12 Best Agroecological Practices

PELUM ASSOCIATION

Brot für die Welt

Swedish Society for Nature Conservation

About PELUM Kenya

Participatory Ecological Land Use Management (PELUM) Kenya is a National Network which currently comprises of 57 Member Organizations (MOs). PELUM Kenya works with its Member Organizations to promote ecological land use principles and management practices for improved livelihoods among small scale farmers and pastoralists in Kenya. PELUM Kenya network is part of the larger PELUM Association which is in 12 African Countries.

The members of PELUM Kenya are Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs) and other networks working with small scale farmers in the field of agroecology. The members of PELUM Kenya are categorized in to four networking zones namely Nairobi/ Central zone, Upper Eastern & Northern Kenya zone, Lower Eastern & Coast zone, Rift, Western/Nyanza Zone. PELUM Kenya is the host to the Eastern Africa Regional Secretariat of the Ecological Organic Agriculture Initiative in Africa.

Vision

Empowered, Prosperous and healthy communities in Kenya

Mission

To Promote agroecological principles and practices among small holder farmers and pastoralists communities in Kenya for improved livelihoods

Thematic Areas

In its 2021 to 2025 strategic plan, PELUM Kenya has the following thematic areas:

1. Institutional Strengthening, Networking & Capacity Development
2. Policy Influence & Advocacy on Agroecological Practices
3. Agro-enterprise and Market Development
4. Climate change resilience and Natural resource management
5. Gender and Youth Inclusion in Agroecology

Introduction to this Publication

For over 25 years, PELUM Kenya has been in the fore front advocating for Good Agro-ecological practices. This is in a bid to ensure that the message on the benefits of Agro-ecology, are known far and wide, across Kenya and beyond. This publication is a result of research and collaborations between PELUM Kenya and selected Member Organizations (MOs) on Agroeology, as the most viable route towards food security, food safety and nutrition security.

This publication brings to you 12 Great Agroecological practices, which every small holder farmer should consider applying at their farms. It is a publication meant especially for farmers in developing countries like Kenya, where small holder farmers are approximated to be above 75 percent. These farmers will for example, get ideas on agro processing, so that their venture goes beyond production. Isn't it ironical that farmers for example, buy yoghurt at three times the selling price for milk at farm gate, yet they can manufacture the same right in their farms? Well, in here are several ideas on value addition, and the benefits that come with the same.

In this publication, you will be able to explore agroecological practices, from Farm to Fork. These include soil health, as a base for production of healthy food, and therefore a wealthy nation. Other issues addressed in here include seeds saving, and the importance of the same towards enhancing agro biodiversity, food diversity and seed sovereignty.

In the wake of emerging and increasing cases of lifestyle diseases, many people are opting for organic foods. You will read how PELUM Kenya is working with MOs in promoting agribusiness in organic agriculture.

Even as farmers strife to ensure minimal chemical use, they sometimes lack knowledge on the best practices in managing pests and diseases. In here, are several methods of Integrated Pests Management (IPM) practices, which are key in avoiding use of synthetic pesticides, which are harmful to the environment and human health.

Food safety is key towards having a healthy society. In here, several issues which are related to food safety are addressed, for the benefit of players across the value chain, from producers to consumers. These and more, are the issues addressed in this publication.

Welcome to read on.

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List of Abbreviations

Africa IPM Alliance – Africa Integrated Pest Management Alliance

BIOGI – Bio Gardening Innovations

CSHEP – Community Sustainable Agriculture and Healthy Environment Program

FAO – Food and Agriculture Organisation

G-BIACK – Grow Biointensive Agriculture Center of Kenya

INOGOF – Innovative Organic Group of Farms

KOAN – Kenya Organic Agriculture Network

NIA – Neighbours Initiative Alliance

PELUM – Participatory Ecological Land Use Management - Kenya

PGS – Participatory Guarantee System

RODI – Resources Oriented Development Initiatives Kenya

SSN – Seed Savers Network

SSNC – Swedish Society for Nature Conservation

Acknowledgement

Production of this publication has been made possible through financial support from Bread for World and Swedish Society for Nature Conservation (SSNC).

We acknowledge all the 57 Member Organisation (MOs) of PELUM Kenya, for your continued support and commitment. Special gratitude to the following MOs, who actively and directly participated towards production of this publication: Neighbours Initiative Alliance (NIA), Community Sustainable Agriculture and Healthy Environment Program (CSHEP), Seed Savers Network (SSN), Resources Oriented Development Initiatives (RODI) Kenya, Grow Biointensive Agriculture Center of Kenya (G-BIACK), Bio Gardening Innovations (BIOGI), Africa Integrated Pest Management Alliance (Africa IPM Alliance) and VI Agro forestry.

The effort by small scale farmers especially those who commit to follow agro ecological practices is hereby much appreciated. May you prosper in your agricultural and livestock rearing ventures.

We acknowledge PELUM Kenya staff lead by Mr. Zachary Makanya, the Country Coordinator, and Ms. Rosinah Mbenya, the Programme Operations Manager, for continued commitment in production of this work. Special acknowledgement goes to Ms. Mary Irungu, PELUM Kenya's Advocacy and Communication Officer.

Soil Health

Make your own Manure at the Farm

Compost manure is key in enhancing soil fertility and health as well as improving crop yields. To begin with, it helps the soil retain more moisture and prevents erosion thus chances of nutrients being swept away by surface runoff are minimal. Additionally, compost manure contains micro-organisms which help to bring life in the soil thus increasing the soil fertility.

Unlike synthetic fertilisers which are costly and harmful to the soil in the long-term, you can make your own compost manure using raw materials readily available on the farm.

Below are **four** types of compost manure that you can manufacture with ease on the farm:

1. Farm Waste Manure

You can make the manure by composting waste from weeds, pruned plant materials, tree leaves, flower cuttings and the kitchen like vegetable peels and egg shells.

After gathering enough raw materials, dig a shallow hole on the ground. This allows micro-organisms that will help break down the raw materials and decompose them, to come to the surface.

- Place the materials on top of the loose soil, starting with dry ones like maize, sorghum and millet stalks.
- On top of them add green materials like nitrogen-rich plants like sesbania, lucerne and any other materials like weeds that you get from your farms.
- Thereafter, add kitchen waste, repeating the process until the heap reaches 1.5 metres high. The width of the pile can be 1.5 meters by any length.

