



Training Guide on Ecological Organic Agricultural Practices for Coffee

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II. Acknowledgement

The development of this manual has been a joint effort of ESAFF Uganda, partners and the small- scale farmers.

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1.0 ESTABLISHMENT AND FIELD MANAGEMENT OF COFFEE

1.1. Introduction

Coffee is major cash crop in Uganda accounting for about 20-30% of foreign exchange earnings. It is mainly produced by smallholder farmers whose average farm sizes range from 0.5 to 2.5 ha producing 90% of Uganda's coffee.

Over 13 million Ugandans derive their livelihood directly from coffee cultivation and related activities. Cash (money) from coffee sales enhance household food and nutrition security.

Uganda produces both Robusta (80%) and Arabica (20%) coffee. Robusta is the major type of coffee grown in Uganda, accounting for about 80% of production. It grows in most low altitude areas of Uganda, covering Central, Eastern, Mid North, West Nile, Western and South Western Uganda that are within 900 - 1,500m above sea level.

Arabica Coffee accounts for 20% of Uganda's coffee volume. It is grown in the highland areas on the slopes of Mount Elgon in the East, Mt. Rwenzori in the West and Mt. Muhabura in the South Western Region, Okoro highlands in West Nile plus other highland areas at an altitude between 1,200-2,500m above sea level.

Most coffee farmers in central Uganda grow coffee and banana as an intercrop.

1.2 Ecological requirements of Uganda coffee

Robust is cultivated mainly between 1000-1500 meters above sea level with optimal temperature range of 18-27°C.

Arabica coffee grows and yields better when grown at altitudes between 1,300 – 2,300m above sea level. A temperature range of 15 – 24°C is ideal for production.

Rainfall requirements for both Robusta and Arabica are between 1200-1500 mm per year of well distributed rainfall over a period of about 9 months.

Soil requirements:

- *Robusta grows and yields better when grown on deep, well-drained, fertile loamy soils (rich in organic matter).*
- *Arabica coffee grows well on deep, well-drained, fertile, slightly acidic loamy soils of pH range 4.5 to 5.*
- *It is always advisable to perform the soil testing exercise before establishment. Waterlogged soils are not conducive for coffee growth.*

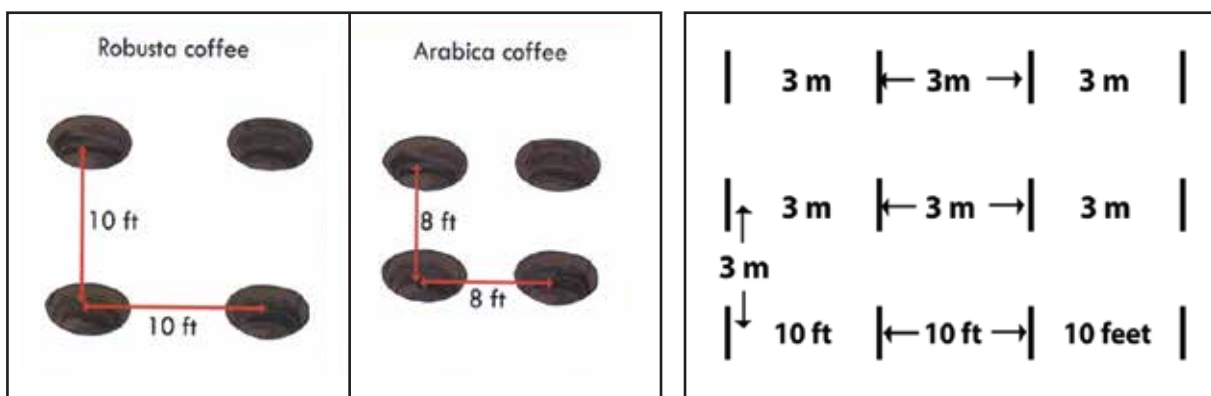
1.3 Field establishment

1.3.1 Preparing the site for planting coffee

- ✓ **Prepare the land during dry season preferably 2-3 months prior to planting.**
- ✓ **Remove excess trees on the site and their stumps. Leave some of the mature trees of recommended shade tree species found on the site for providing shade to the potential young coffee plants.**
- ✓ **Remove weeds by digging, hand-picking perennial weeds such as couch grass, spear grass.**
- ✓ **For slopped terrain, build contour terraces, bands, grass strips or cut-off drains to prevent soil erosion.**

