soil nutrients, soil moisture and light. However, the right kind of trees at the right spacing, with proper management, may actually produce a net increase in yields from croplands. Trees may also provide new products such as fuelwood, fodder or food, in addition to the annual crops.

The position and spacing of hedgerow and crop plants in an alley-cropping system depend on plant species, climate, slope, soil conditions and the space required for the movement of people and tillage equipment. Ideally, hedgerows should be positioned in an east-west direction so that plants on both sides receive full sunlight during the day. The spacing used in fields is usually 4 to 8 metres between rows and 25 cm to 2 metres between trees within rows. The closer spacing is generally used in humid areas and the wider spacing in subhumid or semi-arid regions.

The position and spacing of hedgerows may also be affected by slope and the placement and design of soil and water conservation structures when these are combined with alley cropping. On sloping land hedgerows should always be placed on the contour. If this means that they do not have the desirable east-west orientation, then they may need regular thinning to prevent excessive shading of adjacent crops.

***Species for hedgerow intercropping:*** Alley cropping usually includes leguminous trees to improve soil fertility through nitrogen fixation; hence an ideal alley-cropping tree or shrub species should have following characteristics

- ✓ It should have a sparse, small crown to permit sunlight penetration or should resprout rapidly after pruning, coppicing, pollarding or lopping.
- ✓ It should form a deep taproot system with few lateral root branches near the surface so as not to compete with crop roots.
- ✓ It should have shallow lateral roots that are easily 'pruned' by ploughing along the hedgerow, without serious damage to the plants.
- ✓ The leaf litter or some portion of it, should decompose at *a* rate that makes nutrients available when they are needed in the cropping cycle.

- ✓ Ideally, trees and shrubs used for alley cropping should fix nitrogen and should also produce wood, food, fodder, medicine or other products used by farmers or other local community.

- ✓ The species selected should grow well under the specific limitations of the site such as saline or acid soils, drought, flooding, heavy winds, insect pests or other hazards.

*Eg.Cassia siamea, Leucaena leucocephala, Gliricidia sepium, Callianda calothyrsus* and *Sesbania sesban are* commonly used tree species for alley cropping.

**v) Multipurpose Trees and Shrubs on Farmlands:**

In this system, various multipurpose tree species are scattered haphazardly or according to some systematic patterns on bunds, terraces or plot/field boundaries. The major components of this system are multipurpose trees and other fruit trees and common agricultural crops. The primary role of this system is production of various tree products and the protective function is fencing, social values and plot demarcation. Examples of multipurpose trees employed in agro forestry are: *Leucaena leucocephala, Acacia albida, Cassia siamea, Casuarina equisetifolia, Azadirachta indica, Acacia senegal, Cocos nucifera* etc.

**(vi) Crop Combinations with Plantation Crops:**

Perennial trees and shrub crops, such as coffee, tea, coconut and cocoa, are combined into intercropping systems in numerous ways, including:

(a) Integrated multistorey (mixed dense) mixture of plantation crops;

b) Mixture of plantation crops in alternate or other regular arrangement

(c) Shade trees for plantation crops, shade trees scattered; and

(d) Intercropping with agricultural crops.

**(vii) Agroforestry Fuel wood Production:**

In this system, various multipurpose fuelwood/firewood species are interplanted on or around agricultural lands.The primary productive role of this system is to produce firewood; the protective role is to act as fencing, shelter-belts and boundary demarcation. Tree species commonly used as fuelwood are: *Acacia nilotica, Albizia lebbek, Cassia siamea, Casuarina equisetifolia, Dalbergia sissoo, Prosopis juliflora, Eucalyptus tereticornis* etc.