Leave it to decompose for a minimum of three months depending on the types of materials used. For good decomposition, apply water on it, especially if the manure-making process is not done during the rainy season. You will end up with quality organic manure that will help keep the environment cleaner and earn you big harvest.

2. The Vermi Compost

This involves rearing Red Wigglers worms which break down manure by feeding on the green materials.

In addition to quality manure, you also end up with vermi tea that you can use as foliar or a top dressing agent.

You have to feed the worms on particular plants to end up with specific nutrients from the tea. To get potassium for example, feed the red worms on Russian Comfrey, commonly known as mabaki (in Kikuyu language). Once you feed them, apply water on the pile to wash down the nutrients into harvesting tanks. You then irrigate your crops with the nutritious tea for good harvest.

3. Farmyard Manure

This is sourced from the cowsheds and poultry houses and is a mixture of animal manure, urine, fodder residues and bedding materials. Some farmers use the manure raw, but for good results, let it decompose first to ensure it fully cures and is safe for use. Add carbonatious materials in the manure in order to improve its quality.

To process the manure, heap the animal waste at one location and cover it with twigs or bananas leaves, or pile the manure under the shade. Make sure that the pile is not rained on or hit by direct sunlight. Leave the heap to decompose for a minimum of three months before use. When animal

manure is fully cured, it supplies nutrients to the soil. On the other hand, when not fully cured, it takes time to cure instead of feeding the soil.

4. Bokashi Manure

This is made from either rice or coffee husks as the main ingredients. Other ingredients are quarry dust, charcoal dust, bran, baking yeast and water. If rice husks are not available, chop, sorghum or maize stalks in small pieces or even grass chippings. However, rice husks are a better raw material because they decompose faster and better.

To make Bokashi:

- Add baking yeast to water in a drum and star until the yeast particles are dissolved.
- Pile all the other materials on top of each other then start turning them as you apply the mixtures of water and baking yeast.
- You will be required to turn the materials for a minimum of 5 turns then turn it ones or twice per day for a minimum of 14 days.
- Your Bokashi will be ready for use in 14-21 days. This Bokashi must be used within 3 months. Bokashi is only used as an amendment agent.

Photos taken at GBIACK

Methods of soil preparation

Good soil preparation leads to better fertility and healthy crops. Therefore, it is advisable to always prepare the soil well before planting to keep it healthy and ensure the moisture is evenly distribution.

Below are some of soil preparation methods:

1. Deep digging

This method is suitable in areas with various climatic conditions, but is mostly used in dry areas. It involves digging deep to loosen the soil to enable the roots to grow well downwards and to allow water to percolate well without any hindrances. The loosened top soil will mix well with organic manure and will supply nutrients, oxygen and water with ease.

2. Zai pits

Also known as planting pits or tumbukiza, Zai pits are square-shaped, often measuring 60cm by 60cm or 90cm by 90cm and have a depth of about 30cm. However, the dimensions may vary depending on which crop is to be planted.

Zai Pits in Kitui. Photo credit, The Guardian

After digging, the pits are half-way filled with organic matter like maize stalks, dry leaves and dry grass, which aid in retaining soil moisture.

The dry matter is then topped with mixed manure and top soil, before wetting the pits and planting crops.

Zai pits are good because they help in water and nutrients' retention and reduce competition between the intended crop and weeds.

3. Raised beds

These are suitable for wet areas and are made by raising the soil in which you plant the intended crop. A bed measures 4 ft or 5 ft width by any length. Live a shallow path of about

A photo of a raised bed taken at GBIACK

45 cm along each side of the bed, which will be used during irrigation or walking around. Water flows into the paths and seeps through to reach the crops. The paths allow draining of excess water, leaving the crop with the suitable moisture level. As a good practice, mix manure with soil on the raised bed before planting crops.

4. Sunken beds

Unlike raised beds, sunken beds are suitable for dry areas as they help in water retention. The beds are sunk into the ground keeping them cooler thus retain water for long in dry areas where the rate of evaporation is high.

Sunken beds. Photo credit, nativeseeds.org

5. Mandala gardens

They are circular shaped and are mainly used to grow vegetables, herbs and spices. Some of the garden spaces are paths for the farmer to walk through while tending to the crops. The circular hole is used to trap water, which seeps into the soil to reach the crops. The mandalas are a great way of harvesting water in the garden, and keeping it green and productive, even during the dry seasons.

Mandala garden. Photo: GBIACK

Besides enhancing farming, mandala gardens add beauty to your farm or compound, and can as well be therapeutic.

"Every farmer must pay attention to soil health, this is the initial step towards healthy crops, and good harvests, thus, better returns,"

- Samuel Nderitu, Director, Grow Biointensive Agriculture Center of Kenya (G-BIACK)

Seeds Saving

Traditionally, farmers would harvest their crops, keenly select seeds and save them for planting during the next season. This way, they were assured of seed security, and would even exchange the seeds among themselves. Additionally, they were able to conserve seeds that are particularly suitable for specific areas, depending on climate and other factors.

However, the entry of multinational companies in the seeds' market led to commercialisation of the sector reducing diversity. In ancient days for example, maize was not just white, but there was yellow, purple and black varieties.

With growing dependence on commercial seeds, farmers' access to seeds has been badly affected. Some farmers live too far from town centres where seeds are sold, while others cannot afford to buy them.

According to Food and Agriculture Organization (FAO) of the United Nations, the world has lost over 75 percent of seed varieties in the past years. In a bid to save what remains, and try to reclaim what can still be found, various PELUM Kenya's member organisations have been championing seed-saving as a way of enhancing food and nutrition security, crop diversity and seed sovereignty.

"We strive to ensure that farmers can access and exchange seeds and that seeds which are at risk of becoming extinct are conserved," says Daniel Wanjama, the National Coordinator of Seed Savers Network, which is based in Gilgil, Nakuru.

Even when farmers have to buy seeds, there are many varieties which are not available in agro-shops. Unless such seeds are saved, then these crops will not be grown. This puts the communities at risk of suffering food shortage.

The Constitution of Kenya recognizes traditional knowledge and indigenous seeds in nation economic building. In addition, the Seed and Plant Varieties Act provides an exception on Plant Breeders' Rights where farmers are allowed to save seeds even from registered varieties for their own use.

A seed bank at Seed Savers Network

What is seed-saving?

Seed-saving is an ancient act of selecting and storing seeds for planting during the next season. It is the act of farmers isolating the best plants and using them as a source of seeds. Seed saving is a model for promoting Agro Ecological Agriculture. It ensures suitable and adapted varieties for a given environment are cultivated this minimizing use of chemical fertilizers and agrochemicals for control of pests and diseases.