1.3.2 Marking prepared site in preparation to digging holes for planting coffee

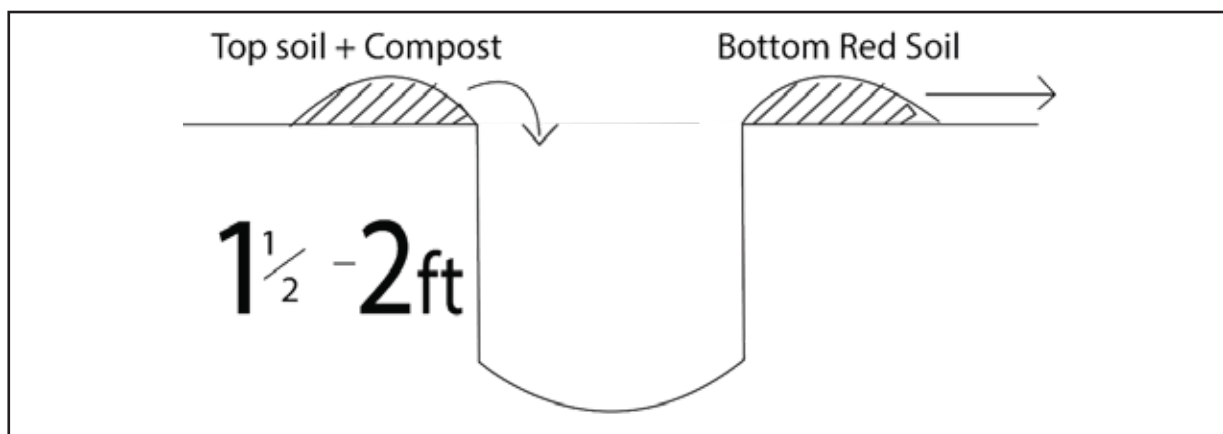
- ✓ Mark the field so that optimum plant population is achieved.
- ✓ Measure and place/pin pegs (about 2 feet) at spots where the coffee plants should be planted.
- ✓ The marked points should be in lines and square patterns.
- ✓ Mark points for planting Robusta coffee at spacing of 3m by 3m or 10ft x 10ft (450 trees per acre).
- ✓ Mark points for planting Arabica coffee at a spacing of 8ft x 8ft (680 trees per acre).
- ✓ The spacing/plant population are adopted to recommendation in Uganda for:
 - Tall varieties
 - Number of stems per tree (3-4 for Robusta and 2-3 for Arabica)
 - Fertilizer recommendations
 - Farming system (intercropping and mono-cropping)



1.3.3 Digging and back filling holes for planting coffee plants

Dig round holes which are at least 2ft (60 cm) in diameter and 1½ - 2ft (45 - 60 cm) in depth at the marked points, at least 3 months before planting. This allows for better water and root penetration through the soil.

Heap the fertile top (black) soil separate from the sub soil. Place the top soil on the upper side, if the land is sloping.

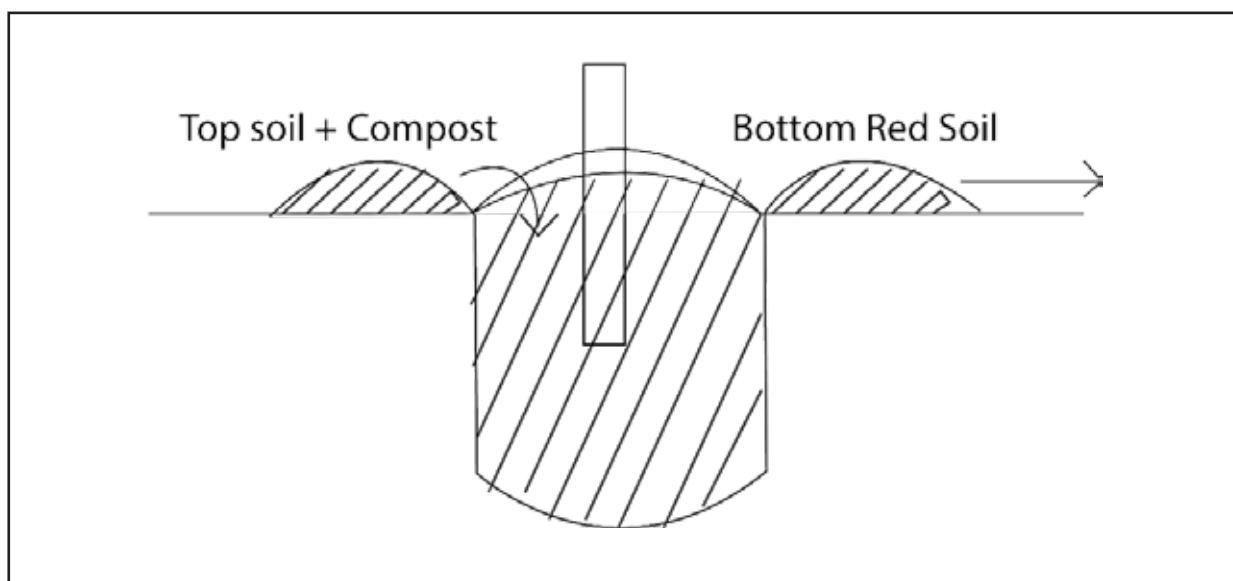


Refill the holes with top soil about a month before planting. Where possible, mix the top soil with a 20-litre basin of decomposed manure (cow dung, chicken litter, household waste) before refilling each planting hole.

