

AGROFORESTRY BEST PRACTICE

FOR ORGANIC FARMER FACILITATORS
AND SMALLHOLDER FARMERS





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INTRODUCTION: THE BENEFITS OF AGROFORESTRY

Agroforestry has been practiced by farmers all over the world for many years and has brought numerous benefits to farmers and rural communities.



Agroforestry is a multifunctional agricultural management system in which wood perennials (trees, shrubs, etc.) are grown in the same plot as foodcrops or livestock in an arrangement that allows plants and animals to interact in a diversified sustainable system (FAO). Agroforestry has been practiced for many years in many parts of the world in different systems, depending on the specific local conditions and has benefitted many farmers and rural communities due to the diverse products and services, the system can provide from even a small plot that is limited in ground area (FAO).

ECONOMIC BENEFITS FOR THE FARMER

Healthy agroforestry systems are designed to yield a diverse production of e.g. food, fodder, lumber, building material and firewood which increases on-farm production per available land-area. Since a wider variety of plants can interact and benefit from each other, agricultural inputs and thus production costs can be reduced long-term. Further, the economic risk of the agricultural production is reduced, as income or food production for the household depends on a variety of crops

instead of on a single crop grown in a monocultural system which may fail due to weather or market conditions as well as pests or diseases.

SOCIAL BENEFITS

The multitude of different products yielded from a well-designed agroforestry system can provide a wide variety of healthy nutrition for food as well as fodder for animals on-farm. Some systems can even produce enough spare wood for it to be harvested for lumber and firewood. The money and efforts previously spent to acquire these products from elsewhere can instead be applied to tasks on-farm to optimize production. Some larger tasks especially during establishment of the agroforestry system may require more work which advantageously may be carried out collaborately in FFLGs (Farmer Family Learning Groups). FFLGs are groups of farmer families, who together define their needs and goals in relation to their own future development as individuals, families and as a group. The group members work in rotation on each other's farms and support each other in reaching these goals.



The groups form strong networks that benefit each other and the entire local community. Some agroforestry trees provide fruits to be harvested from farm to farm hence creating unity in communities. Other agroforestry trees have cultural values and provide medicine that is freely shared which contributes to binding people together socially.

ENVIRONMENTAL BENEFITS

Well-established and -managed agroforestry systems have demonstrated to contribute to improving soil fertility, protecting crops and livestock from wind and sun, restoring degraded lands, improving water conservation, limiting pests and preventing soil erosion.

Well-arranged systems can provide space for biodiversity conservation and contribute to mitigating climate changes or support agricultural productions in adapting to climate-changes such as unpredictable rainfalls, drought, and storms.

BENEFITS OF AGROFORESTRY SYSTEMS

According to the Agroforestry Research Trust some of the many benefits of agroforestry systems are that they can:

- control runoff and soil erosion which reduces loss of water, soil material, organic matter and nutrients
- maintain soil organic matter and biological activity to sustain soil fertility
- secure more efficient use of nutrients
- minimize the development of soil toxicities and reduce existing toxicities as well as reduce insect pests and associated diseases
- utilize solar energy more efficiently than monocultural systems due to differences in plant height, leaf shapes and alignments
- moderate microclimates and improve yields of nearby crops and livestock
- provide shade for livestock
- provide a more diverse farm economy and stimulate rural economy, leading to more sustainable agricultural production for farms and communities

AGROFORESTRY SYSTEMS



THE MOST COMMON SYSTEMS

The most common agroforestry systems are:

- agrisilvicultural systems: wood perennials grown in crop fields, e.g. in alleys
- silvopastoral systems: wood perennials grown in pastures for grazing domesticated animals
- agrosilvopastoral systems: wood perennials grown in croplands used for grazing domesticated animals after crop harvest

In rural areas, trees or shrubs are often grown in pastures (e.g. *Acacia* spp, *Eurphobia* spp, *Cassia* spp, *Albizia* spp, and *Ficus* spp) or in hedges (e.g. Finger *Eurphobia* (*Eurphobia tirucalli*), *Cassia* spp, Kei apple (*Dovyalis caffra*), and *Cassia spectabilis*). In home gardens, tree types that are often grown include *Mangifera indica*, *Persea Americana* (Avocado), Jackfruit,

Grevillea spp, *Markamia lutea*, *Ficus* spp, *Citrus* spp and *Jatropha* to support vanilla vines, some places interplanted with coffee, cocoa, bananas and annual crops. In woodlots, *Acacia* and *Cassia* are often grown, whereas in compounds, Mango, Avocado, Jackfruit as well as *Cassia* are widespread.