To identify the plants from which to source seeds from, farmers need to note the first plants, which sprout after planting. The plants are then marked, for example, by tying the stems with a conspicuously coloured string.

Farmers must keenly observe their crops and note the healthiest ones, for instance, those that fruit first and those that yield in plenty. For beans for example, check the plants whose pods have more. It is from these ones that you should harvest seeds.

During harvesting, farmers should separate the ordinary harvest from those selected as seeds, which are the healthiest looking, as they are bound to be more productive.

Even for crops like tomatoes, whose seeds are viewed as solely commercial, seeds can still be extracted, grown, and allowed to thrive. An 8m by 15m greenhouse for example, needs tomato seeds worth at least Sh2,500, yet, farmers can just extract the same from ripe tomatoes, and save the money.

For potatoes, most farmers depend on saved seeds, with only about 3 percent of seeds coming from the commercial market, according to Seed Savers Network. The crop, therefore, is an example of how sustainable and practical seed-saving works. If only farmers get the necessary training especially on seed selection, pests and diseases control.

Seed Savers Network works with farmer groups who come together and

save seeds in seed banks at their homes. By working in groups, farmers are able to exchange seeds, motivate each other and share ideas. Additionally, organisations like Seed Savers Network are able to reach out to the farmers and train them as groups.

Seeds Storage

The seeds are stored in airtight containers and preserved using natural methods, such as adding ash or diatomaceous earth dust. Farmers hold each other accountable throughout the storage period. While some prefer saving seeds in individually-owned banks, there are those who would rather store them jointly, to keep off temptations of turning the seeds into a meal. This temptation is especially rampant during prolonged dry seasons, which are usually occasioned by food shortage.

For planting materials for crops such as sweet potato vines, cassava stems and arrowroots, farmers are advised to establish planting material banks by setting aside a portion on their farms and nurturing planting material, for their own use, and for exchange among themselves.

Women and Seed Saving

Traditional seed varieties are often maintained by women. Over many generations, women have been custodians of local varieties because

A farmer checks on her saved seeds at a seed bank in Baringo. Photo Courtesy - Seed Savers Network

they are interested in in diversified diets for their families. On the other hand, men are often interested earning income. Therefore, it is always important to pay key attention in empowering women as champions of seeds saving.

Documentation of Traditional Varieties

Seed Savers Network documents traditional knowledge about indigenous varieties by carrying out research from farmers. This knowledge is integrated with scientific research and analysis from the laboratory, to get the nutritional wealth of these varieties. Documentation is a sure way of supporting and justifying the need for conservation of indigenous varieties.

In conclusion, seed-saving as an agro-ecological practice is important because it:

- Enhances seed security, resulting to nutrition and food sufficiency.
- Reduces dependency on commercial seed sector.
- Ensures availability of right seeds for right climatic conditions – crops are more adoptive.
- Supports agro-biodiversity.
- Increases access to various kinds of food.
- Protects loss of crops diversity.
- Promotes organic agriculture, thus enhancing food safety and environmental conservation.
- Saves money.
- Saves time.
- Enhances people's capability to produce, consume and sell their own food.

"Seed-saving is not about one institution or a single farmer having so much seeds. It is about having thousands and millions of farmers having small amounts of seeds, individually, and being able to share with each other,"

- Daniel Wanjama – National Coordinator – Seed Savers Network

Water Conservation

The importance of water on the farm cannot be gainsaid. Amid challenges such as climate change, water as a natural resource is becoming scarce. It is, therefore, important for farmers to ensure they save water, so that they can be able to farm even when the rains fail or during dry seasons. There are two ways of conserving water, that is, in-situ and ex-situ

In-situ water conservation

This is the more sustainable and recommended way of conserving water for farming. It involves using the soil. The methods include:

Terraces

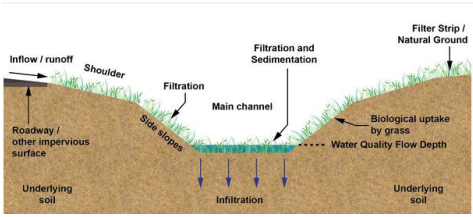
Terraces are categorised as either fanya juu or fanya chini. In the former, soil is heaped on the upper side of the terrace. These types of terraces, however, have a disadvantage since the heaped soil blocks water from flowing into the terrace.

On the other hand, in fanya chini, soil is heaped on the lower side of the terrace. This allows water to flow into the terrace, and the heaped soil aids in blocking overflow.

A terrace at GBIACK

Swales

Swales are v-shaped modern terraces that do not easily allow water to break its walls. They are, therefore, long-lasting and not destructive even when there is pressure from water. By using swales, farmers manage water flow on the farm, thus, mitigating soil erosion and its effects.



A terrace at Swale Graphic - Photo credit North Carolina Erosion and Sediment Control Planning

Water infiltration

This involves construction of structures that allow water to infiltrate soil. These are:

Small dams in which water is collected. The water percolates into the soil, thus, reaching the roots of surrounding crops. In some cases, the dams have liners. In such cases, the water is collected and used for irrigation.

Roadside dams are dug strategically to collect rainwater that flows by the roadside. They curb soil erosion, which the water may have caused by flowing through one's farm. Additionally, they may also be used to collect water, which percolates into the farm, thus, keeping your crops watered.

Dry Mulching

To keep your farm moist, collect farm waste like from pruned crops and use them to cover the ground. This prevents water evaporation and keeps the ground cool, thus retaining moisture. Mulching also suppresses growth of weeds, therefore, saving your crops from competition, and the cost that comes with weeding.

Dry Mulching at Seed Savers Network

Living mulch

This is whereby you plant cover crops like pumpkins and sweet potatoes, which cover the ground helping in retaining moisture, while suppressing weeds and of course giving one harvest. Living mulch provide mini climate which regulates the temperatures in the soils.

Sweet potato vines are a sample cover crop which can be planted as living mulch. Photo taken at GBIACK

Water pans

These are ponds or holes dug in the ground, in circular, rectangular or square shapes, and used to collect run off water. Their capacity depends on the size of holes dug. Farmers are advised to consider the size of land and the amount of crops which is need to be watered while digging water pans

Water Pan. Photo Credit, Agatha Ngotho - The Star

Ex-situ water conservation method

This is harvesting rainwater from rooftops and storing it into tanks mostly for household use and irrigation.