Heap the soil above the ground level to allow for sinking when the soil settles.



After digging, the hole should be refilled with a mixture of top soil and bucket/basin of composite manure/well up to the top about a month before planting.



Put a marking stick in the middle of the hole to indicate where the coffee seedling shall be planted.

1.3.4 Coffee seedlings

Uganda coffee Development Authority (UCDA) recommends that farmers acquire seedlings from certified nursery operators.

At present, the 3 types of seedlings used to plant Robusta coffee are elite coffee seedlings, clonal coffee seedlings and the KR coffee seedlings.



Nursery certification ensures farmers get the right planting materials for high yields

1.3.5 Selecting appropriate coffee planting materials

- ✓ Obtain all planting materials from a UCDA certified source.
- ✓ Plant coffee seedlings with 6-8 leaves.
- ✓ Avoiding plants with a twisted main/tap root.
- ✓ Plants for re-filling/gap filling may be bigger, but they should be in larger polythene pots, which allows for root expansion without twisting.

1.3.6 Planting

- ✓ Good pest and disease free should be planted 2-3 weeks at the onset of the rainy season into the holes.
- ✓ Trim off the roots protruding beyond the polyethene bag.
- ✓ Remove the polyethene bags from the potted plant before planting.
- ✓ Open up the centre of the filled holes sufficiently to fit the size of the potted soil.
- ✓ Place the plant in the opening with the collar of the seedling at level of the surrounding soil.
- ✓ It is advisable to plant during afternoon hours. Water and shade should be provided to newly planted seedlings to avoid harsh environment.

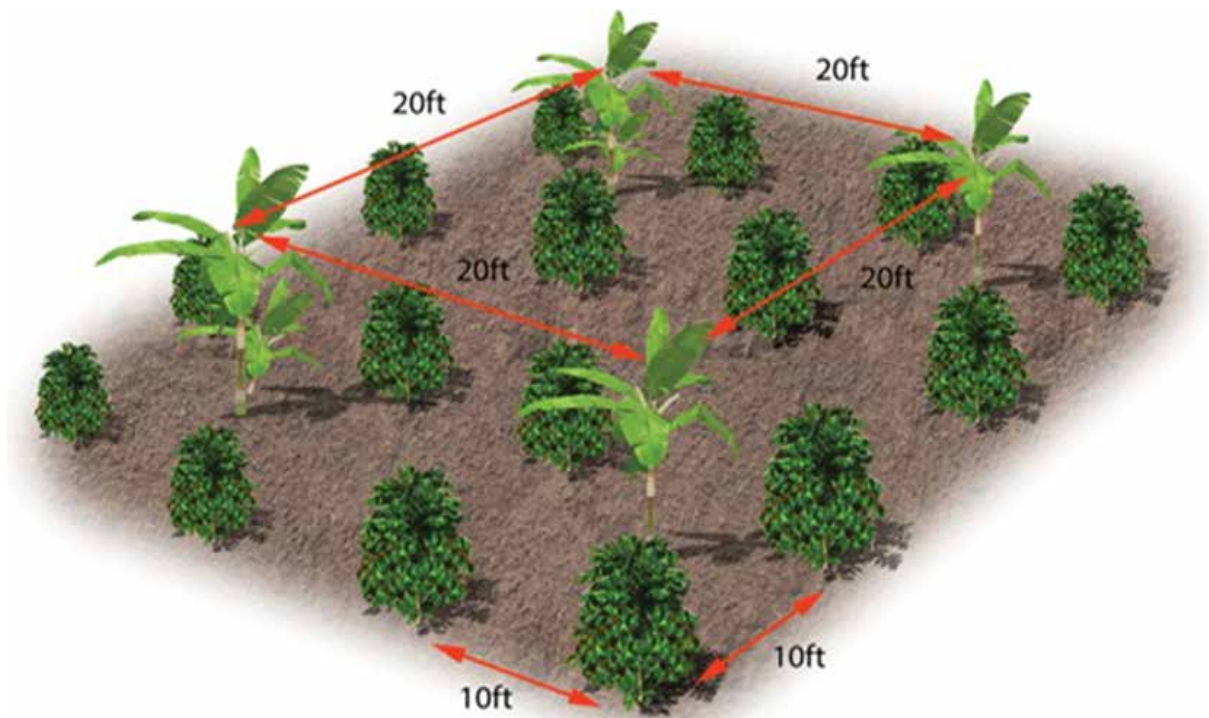
1.3.7 Intercropping systems

One way or two-way intercropping system can be applied.