RECOMMENDATIONS WHEN PLANNING THE ESTABLISHMENT OF THE AGROFORESTRY SYSTEM

As mentioned in the introduction, well-designed and well-managed agroforestry systems can bring many benefits to the farm, its community, and the environment. Unproper planning or poor establishment of the system may, on the contrary, lead to poor yields and reduced longevity in cases in which wood perennials and crops in the system compete with each other or do not benefit from the diverse interactivity of the system, leading to loss of crops and investment. It is thus highly



recommended to seek the necessary support from experienced farmers, FFLG facilitators, manuals, or other sources to effectively plan, establish and maintain the agroforestry system according to the specific conditions and needs of the farm and its community. It is also important to use participatory tools to ensure the establishment is properly initiated and managed.

COLLABORATION IN PLANNING, ESTABLISHING AND MANAGING THE AGROFORESTRY SYSTEM

If the farm participates in an FFLG, it is highly recommended to involve the group in planning and establishing the agroforestry system. Establishing a system collectively in the group will provide opportunities to share costs and resources, which are especially highly required in the phase of establishment.

The following phases of managing the plot and bringing produce to market will also benefit from the collaboration and mutual efforts to provide the best yields from the system long-term. Establishing and maintaining agroforestry systems is a process which may require the involvement of knowledge from many fields of agronomy, animal care, landscape planning, forestry, economy and so forth. Seeking knowledge from trained FFLG facilitators or other specialists is recommended prior to establishing the agroforestry system.

An agroforestry tool for collecting general and specific data on the agroforestry intervention can be downloaded from www.organicfflg.org

12 KEY STEPS IN CONDUCTING A SUCCESSFUL AGROFORESTRY INTERVENTION

1. Develop a good understanding of the functions for which farmers want to introduce agroforestry.
2. Establish the existing knowledge and practices on agroforestry.
3. Gain experiences from existing agroforestry systems.
4. Develop a criterion with the farmers to determine which farmer groups and particular farmers to involve in establishing the agroforestry system.
5. Make agreements and ensure the selected farmers/farmer facilitators clearly state common goals, expectations and responsibilities.
6. Conduct site analysis for each selected family farm to determine type and number of trees to integrate on each farm. Ensure this is updated periodically after initiating the agroforestry intervention.
7. Identify types and numbers of trees to be integrated into the different farms (when establishing own nursery, ensure to follow best practices for nursery bed establishment; when buying from existing nurseries, ensure high quality of seedlings and if possible, make written agreements with the nursery operator).
8. Make a clear delivery schedule of tree seedlings and ensure the recipient signs the delivery forms.
9. Emphasize follow-up monitoring the first six months after planting.
10. Form relevant synergies with proponents of agroforestry such as conservation authorities.
11. Form structures to support value addition and marketing of the agroforestry products.
12. Maintain clear records through the entire intervention process to enable learning and knowledge creation.



AGROFORESTRY IN PRACTICE

Many factors may influence how to establish an agroforestry system in practice to gain as many benefits for the farm as possible. Planning where and how to establish an agroforestry system properly as well as ensuring good agricultural practices for managing the system as it develops are vital to gain good yields from the system.

WHAT INFLUENCES THE DESIGN OF THE SYSTEM AND THE CHOICE OF TREES?

First step of the process when establishing an agroforestry system is to define the intention or purpose of developing it. These defined goals will influence which system to adopt and what type of trees to grow. If the intention is to provide food for home use, fruit trees are often favored, while if the intention is to produce livestock feed, Calliandra/Sesbania hedges may be preferred. If income generation is the main intention, timber trees such as Grivellea Robusta are frequently chosen, whereas if the purpose is boundary marking, Euphorbia could be a good choice.