A sample rain harvest water tank at GBIACK

"If only farmers committed to harvesting water during the rainy season, then they would not suffer much due to water shortage, when dry season strikes," Samuel Nderitu, Director, Grow Biointensive Agriculture Center of Kenya (G-BIACK)

Urban Farming

The growing urban population, occasioned by rural-urban migration, has caused a rise in demand for food. Approximately over 27.51 per cent of Kenyans live in urban areas, with the World Bank indicating that this population grows by 4 per cent annually.

However, people living in urban areas often have to contend with food whose source or safety is unknown. Some unscrupulous traders source food, especially vegetables, from unsafe sources like sewer lines and sell. This puts consumers at risk of contracting diseases caused by contaminated food.

Like other persons, urban dwellers are increasingly becoming cautious of what they consume because of rising cases of lifestyle diseases, and increased calls by nutritional experts for people to embrace healthy diets. Besides, the cost of living is on the rise, therefore, urban dwellers should be encouraged to grow their own food to cut costs and have safer food.

Benefits of Urban Farming

It gives consumers an opportunity to eat clean, nutritious, safe and organic food.

The urban population is also able to access a variety of foods, beyond what is available in the market. For example, a farmer can grow broccoli in an area where the vegetable is unavailable in the market, or fruits like strawberries and gooseberries, which are rare to find in most markets, yet easy to farm on small spaces.

It gives access to fresh food, thus, consumers are able to enjoy the benefits that come with that.

Urban farming enhances food security as households are able to access food, even when they have no cash.

With agriculture being given little attention in schools, urban farming offers an opportunity for children to learn and explore agriculture practically. This prepares them for possibilities of taking up farming as a future career, while appreciating agribusiness as a profitable venture.

Through urban farming, one has an opportunity of earning extra income

as they can sell the surplus. There is often a ready market for such produce, as demand for safe, healthy food, whose source is authentic, is often high.

You have no Land? Here are Viable Urban Farming Ideas

1. Veranda Garden: Instead of planting flowers around the house, urban dwellers can plant onions, herbs and spices. Alternatively, they can intercrop flowers with the food crops and enjoy the benefits of having both.

2. Green Wall: This is achieved by growing crops in plastic bottles hanged on house walls or fences. It makes the walls more beneficial, beyond the initial intended reasons while enhancing access to safe, healthy and organic food.

3. Hanging Garden: This is done by recycling things like old car tyres or containers and hanging them around the compound to grow food.

4. Potted Crops: Flower pots do not have to be used for growing ornamental plants alone. They can as well be used to produce food such as vegetables, herbs and fruits (like strawberries) among others.

5. Vertical Gardens: They save space and are constructed using locally available raw materials such as polyether bags and water pipes cut into two.

Urban farmers can sustainably manufacture their own manure by recycling kitchen waste. One then uses red wiggler worms to break down the waste producing liquid fertiliser and vermi-compost.

Verandah garden at RODI Kenya

Vertical Garden at RODI Kenya

Wall garden at RODI Kenya

“A child can observe urban farming, learn it, like it, get inspired and pick agriculture as a future career,” Moses Muthike Mbiri, project officer, RODI Kenya.

Integrated pest management

By Dr Nehemiah Mihindo , CEO - Africa IPM Alliance

Pests are responsible for 30 - 40 per cent of losses in Kenya's agricultural production. The most conventional and common way of pest and disease control is through the use of synthetic pesticides which kill or deter the destructive activity of the target organism.

Unfortunately, these compounds have inherent toxicities that endanger the health of the farm operator, consumer and the environment. The current concern is on the health hazards posed by the presence of the chemicals in the environment.

The situation in Kenya is aggravated when cases of pesticide misuse occur due to farmers' ignorance and illiteracy. Kenyan farmers, especially those from pastoral communities, have lost cattle after spraying insecticides instead of acaricides. Sale of fake, expired or banned pesticides is also common. It is, therefore, important to train communities on methods that use less synthetic chemicals, but maximise on preventive measures to curb pest attack.

Defining a pest

Pests are organisms that damage or interfere with desirable plants on the farm by either causing physical damage or transmitting diseases.

Pests include plants (weeds), vertebrate (birds, rodents, or other mammals), invertebrate (insects, ticks, mites, or snails), nematode and pathogens (bacteria, virus, or fungus) which cause diseases, or other unwanted organisms that may harm water quality, animal life, or other parts of the ecosystem.

Integrated Pest Management (IPM)

IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques, which aim at reducing the pest population and keeping them below economic injury levels. IPM is not a one-stop shop remedy but a system of manipulating the pest population while taking into consideration the

effect any intervention will have on the environment and our health.

Principles of IPM:

- **Monitoring:** This includes regular site inspections and trapping to determine the types and infestation levels of pests at each site.
- **Recordkeeping:** A recordkeeping system is essential to establish trends and patterns in pest outbreaks. Information recorded at every inspection or treatment should include pest identification, population size, distribution, recommendations for future prevention, and complete information on the treatment action.
- **Action levels:** Pests are never eradicated in total. An action level is the population size which requires remedial action for human health, economic, or aesthetic reasons.
- **Prevention:** Preventive measures must be incorporated into the existing structures and designs for new structures. Prevention is and should be the primary means of pest control in an IPM programme.
- **Evaluation:** A regular evaluation programme is essential to determine the success of the pest management strategies.

Methods of IPM

Cultural methods

These include all agronomic practices carried out on the farm primarily not aimed at managing pests but end up helping in keeping their population low. They include:

- Soil fertility management
- Crop rotation
- Intercropping
- Proper watering
- Use of right planting materials
- Timely planting
- Timely harvesting
- Field general hygiene

Physical/mechanical methods

They involve:

- Physical removal of pests from the field
- Use of traps
- Use of barriers

Biological methods

These involve the use of living organisms to manage pests including:

- Predators
- Parasites and parasitoids

Botanical pesticides

They involve extraction of active ingredients from plants with pesticidal properties, which include but not limited to:

- Pyrethrum
- Tephrosia Vogelii
- Aloe felox
- Solunum incunum
- Tegetes minuta
- Tithonia diversifolia
- Euphobia tirucalli
- Melia azandirac
- Lime sulphur brew

Note: The botanical methods should be used as the last resort and caution should be taken when handling them.

Small Livestock Production

This involves keeping small animals that include poultry, rabbits, pigs, sheep, goats, fish and bees.