Cover crops like soya beans can be intercropped in newly planted coffee.

Two crops of these intercrops can be grown per year during the first 2 years.

Coffee can be intercropped with bananas while maintaining the coffee spacing (10 x 10ft) and planting bananas at 20 x 20 ft).



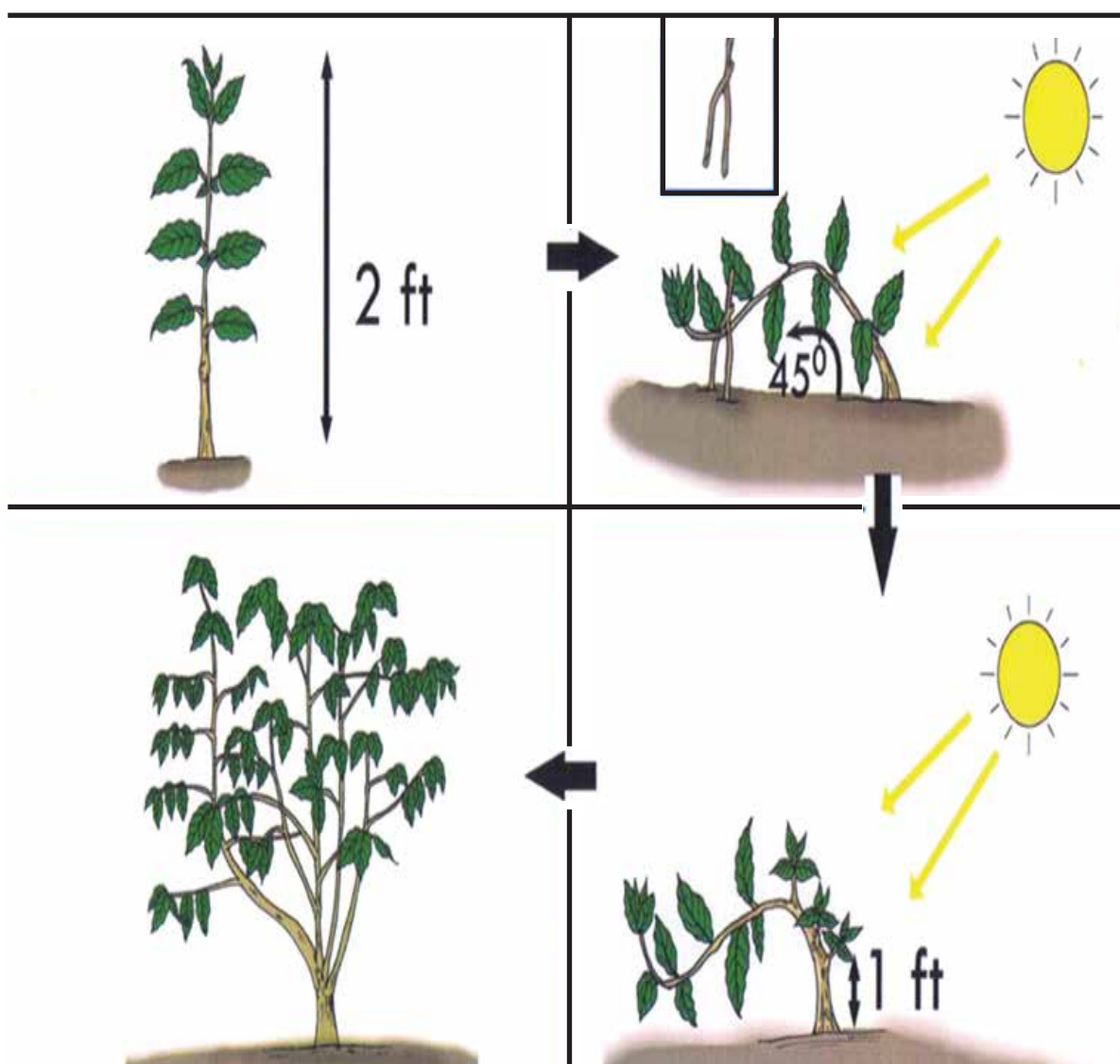
2.0 TRAINING OF COFFEE SEEDLINGS

Coffee is trained in a multiple system by bending and pegging down 6 months old plants at about 45 degrees to stimulate production of suckers.

Bend the coffee plants along rows in east-west direction.

Six months after bending, select only 3 - 4 healthy looking suckers, which originate at about 0.5 inch - 1 foot from the base of the trained Robusta coffee plant and 2-3 stems for Arabica coffee plant and allow them grow into future fruit production stems. For Arabica, allow 2-3 stems. Remove the unselected stems using a pair of secateurs.