For ecological benefits, e.g. wind breaking and microclimate regulation, big trees are grown on the boundary. These are mixed with medium and short height trees to catch wind at different heights. For bee forage, flowering, sweet smelling trees would be preferable. The purpose of growing trees greatly influences the choice of trees, their distribution in the available growing space and management practices. For instance, most trees grown for firewood will in most cases be seriously pruned or pollarded.

SIZE OF THE LAND AND SPACING

Farmers with very small land areas will find it only possible to grow small trees such as Prunus Africana as opposed to those with bigger areas available that can grow bigger trees such as Albizia coriaria. The spacing will be smaller on steeply sloping land than on gently sloping land. Shrubs may do better on steep slopes than tall trees.

TOPOGRAPHY OF THE LAND

In valleys that are swamped or water-logged, it is recommended to plant water loving trees in a system of e.g. yams which will not drain the water. Steep slopes or hills have shallow soils which can only favor shallow rooted surface feeder trees and digging deep planting holes is not always possible. It is advised to begin by establishing pioneer trees that tolerate shallow soils and then slowly introduce deep rooted trees as the soils become deeper with controlled erosion. Same procedure may be followed on flat land with shallow soils, though it may be possible to grow bigger species of trees in such areas. In a valley

without waterlogging, it is common to find sandy soils, and establishing deep-rooted trees is recommended to avoid toppling due to shallow soils. On flat land areas with deep soils, most trees can grow and should be integrated to form different canopy heights.

WEATHER CONDITIONS

Weather conditions should be considered to avoid competition for water. For instance, where too heavy rainfalls cause erosion, agroforestry trees with big canopies should be grown. Where rains are limited and dry periods prolonged and hot, adopted trees such as Neem, Grivellea robusta that will shade off leaves should be considered and trees with reversal phenology should be avoided.

SOIL TYPE AND THE NATURAL VEGETATION

Some trees (pioneers) such as Prunus africana and Milletia dura can grow in poor soils while others such as avocado and papaya prefers deep fertile soils.

WHERE TO ESTABLISH THE AGROFORESTRY SYSTEM

Most smallholder farmers do not have access to a land area that is big enough to grow trees. However, optimizing spacing through proper site analysis can help to find space for planting trees, e.g. by establishing hedgerows along boundaries, by riverbanks and swamps and in pasture land for animals or in intercropping systems which however requires good understanding of interactions between the different crops. Good land use planning makes it possible to establish even woodlots or fruit orchards on smallholder farms.

SITE ANALYSIS

It is vital to ensure the right spacing between trees in different systems and to plant trees in the most suitable location where they best interact with other elements on the farm. This is attained by conducted a well-informed analysis of the farm. During the analysis, it is recommended for facilitators to take a walk at the farm with the farmer family members to discuss which tree species to integrate in terms of their usefulness on the farm. During the farm walk, make sure to understand the whole system. Feel the soil, look up at the current canopy formation, see spaces

between plants, look at location of animal structures, slope of the land, note the existing crops, etc. It is useful to draw a map of the farm (see illustration below). The map of the farm in its current state before integrating trees is drawn and appropriate trees as per the discussion can be added to the farm plan to integrate the different elements ensuring to place them at the most appropriate places. The map should be adjusted until the most suitable design is arrived at. The space, soils, interaction with other crops, impact on animals, pests and diseases that affect the trees etc should be taken into consideration in the plan. It is recommended to maintain the map and update it regularly.

An ESFROMA Site Analysis tool for Agroforestry can be downloaded from www.organicfflg.org

HOW TO PREPARE THE HOLE FOR TREE PLANTING

For soft soils, dig a round hole: 20 cm wide in diameter and 30 cm deep. For hard soils, dig a rectangular hole to let roots penetrate through the corners: 50 cm wide and 50 cm deep. If you plant a seed (spot planting), dig a small rectangular hole: 20 cm wide and 30 cm deep. If you plant a cutting with a bud (for example for hedges), dig 30 cm deep. Follow the instructions below regarding soil preparations. Separate top soil (10 cm depth) from sub soil. Leave the holes for seven days to three months depending on tree

species. Note that the size of the hole should be three times bigger than the root ball of the tree seedling.