Keeping small livestock is sustainable, affordable and comes with numerous benefits including financial and better health. Small livestock requires little space thus farmers who own tiny farms, including those in urban areas, can comfortably keep them.

These animals are not heavy feeders, therefore, farmers require minimal capital to purchase feeds and house them. Some like poultry and rabbits can be fed with kitchen, farm and compound waste, thus helping in waste management while still giving the benefits that come with rearing them.

Additionally, small livestock are not labour-intensive. They require minimal workforce, thus can be managed even by farmers who have busy schedules like those in full-time employment. The basics of keeping them is ensuring feeds and water is available, while not forgetting other essentials like regular cleaning of their houses, and measures for pest

and disease management.

Small livestock are a source of milk, meat, manure, honey and honey products and hides. They are also therapeutic, and a way of teaching young generations sustainable agriculture and its benefits.

With land becoming scarce, amid increasing population and massive subdivisions, small livestock rearing is a sure, sustainable option for many farmers. Think about this, a single cow needs an acre to feed sustainably throughout the year. Yet, the same amount of land can feed six people.

Anticipated Growth for Livestock

According to FAO, demand for livestock products is anticipated to grow by 50 percent by 2050, driven by Africa and Southern Asia. FAO further states that livestock account for 34 percent of global food protein. Globally, over 600 million people earn their livelihoods from the livestock sector.

"Would you rather choose to keep one cow on an acre or grow crops to feed six people for one year on the same piece of land?" Samuel Nderitu, Director, Grow Biointensive Agriculture Center of Kenya (G-BIACK)

Pasture Management

Arid and semi-arid lands (ASAL) are characterised by prolonged dry periods, occasioned by erratic rainfall patterns. In these areas, livestock keeping is the backbone of food and economic security. Yet, the dry spells, coupled with minimal, unevenly distributed rainfall, is a major threat to livestock keeping.

Therefore, pasture security is important for the sustainability of livelihoods in ASAL areas. Neighbours Initiative Alliance (NIA), a member organisation of PELUM Kenya, works with pastoral communities on pasture management. They explore ways which pastoralists can ensure sustainability in feeding their livestock even during dry periods. They include:

Paddocking

Livestock keepers in ASAL areas often have large chunks of land. This means that naturally, fodder grows on the land and thrives during the rainy season. NIA thus trains the farmers to sub-divide the grazing land into portions (paddocks) and fence each. Animals are then let to graze in each paddock at a time, allowing the livestock keepers to have pasture even when the rains cease, thus being fodder secure.

Harvesting and Storing Natural Standing Hay

Another way of conserving fodder for animals in dry areas is baling the natural standing grass. This is done by harvesting the grass, baling it and storing for feeding animals when there is shortage of pasture during dry seasons.

Through NIA, pastoralists are provided with brush cutters which they use to harvest the grass, as well as balers for baling.

The grass thrives during the rainy season, offering pastoralists more pasture for their animals than is needed at that time. If not harvested, the fodder may end up going to waste yet it can be saved for utilisation during dry seasons.

The naturally grown grass is organic as no fertilisers or chemicals are added, thus, animals fed on it yield organic products.

Pasture being moved to storage after harvesting: Photo: NIA

Production of Farmed Fodder

To be fodder secure, pastoralists can grow grass during the rainy season, harvest, bale and store. To farm fodder, one buys seeds, prepares land and broadcasts them. The grass is then left to grow to maturity before harvesting.

Boma Rhodes is the most common fodder grass farmed in Asal areas. While some farmers grow fodder grasses for their own livestock, others, especially those who do not have many animals, grow for sale.

For good agro-ecological practices, farmers should not add any chemical fertilisers, artificial pesticides or herbicides on their fodder farms. Animals that are fed on chemical-free fodder end up producing milk or meat that is organic thus safe for consumption.

A proper hay store should:

- Be raised, to keep off destructive intruders such as rodents.
- Have good ventilation to aid in air circulation.
- Be well-roofed to keep off moisture, which is destructive to grass.

Fattened Steers

NIA encourages pastoralists to buy steers when they are still young and fatten them during the rainy season, when there is abundant pasture.

This way, the steers are energetic enough to withstand pasture shortage during the dry season.

The steers are also provided with water, and natural magadi (salt). The magadi provides minerals to livestock.

A trainer demonstrates to Melelo women group on how to use a brush cutter machine. Photo credit, NIA

"Milk processors always buy raw products from pastoralists because they know, even if production is low, the milk is organically produced and has high fat content," said Ann Nashipae, Programme Officer-Livelihood Development, NIA Kenya

Food Forest

Near the shores of Lake Elementaita in Nakuru County, there is a food forest, run by Charles Mwangi, who inherited the farm from his late grandmother. In her own wisdom, Mwangi's grandmother had perfected the art of growing different foods on the one-acre farm, with the aim of having something ready for harvest at any given time of the year.

On this farm, there is so much for everyone, from sweet potatoes, beans and vegetables such as black night shade to maize crops, sugarcane and custard oil plants.

There are also various varieties of oranges, mangoes and avocados. Mwangi also grows timber trees, which surround his farm on the side facing the lake.

Some orange trees have ready fruits, while others are young. Some avocado fruits are ready for harvest while others are still fruiting.

The farm has not only been of benefit to his generation, but also farmers from different areas across the country, who visit for learning purpose.

Establishing a Food Forest

To establish a food forest, farmers need to consider growing different crops, which have various uses like food, medicinal, spices and timber. Through a food forest, farmers are able to utilise space including vertically, for example, by growing climbers like passion fruits on the tall trees.

A food forest has seven levels, including a canopy which is characterised by fruits and nut trees, low tree layer that has dwarf fruit trees while shrub layer has currants, berries and other plants.

The herbaceous layer consists of crops like herbs, comfreys and beetroots. The rhizosphere consists of root crops while soil surface has ground crops live sweet potato vines while the vertical layer has climbers.

Growing Crops Under Food Forest System

You have to estimate how wide the big trees will grow by the time they mature and leave space between them, to fit well at full canopy. Usually, most trees need spacing of between 6 by 6 feet and 12 by 12 feet.

The main trees may include custard apple, jackfruits and some avocado species, among others.

You also need to plant nitrogen fixers such as sesbania and lucerne, which you must keep on pruning and spread the cut branches on the ground to fix nitrogen, which feeds the main canopy.