Remove the peg when the selected suckers are about 30cm tall to allow the bent stem to develop upwards.



3.0 WEED MANAGEMENT IN COFFEE GARDENS

Weeds compete with coffee for water, light and nutrients leading to reduced growth, low yield and poor quality beans. They may be alternative hosts for coffee pests and diseases.

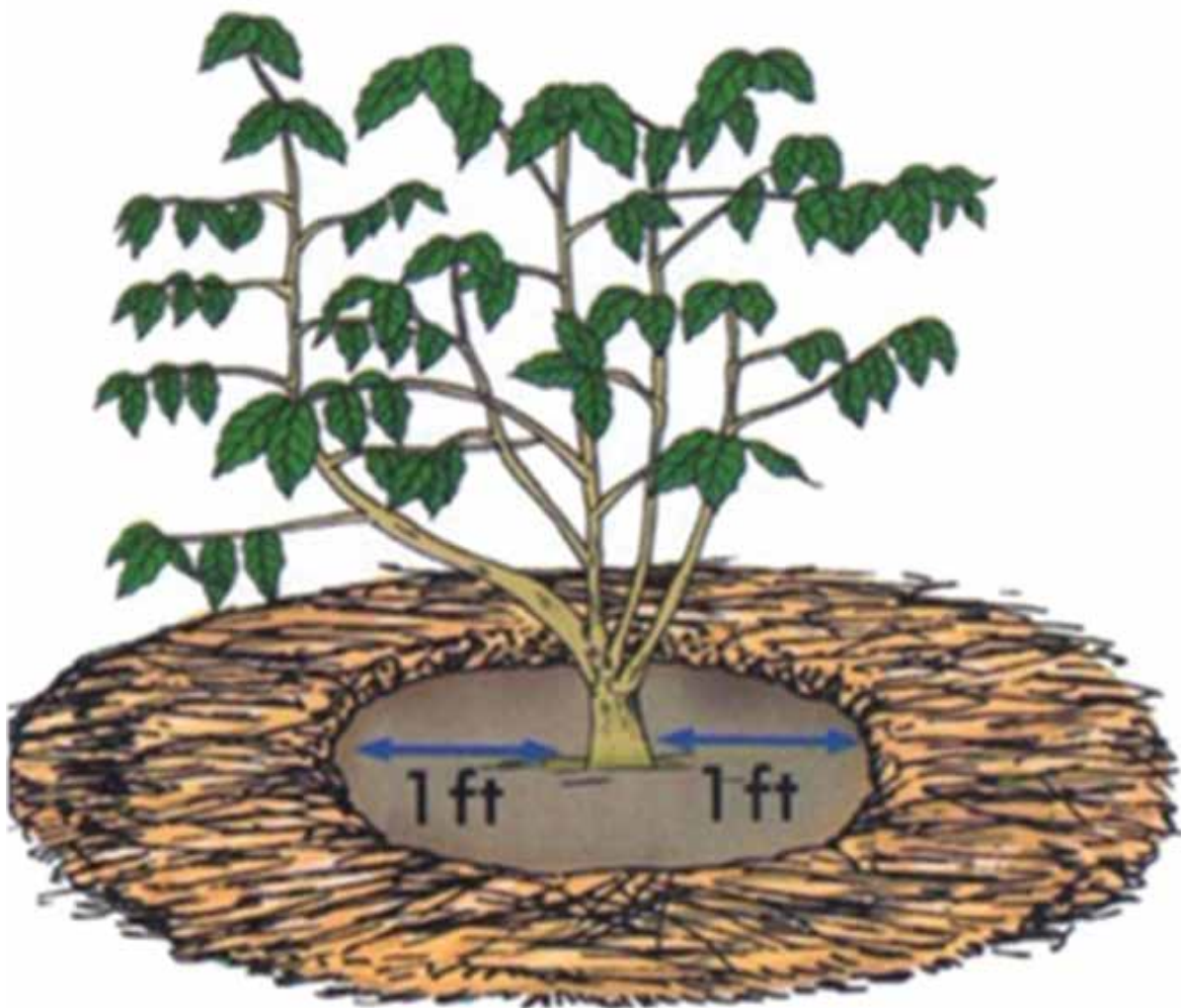
Remove weeds in gardens of young coffee (up to one-year-old) by mulching, digging, slashing or mulching. Remove weeds in old coffee gardens by mulching or alternating digging and slashing.

Ring weed below the tree canopies to avoid damage to the plant during slashing.

3.1 Mulching

Mulch coffee garden with up to 6 inches of maize straw, bean trash, banana leaves, grasses or any other dead plant materials to conserve moisture, control weeds and soil erosion, and add nutrients to the soil.

Place the mulch 1 foot away from the coffee stem to prevent infection from collar rot disease or attack by ants, termites or other pests.