HOW TO PREPARE THE SOIL FOR PLANTING

Mix topsoil and subsoil (ratio 2:1), make a fine mix by crushing crumbs. Mix the soil mixture with well composted manure or compost (ratio 1:2). Fill the hole completely with the mixture. Leave the filled hole one to three days.

HOW TO PLANT THE TREE

Time the rains onset well, plant one to seven days before rain. Water the hole with a slow flow of water (20 l) in the morning or evening. Open a hole depending on the size of the seedling and species. If your seedling is in a black polyethylene bag, cut off the bottom if closed. Be careful not to destroy the roots. Place the seedling gently in the hole to half down the stem. Plant seeds 5-10 cm deep. Plant cuttings 30 cm apart and 10 cm deep. Return the soil to cover the hole and flatten. Water the seedling until it is saturated.

HOW TO CARE FOR YOUNG AGROFORESTRY TREES

Like any other plants on the farm, trees should be monitored frequently by the farmer and the FFLG members. Good agronomic practices to ensure the tree grows healthily include compost manure application, watering,



Illustration: multipurpose agroforestry trees integrated on an organic smallholder farm





weeding, mulching, pruning, pollarding, coppicing, staking, managing pests and diseases and protecting trees from domestic animals like goats. The different agronomic practices are implemented with respect to the situations on the farm for example rate of watering during the rainy season is less required compared to when trees are planted during the rainy season. Therefore, to appropriately implement good agronomic practices, the facilitator should have a wide knowledge of these and more practices deemed appropriate.

MULCHING AND COMPOST

Mulching involves covering the root zone of the young trees with dry material to:

- store water and keep it cool in the soil during the dry season
- suppress weeds that may compete with trees
- protect the soil from erosion
- form organic matter after decomposition

At planting, well composted manure is mixed with the topsoil and this soil is returned into the planting hole when the tree seedling is being planted. This gives chance for the tree seedling to quickly absorb soil nutrients and thus establish quickly within the rain season which is relied on by most farmers. Most trees will after that be able to mobilize their own nutrients from the soil including bringing back leached nutrients from deeper layers of the soil.

WATERING

Watering is done most preferably in the evening and thus tree seedlings should preferably be planted in the evening to enjoy the cool of the night and avoid immediate evapotranspiration. Water should mostly be applied to the soil and avoid direct sprinkling on the tree. To avoid soil splashing on the tree especially in grafted trees which are prone to soil borne infections, the mulch should be applied before watering.

To avoid too much need for watering, plant trees during March-May and September-November. Depending on the soil texture, if the rain does not come in two days, watering should be done on third day. Always provide a simple shade for the tree if it is grown in open sun so to avoid fast drying of the applied water.

WEEDING

Weeding ensures the young tree seedling is not subjected to competition for nutrients, water and light and also to avoid buildup of pests and diseases. For agroforestry on already established farms, the weeds are most likely not a problem however under new establishments weeds may quickly build up. Weeds can be smothered using dry mulches or live cover legumes. Spot weeding by hand (at least one m radius around the tree) is necessary. Weeds can be used as animal

feed, mulch material, dug back into the soil or included in the compost material. Avoid herbicides in weed control.

HOW TO MAINTAIN THE AGROFORESTRY TREE

The common practices for maintaining agroforestry trees include pruning, pollarding and coppicing.

PRUNING

Pruning involves carefully removing excessive branches, which has the following benefits:

- Reduces the risks of diseases and pests
- Reduces the shade of the tree on other crops
- Boosts plant growth of the tree
- Encourages flowering and fruit development in fruit trees
- Protects property and other living organisms
- Improves the general appearance of the tree
- Pruned branches can be utilized for e.g. fuel wood, mulch and tool handles

The farmer or farm adviser should ensure the right trees are pruned at the appropriate size and time of the year, and that it is done properly, using the right tools.