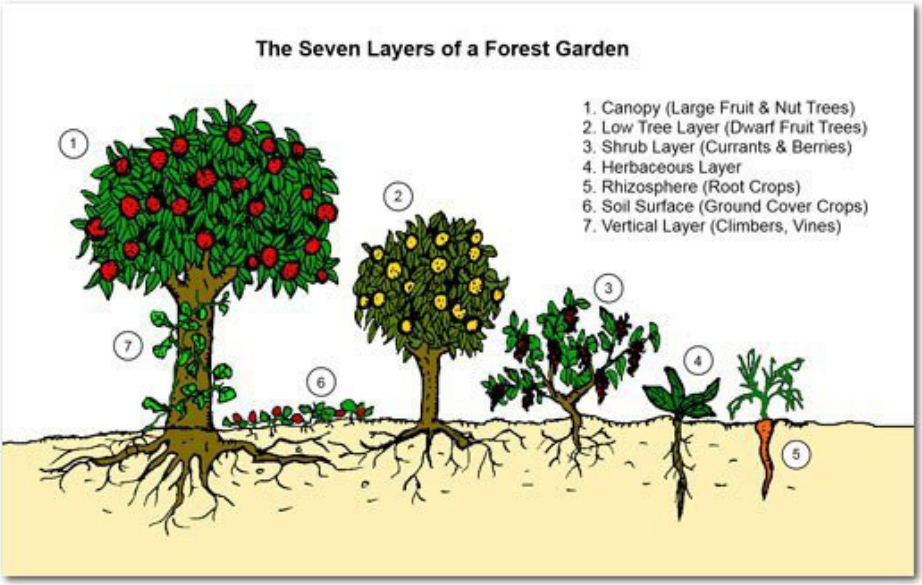
Short-term nitrogen fixers such as legumes are not only good for soil nutrition, but also mulching.

Dynamic accumulators such as comfrey plant, commonly known as mabaki, have a high root network, which goes deep and fetches minerals such as potassium and phosphorous, and bring to the surface.

Scent masker like rosemary, lavender and coriander green produce different scents, thus, confusing pests which follow a particular smell to attack a crop, while cover crops like sweet potato vines, cover the ground.

Rearing Livestock in Food Forests

Small animals like poultry, ducks, geese and rabbits can be kept, as they support the system by providing manure through their droppings, yet they are not very destructive.



Source: Permaculture Research Institute

Food Forests for Diversified Diets

By establishing food forests, farmers are able to get away from the mono-cropping culture and spread their risks as they diversify on production. This is a way for farmers to get to a much more resilient system that gets more fertile, as opposed to what is currently practised that is getting soil nutrition more depleted.

The food forest concept is not only a way to safeguard food and nutritional security, but also ensure diversity in terms of seed collection and enables farmers to save. This way, farmers will gradually cease from being dependent on the traditional maize and beans farming, but also embrace other crops such as fruits and herbs, which rarely find space on smallholder farms.

"The more varieties of crops farmers grow, the more there will be seed saved and thus, varieties of seeds, which farmers can exchange," says Peris Kamau, training officer, Seed Savers Network.

Agro-processing/ Value Addition

This involves changing form of raw agricultural produce into high-value products that have a longer shelf-life. Agro-processing can be done both at household level, whereby produce is processed for domestic consumption and even for sale, using simple household items; it can also be done for sale at industrial level.

Unfortunately, agro processing is not given the attention it deserves because of the culture enshrined by The Cotonou Agreement between Africa, Caribbean and Pacific Countries (ACP) and European countries. ACP countries were encouraged to sell everything but arms, tariff free on condition they were in raw form. Processing was discouraged through high and escalating tariffs and non-tariff barriers. Emphasis was and still is put on increasing production. These oversights are the main causes of poverty both at rural and national levels. Why? Increasing production without processing pushes farmers deeper into poverty, because when the supply goes up, demand and prices go down.

When farmers, or the country, sell agro products unprocessed, they do it at throw-away-prices and lose the opportunities of establishing industries, employment and wealth creation, only to import the same products at many times the selling price.

This has led to high levels of poverty, especially among small-scale farmers, who are the bulk of food producers.

Agroprocesing and value addition comes with many benefits to the agriculture value chain, from the farmer who produces the product to the consumer who uses it. If a farmer, for example, learns how to make his/her own yoghurt, there would be no need to buy from processors. After all, the farmer buys the same product he/she sold to the processors at more than thrice the selling price.

Benefits of Agro-Processing:

- Mitigates against post-harvest losses: Farmers are able to reduce perishability and increase shelf life.
- Economic Empowerment: Farmers are able to sell processed products at a much higher prices than if they sold them raw.

- Creates Employment: A bigger labour force is needed in value addition, therefore, more people, especially the youth, would get employed at agro-processing plants. After acquiring skills through training, youth can also become trainers of other people at a fee.

- Mitigates against post-harvest losses: Value addition increases shelf-life of produce. Farmers should learn how to process harvest especially when production is high, and sell the same when it is low.

- Increases Diversity: Agro-processing gives producers opportunities to reach out to a wide range of clientele with a variety of products, thereby opening market outlets. A person may not be interested in buying raw tomatoes, for example, but the same client may buy tomato source; processing also eases handling and transportation of produce.

- Creates Business: Opportunities arise to retail /sell products needed in processing, such as flavours and packaging materials, among others.

Failure to Embrace Agro-Processing has Consequences:

Farmers are forced to sell produce and sell at throw away prices to brokers and middle traders to avoid loss since most farm products are perishable.

Opportunities to create employment, especially for youth, are lost as there is no much activity between production and trading. The loss of these opportunities means loss of chances to improve livelihoods.

Additionally, failure to embrace agro-processing means that the country becomes over-dependent on imported products. Interestingly, some of the imported agricultural products are manufactured from exported raw materials. This means that instead of processing produce, and reaping the benefits of value addition, raw materials are exported at low cost, while end-products are imported at higher prices.

Resources Oriented Development Initiatives (RODI) Kenya, a member organisation of PELUM Kenya, trains farmers on agro-processing. Producers are equipped with the necessary skills to take their agri-ventures to new levels by doing value addition.

Additionally, the trainees are encouraged to share the knowledge

acquired with their friends, neighbours and fellow farmers.

They are also exposed to business opportunities in selling ingredients, equipment, packaging materials and other things needed in agro-processing.