4.0 SOIL FERTILITY MANAGEMENT, SOIL AND WATER CONSERVATION

Maintenance of soil fertility requires a combination of measures that can improve the soil both chemically and physically. Coffee requires fertile soils with high levels of nitrogen, phosphorus, potassium and organic matter.

Apply about 5-10 kg of organic manure (plant compost, decomposed animal dung, chicken litter or compost) around each coffee plant to improve plant growth, disease resistance, yield and quality. Do this once a year at the beginning of the rains.

4.1 Types of organic matter used in coffee production

- ✓ **Mulch: releases nutrients upon decomposition, reduces soil erosion, reduces maximum daily soil temperature, and prevents loss of nitrogen prevents loss of soil moisture.**
- ✓ **Crop residue and weeds should be incorporated into the soil.**
- ✓ **Main source of farmyard manure through livestock feed.**

4.1.1 Compost manure

- ✓ **Decomposed mixture of organic waste.**
- ✓ **Compost helps in the creation of good condition for soil organisms;**
- ✓ **Improving of soil moisture holding capacity**
- ✓ **Supply of organic matter**
- ✓ **Prevents conditions which lead to the creation of extreme acidity**

4.1.2 Farmyard manure

- ✓ **Obtained from animal droppings and bedding heaped in a safe and allowed to decay properly before application.**
- ✓ **Easier to manage droppings/manure if animals are kept in a confined place during the night or housed/zero grazing.**
- ✓ **Collected urine can be applied directly on the field or used in compost manure making. Ekirimbe (chicken droppings) is very rich in nitrogen etc.**

4.1.3 Green manure making

Ploughing in of green plant material to improve the soils.

4.1.4 Leguminous plants and cover crops

- ✓ **They help to retrieve soil nutrients that are lost through leaching.**
- ✓ **They fix atmospheric nitrogen for crops.**
- ✓ **Leguminous cover crops protect soil from erosion and add nitrogen to the soil and used as fodder.**

4.1.5 Making and use of compost

- ✓ **Farmers are encouraged to produce compost by constructing pits or making heaps in their homes.**
- ✓ **Kitchen waste, crop residues, animal droppings and bedding are piled into pits/heaps.**
- ✓ **Good yields can be obtained by simply applying compost without using inorganic fertilizers.**

The beneficial effects of adding compost to the soil in coffee gardens are more long lasting than in case of inorganic fertilizers.

4.1.6 Bio slurry and Night manure

Use of Biogas manure (Bio slurry) and Night manure is giving momentum in coffee, vegetables, banana and other crops.

4.2 Soil and water conservation measures in coffee gardens

Dig pits/troughs at the same points of the terrace to preserve rainwater. Add a small amount of oil to the water trapped in the pits/troughs to prevent breeding of mosquitoes.

Mulch the coffee to prevent erosion and retain soil moisture.

Plant cover crops such as Mucuna, Phaseolus beans, lablab and groundnuts.

Plant grass at the edges of the gardens and ridges/terraces/contour bands.

Plant shade trees and/or bananas in the coffee garden.

Construction of water retention structures such as terraces/Fanyajuu and fanyachini) and bunding to reduces soil erosion, check run off speed and promote infiltration.

Planting hedges and shelter belts to reduce wind speeds/ lower rates of evaporation.

Weeding to reduce soil moisture loss and lessen competition for moisture.

Allow mature coffee trees to have substantial water stress for at least 3 weeks for inducing flowering.

Use the Intercropping system to optimize use of soil moisture.

Harvest water for crop production (deep trench to collect and store water/ retention ditch). Irrigation is important to water the coffee plants.

4.3 Irrigation of coffee gardens

Apply water on coffee plants in appropriate ways and quantities to minimize drought effects.

The following can be used in irrigation;

- Water bottle
- Drip
- Sprinkler/water gun
- Watering cans

5.0 MANAGEMENT OF THE COFFEE TREES

5.1 Pruning and desuckering of coffee plants

Remove unwanted stems and suckers, dead, weak and unproductive branches using secateurs or pruning saws. This encourages new growth, minimizes pests and diseases, and improves productivity.

5.2 Stumping coffee trees

Stump coffee after 7-9 years to renew the stem cycle and improve productivity.

When stumping, leave a breather stem, which should be removed 6 months after stumping, when young suckers have developed.

Stumping can be either staggered or clean. If staggered, stump a third of the trees every year so that the entire garden is stumped over a 3-year period.

The cut edge of a stumped tree should be at about 45 degrees and sloping away from the breather stem

5.3 Rehabilitating coffee garden

This is the process of putting a neglected coffee garden back into production through a set of agronomic practices.