POLLARDING

Pollarding involves removing all the upper branches of the tree while coppicing involves cutting the tree from the ground (two feet) and left to regrow. The pollarded branches are good sources of firewood, and leaves can be used for mulch or compost. Always pollard at the beginning of the rainy season. Similarly, coppicing should be done at the onset of the rains to enable more stems sprout from the trunk. This enables having multiple main stems of the tree (maximum three depending on the size of the cut stem) to produce more biomass and boost the size of the tree trunk in case the original tree was stunted/infested by pests.

UTILIZING AGROFORESTRY TREES WITHOUT HARM

Agroforestry trees are planted for multiple benefits. It is important to ensure all the benefits are attained without destroying the tree. Avoid cutting agroforestry trees as much as possible when they are still young. Trees can be used without harming them as they continue to grow, e.g. by:

- using trees to support other early yielding crops such as passion fruit
- carefully collecting herbal medicine from the tree
- pollarding them
- pruning them appropriately
- hanging beehives on tree branches and using them as bee forage

MARKETING PRODUCE FROM AGROFORESTRY SYSTEMS



AGROFORESTRY SYSTEMS

When marketing agroforestry products, it is important for the farmer to know the market dynamics well in advance and to know who the customers and the final consumers are. The customer can be a supplier in the value chain or the final consumer, who is usually the key person to address in successful marketing. The requirements of the final consumer for the product have a big influence in the marketing value chain.

Therefore, it is important while producing to be mindful of what the final consumer wants or intends to use the product for. In this aspect, it would be good for the farmer to use a “demand pull” rather than a “supply push” approach, meaning the farmer targets production and supply to the market and to consumer demands which increases the prospect of selling

products. Consumers are generally familiar with and demand products that are organic and fair trade certified. Farmers supplying organic agroforestry products for the market have the opportunity to meet this demand.

It is important for the producer to be aware of current suppliers in the value chain, potential entrants in the value chain, buyers and substitutes. Further, it is important to understand the competitive forces of the market, determined by the product’s market strengths, weaknesses, opportunities, and threats. It can be helpful to note these to develop a strategy for marketing the product successfully.

CUSTOMER CARE, PRICE, QUALITY AND QUANTITY

Customer care is very important in the marketing of agroforestry products to ensure current customers are coming back and



new customers are attracted. Setting the right price depending on the price level and demand of comparable products will naturally have an impact on how attractive customers find the products.

Also key in marketing is the quality and quantity of the product. It is important to know the form of the quality the consumer want the products. This will make the consumer to make a repeat purchase or not. It is also critical to know what volumes or quantities the consumer or customers want of the product. This is to avoid miss match between demand and supply.

MARKETING ASSOCIATIONS AND GOVERNMENTAL POLICIES

Producers are at an advantage when they bring their product together as a marketing association. They agree on the quality and standards so that their products are uniform at the market.

Producers should always be aware of policies that government may put in place. Government can create policies which are not friendly to the business environment. Farmers that are a part of an association or coalition are better equipped to advocate for better government policies that may affect the marketing of agricultural products.

SELECYRIF AGROFORESTRY PRODUCTS AND HOW TO MARKET THEM

Product	Form in which to sell product	Conditions for successful selling	Possible places to sell
Fruits	Whole fruits, Pulp, juice,	UNBS certified markets, super-markets, hotels, tourist places, etc.	Farmer markets, farm gate, Supermarkets, juice factories
Herbal medicine	Powder, solution, fresh parts e.g. barks, leaves.	Good packaging, Labelling, branding UNBS certified	Pharmacies, farmer markets, hotels and parks
Firewood	Dry stems	NFA license	Wood stores
Tool handles	Molded	Non (personal customer care)	Ordinary shops, farm gate, carpentry workshops
Timber	2x4'', 2x6'', 4x4''	NFA license	On farm, showroom
Arts and crafts	Curved woods, furniture	NFA license, Marketing association license	Show rooms, tourist places, hand craft shop, hotels, etc.



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