The table below shows farm produce and what can be processed from them:

Primary produce	Sample end products
Irish potatoes	Chips, Crisps, bar soap, flour and starch.
Indigenous chicken eggs (one goes for Sh15)	Hatch and sell as one-day-old chicks for between Sh100-Sh120 each.
Cow/goat/camel milk	Yoghurt, fermented milk (maziwa mala), butter and ghee.
Tomatoes	Tomato sauce, jam, juice, puree, pickles and chutney.
Sunflower seeds	Cooking oil, soap oil and seed cake (for livestock).
Sweet potatoes	Juice and flour.
Arrowroots	Flour and crisps.
Bananas	Wine, jam, juice, crisps and flour.
Apiculture (Beekeeping)	Honey, beeswax, skincare products, pollen, royal jelly and propolis.
Fruits	Dried fruits, jam, juice, fruit powder and fruit salad.
Vegetables	Dried vegetables and vegetable salads.
Herbs and spices	Dried and crushed herbs and spices.
Cassava	Crisps and flour.
Sugarcane	Juice
Maize	Flour, animal feeds and corn oil.
Wheat	Flour, bread, cakes, cookies and biscuits.
Groundnuts	Roasted groundnuts, peanut butter, flour, oil and sauce.
Fish	Fillet, fish skin and fish bones/bone meal.

"Agriculture should be given the attention it deserves; and anything grown on the farm should not be sold unprocessed if the country has to pull itself out of poverty," Eliud Ngunjiri, executive director, RODI Kenya.

Food Safety

Food safety describes preparation, handling and storage of food in ways that keep the consumer safe. It is achieved by following protocols and precautions, right from production to consumption. Failure to follow food safety procedures at every stage puts consumers at risk of contracting diseases, and can even lead to death.

In the wake of the popularity of conventional agriculture, farming as a business is gaining momentum at the expense of food safety. However, there are still groups of people who are still keen on promoting food safety, by creating awareness and championing agro-ecology.

The rising cases of lifestyle diseases that include cancer, diabetes and hypertension, which have been linked to unsafe food, is a wakeup call for all to observe food safety at every level. After all, it is either one gets such diseases or is affected when a family member develops them.

Food Safety at Production Level

At this level, farmers must adhere to proper procedures right from soil preparation. They should avoid use of synthetic chemicals in their soil or crops. Organic manure offers a better alternative to improve soil fertility and integrated pest management (IPM) methods help to control pests and diseases. Synthetic chemicals have highly been associated with some types of cancers and are, therefore, a threat to food safety.

Indigenous ways of food production involve natural, safer methods of production. These methods may today look outdated but are definitely healthier and enhance food safety, while saving on cost of production.

Often, consumers have no information on how and where the food they buy is grown. This brings an opportunity for relevant authorities to emphasize on laws that enhance traceability.

Food Safety at Processing Level

At this stage, it is important to observe the necessary measures and ensure zero contamination. Workers must wear the requisite protective gear like hats to cover hair and aprons when processing food.

Additionally, food handlers should ensure they wash hands with clean

water and soap to avoid contamination. Vegetables and fruits should be washed thoroughly, preferably under running water, before cooking, consumption or any further processing like juicing. Use separate chopping boards for meat and vegetables.

Food Safety at Storage Level

Aflatoxin contamination in cereals has been a big hindrance in achieving food safety. However, farmers are advised to grow indigenous seeds which are more resistant to aflatoxin. Further, they should harvest cereals when they are well-dry, and dry them further before storing. Cereals like maize and groundnuts should be stored in moisture-free areas.

Farmers should avoid use of pesticides while storing food. Most chemicals if used for long are harmful to human health. Instead, they should use indigenous methods, like application of wood ash, as opposed to pesticides, as the traditional methods are more affordable, sustainable and cause no effects to human health.

In Summary, food safety comes with several benefits, such as;

- A healthy and productive population.
- Reduced cost on healthcare.
- It mitigates post-harvest losses.
- Improves cognitive intelligence.
- Environmental conservation.
- A safer planet.

Failure to Follow Food Safety Measures Results to:

- Lower life expectancy.
- Loss of manpower, meaning Africa may never catch up with developed world.
- Increased dependency, for example, relatives suffering from lifestyle diseases depend on those who are working.

"Indigenous ways of food production may not appear progressive, while conventional ways may look attractive and stylish. However, at the end of it all, the traditional methods of food production and handling are safer and more efficient," – Ferdinand Wafula, CEO Bio Gardening Innovations (BIOGI)

Organic markets

For over the years, organic agriculture has been done exclusively for subsistence while conventional agriculture is seen as a money-making venture. However, with increased awareness on the need to consume safer and healthy diets, organic produce is steadily gaining popularity. The increased uptake has also been occasioned by the rising cases of lifestyle diseases like cancer, which have been linked to use of synthetic chemicals on crops.

PELUM Kenya has been working with member organisations to promote organic agribusiness. Among the organisations working with PELUM Kenya is Community Sustainable Agriculture and Healthy Environment Program (CSHEP). CSHEP, in partnership with farmers, organises weekly organic farmers markets in Kiserian, Kikuyu and Garden Estate in Nairobi. Based in Kiserian, CSHEP promotes organic farming, trains farmers and links them to consumers.

A day at the organic market

About 8am on a Friday in Kiserian, Kajiado County, Stella Njoroge joins two of her employees in harvesting various types of vegetables from her farm.

They start with spinach, then cabbages and various capsicum varieties that include red, yellow and green ones.

They then harvest basil herbs, and like in the case of spinach, ties them in bundles. Their target is the weekly Kiserian Organic Farmers Market, which is held at Enkang restaurant, off Magadi Road,ever Friday.

A talk about lifestyle diseases

Stella established her Masapa Organic Farm after attending a meeting where doctors spoke about lifestyle diseases and need for good health.

“The discussion was about a 24-year-old who was suffering from leukaemia,” recalls Stella, adding, “The medics traced the disease to the patient’s mother, who worked at a flower farm when she was expectant. They associated the leukaemia with chemicals’ use on flower farms.”

For the next three years, Stella spent time researching on organic farming by visiting farms to get first-hand knowledge. In the meantime,

she started feeding her family with organic food, especially vegetables.

She later went to CSHEP for training, where she learnt different aspects of organic farming. Today, Stella is among key organic farmers who participate at the weekly Ngong Organic Market.

CSHEP founder and director Esther Kagai is not only a certified organic agriculture trainer, but also an enthusiast of agro-ecology practices and access to safe, healthy food for all. CSHEP has trained about 300 urban farmers within Kiserian and its environs.