- ✓ **Clear the bush and shrubs in neglected gardens.**
- ✓ **Hoe dig to open hard pans.**
- ✓ **Stump the coffee trees.**
- ✓ **Implement routine recommended agronomic practices (selecting desired suckers, subsequent weed management, soil fertility management, canopy management, mulching, pruning and desuckering).**

5.4 Renovating a coffee garden

This is the addition of new coffee plants and shade trees in a coffee garden by either replanting the entire garden or in-filling to increase the coffee tree population appropriately.

Replanting involves uprooting the old/diseased coffee trees, preparing the land for new plantlets, planting the plantlets and nurturing them to maturity. It may also involve planting new shading trees.

In-filling entails planting new trees among existing ones to increase tree density in the garden. It may also involve planting more shade trees in existing gardens, with low density of shade trees.

6.0 PEST AND DISEASE MANAGEMENT

6.1 Coffee Pests

The major pest in coffee are Black Coffee, Twig Borer (BCTB), Coffee berry borer, berry moth, root and canopy mealy bugs, coffee, lace bugs, stem borers, termites, biting ants, tailed caterpillars, leaf skeletonizers, leaf miners, scales etc.

6.1.1 Black Coffee Twig Borer

The Black Coffee Twig Borer (BCTB) is currently the main insect pest attacking coffee in Uganda. In Uganda it prefers Robusta to Arabica coffee.



Managing the BCTB

- *Use BCTB-free seedlings from UCDA certified nurseries.*
- *Regularly inspect coffee fields for BCTB infestation and promptly trim and burn all infested plant materials.*
- *Avoid bushiness by weeding, desuckering and pruning.*
- *Avoid too much shading by planting coffee and shade trees at recommended spacing.*
- *Eliminate BCTB alternate host plant species within and in vicinity of coffee fields.*
- *Enhance plant nutrition as well as conserve soil and moisture in coffee plantations.*
- *Use NARO-BCTB Trap to capture adult female BCTB as they leave their broods to establish new colonies,*
- *Spray with molasses and or mulch to attract BCTB predators *Plagiolepis sp* into the coffee thus enhancing biological control of BCTB.*

6.1.2 Coffee berry borer

This Attacks both Robusta and Arabica coffee.



Managing the coffee berry borer

- *Open the canopy of both coffee and shade trees by pruning to encourage natural biological control for the pests e.g. ladybirds.*
- *Pick ripe cherries at least once in every two weeks to reduce infestation.*
- *Strip off and burn overripe cherries to reduce inoculum.*
- *Remove all remaining cherries from the tree and the ground at the end of harvest period to prevent carry-over of infestation into the next crop (phytosanitation).*
- *Bury fallen berries in the ground to suffocate CBB larvae or burn them.*
- *Use Brocca or NARO-BCTB traps at a density of 15 traps per hectare to reduce the population of adult beetles in the garden.*

6.1.3 Coffee root and canopy mealy bugs

These are small sucking insects (about 3 mm long) that form white masses on coffee roots and base of stems (root mealy bugs) as well as on leaves, stem and berries (canopy mealy bugs).



Managing the root and canopy mealy bugs

- Application of cow-dung and bean intercrop suppresses incidence of root mealy bugs.
- Remove suckers and branches touching ground to prevent attendant ants from accessing mealy bugs

6.2 Coffee Diseases

The major diseases are coffee wilt disease (CWD), coffee leaf rust disease, red blister disease, coffee berry disease, root rot or collar crack disease all caused by fungal attack.

6.2.1 Coffee Wilt Disease (CWD)

- ✓ In Uganda, CWD attacks only Robusta coffee.
- ✓ The fungus blocks the vascular system of the coffee plant, thus interrupting water and nutrient transportation from roots to other parts of the plant. This results in wilting and death of affected plant.
- ✓ The disease is often recognized by black/brown or violet streaks or bands on the interior wood of affected trees when the bark is peeled off.



Managing CWD

- Plant coffee wilt disease resistant varieties (KR1 to KR10) purchased from UCDA certified nurseries,
- Inspect fields regularly to identify and destroy diseased trees on site by uprooting, chopping and burning the whole plant,
- Allow 12-24 months before replanting in spots where diseased trees were removed,
- Restrict the movement of infected plant materials and soil,
- Sterilize garden tools used in infected fields by flaming the metal parts over the fire,
- Avoid wounding coffee trees during weeding and don't tethering livestock on coffee trees.

6.2.2 Coffee Leaf Rust (CLR)

Attacks both Arabica and Robusta coffee but in Uganda it is more severe on Arabica coffee.

The disease is mainly recognisable by the yellow-orange, powder-like lesions (pustules) on the underside of leaves, where stomata are found.



Managing Coffee Leaf Rust

- Good field management practices starting with proper field preparation,
- Use of clean planting materials from UCDA recommended nurseries,
- Regular weeding, pruning and desuckering, and fertiliser application to boost the level of nitrogen as first line of defence against,
- Plant CWDR Varieties (KR1-KR10) which are also resistant to rust or KP423 in case of Arabica coffee

6.2.3 Coffee Berry Disease (CBD)

Coffee berry disease (CBD) is the most important disease in Arabica Coffee grown at higher altitudes in Uganda (over 1,600 m above sea level).



Managing the CBD

- Use of resistant or tolerant varieties e.g. KP423.
- Use planting material from disease-free sources.
- Maintenance of healthy coffee plants through pruning or stumping practices. Quarantine.

7.0 HARVESTING

Pick only brick-red ripe berries and dry on raised platform (racks), coffee wire trays or tarpaulins.

Strip off and dry separately all black and yellow/unripe, berries (mbuni) at the end of every picking to the next crop. Use clean gunny bags to handle the harvested coffee.

8.0 CLIMATE CHANGE IMPACTS ON COFFEE

Extreme weather events/phenomena such as El Nino have already negatively impacted coffee production and resulted in production losses.

Emergence and/or intensification of the occurrence of certain insect and pests e.g.

- i). Intensification of coffee lace bug, stem borer and root meal bug (UCDA 2008) in Eastern Uganda.*
- ii). Outbreaks of black coffee Twig borer in central and South Western (Egongu et al 2009)*

Emergence and/or intensification of the occurrence of diseases e.g.

- i). Intensification of red blister disease on Robusta boffee*
- ii). Outbreak of coffee wilt Disease (CWD)*

There is general decline in soil fertility as a result of:-

- a). Unavailability of ground water and nutrients to coffee trees due to drought (NARO 2001)*
- b). Soil erosion/run off*
- c). Floods-leakage, impermeability*

Socio-economic implication of climate change

- a). Reduced crop yield and quality leading to reduced exports and forex earnings*
- b). Reduced labor availability (women/youths) for the coffee enterprise as a result of coping actions.*
- c). Reduced competitive and resource allocation for coffee in relation to other enterprise.*
- d). Reduced family income leading to family conflicts.*
- e). Fall in livelihoods of coffee farmers.*

9.0 COFFEE RETURNS PER ACRE

An acre has approximately 450 trees; the yield is approximately 4kgs/tree in two (2) season per year i.e. 450 trees x 4kg tree as yield x 2 seasons. It gives 3600kgs of Kiboko coffee/dry berries.

One kilogram of Kiboko with a moisture content of 10-13% is 2,000/= an average i.e. gross profit is 3600x2,000/= Ugx.7.2m. This is the farmer who cannot afford to add value to his/her coffee garden.

Primary processing/hulling gives income and aside gain from the coffee husks. The return of coffee husks to the garden stops soil mining.

The shelled coffee is referred to Fair Average Quality (FAQ) as a standard of coffee beans with a moisture content of 10-13% with no debris and stones. This fetches a higher price than Kiboko.

In Uganda a tree can give 3kgs/tree of FAQ standard under average management but under good management a tree can give 5kg of FAQ. (In Vietnam it is 10kg FAQ)

On average a kilo of FAQ is from 4,000-5,000/=. The more you add value to your coffee, the higher the returns.



10.0 Conclusion

ESAFF Uganda recognizes that Ecological Organic Agriculture has potential to sustainably feed the population while restoring the degraded agricultural ecosystems including loss of biodiversity. This is mostly because organic agriculture enhances small-scale farmers’ ability to live in harmony with nature and to derive economic benefit from their land and increase total land productivity, enhance ecosystem health and services, more resilient to the changing climatic conditions, significantly contributes to climate change mitigation as well as contributes to attainment of multiple SDG goals and Uganda’s vision 2040.

We equally recognize that scaling up of Ecological Organic Agriculture in Uganda will require concerted efforts from various categories of stakeholders systematically working together and therefore call upon the government to equip extension service providers with knowledge and skills on agroecology system of production in order to motivate uptake of Ecological Organic Practices among small-scale farmers.

About ESAFF Uganda

Eastern and Southern Africa Small-scale Farmers’ Forum (ESAFF) Uganda exists to create a platform to bring together small-scale farmers into a farmer-led advocacy movement to influence policies and practices at the local and national level and contribute through ESAFF to policies and practices at regional, continental and global levels.

ESAFF Uganda is a small-scale farmer-led advocacy movement formed to facilitate processes through which small scale farmers’ development concerns can be solicited, articulated and ultimately addressed through policies and programs. ESAFF Uganda focuses on advancing economic empowerment, agroecology and food sovereignty.

ESAFF Uganda is currently having a membership of 1359 farmer groups with 48210 individual small-scale farmers of which 64 per cent are women in 54 districts (under the administration of 30 historical districts’ forums).

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