Most farmers, especially those in urban areas, engage in organic food production for domestic consumption. However, some sell the surplus produce to neighbours or at the organic markets. This ensures access to safe, healthy food for more households, while curbing post-harvest wastage and enhancing better health. However, there are commercial organic farmers, who produce food in large-scale, for sale.

Every Saturday, organic farmers gather at the Innovative Organic Group of Farms (INOGOF) Farmers Market at Garden Estate, to sell their produce.

For those selling at the market, theirs is a story of friends, who initially had established kitchen gardens on their balconies, backyards and other small spaces, but realised that they were producing in excess.

The 90 members of INOGOF have been trained by CSHEP and majority of them are urban farmers.

Recently, the 'Kikuyu Organic Farmers Market' was established at Kikuyu, in Kiambu County, growing further the organic produce agribusiness.

All the markets are formed by the Farmers in collaboration with CSHEP.

Produce on sale at Kiserian Organic Farmers Market, at Enkang restaurant, off Magadi Road.

Africa should adopt organic farming

Africa should embrace organic farming to ensure countries have safe food and keep lifestyle diseases at bay. Organic farmers should work in unity so that they are able to jointly market their produce. This will ensure sustainability in supplies and better bargains for products.

Becoming an organic produce agri-preneur

Becoming an organic produce agri-preneur starts with training farmers on how to produce purely organic food. Farmers are trained on issues such as; Land Preparation, Crop Management, Pest and Diseases and Marketing and Certification.

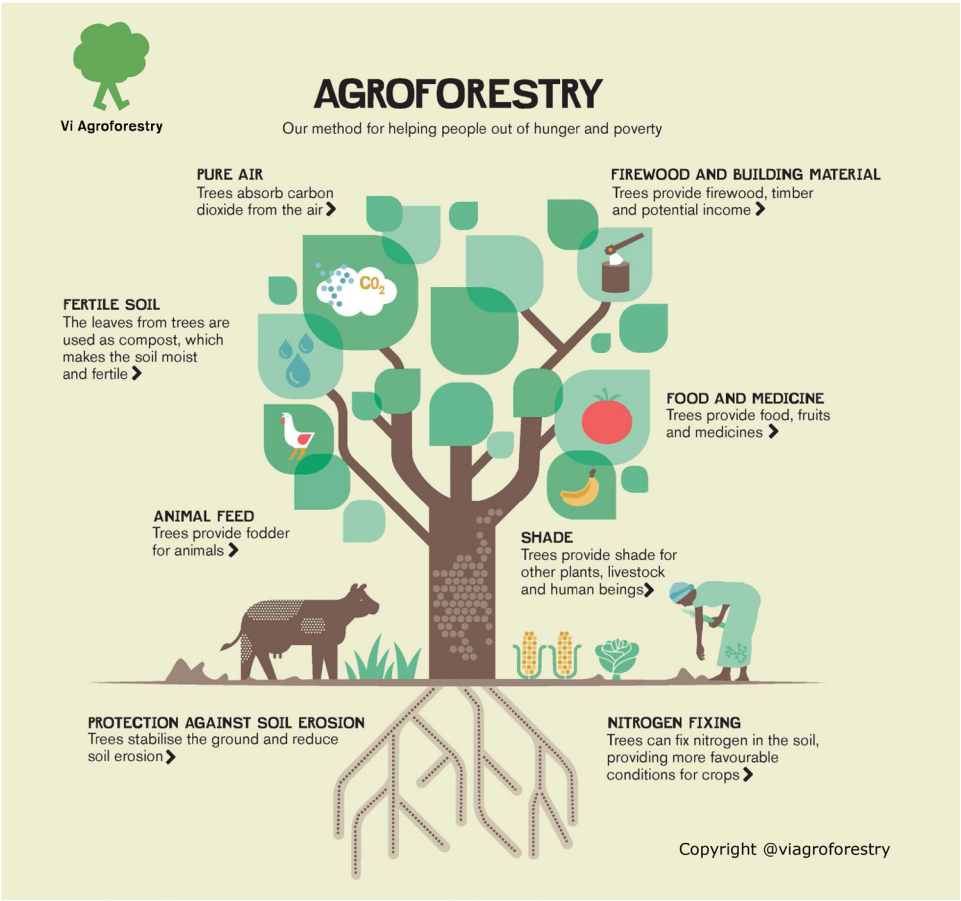
Once grown, crops are monitored using the peer review method, whereby, the farmers inspect each other. It is, however, recommended that those farmers who are well-known to each other, do not inspect one another's farms. Instead, inspecting farmers should be from a different group.

The farmers are then assessed for Participatory Guarantee System (PGS) by Kenya Organic Agriculture Network (KOAN). When the group is qualified by KOAN the Kilimohai Mark of Quality is given, and the farmers can start their market. The Kilimohai Mark of Quality is the only way to be certain that the food is organic due to the misuse of the name 'organic'.

"Organic farmers have the opportunity to grow healthy food for their families as well as for sale. This way, we will have healthier and wealthier farmers," – Esther Kagai , Founder/Director - CSHEP

Agroforestry

Agroforestry is the practice of deliberately growing trees along food crops and livestock, so that the three can benefit from each other. Small holder farmers often struggle with land utilization and food security. However, through adopting agroforestry, they are able to make maximum land utilization and enjoy the benefits that come with it. Although they may own small pieces of land, Kenya's small holder farmers too, have a role to play in achieving the country's target of 10 percent forest cover, and Agroforestry is a viable way of doing this.



Benefits of Agroforestry;

- Increases Biodiversity
- Improves Soil Humidity
- Improves Soil Fertility
- Enables Diversified Food Production
- Enhances Food Security
- Contributes to addressing gender equality
- Provides firewood for domestic use

How to Plant Trees in your Farm

Farmers are advised to plant Long term trees along farm boundaries, on crop land, on soil and water control structures, homesteads and on woodlots. These trees are classified into different categories such as for timber, fodder, ornamental, fruits, medicinal and for soil fertility improvement. Example of timber trees includes Grevillea Robusta, croton macrostachyus ,markhamia lutea etc. Fruit trees includes mangoes, avocadoes, oranges, guavas, lemon, pawpaw among others. . Basically, the choice of trees depends on the various agroecological zone and the intended purpose of the farmer.

An Agroforestry Farm. *Source: Elizabeth Mwiyeria, 2020*

Short term trees can be used to make partitions within the land. These trees subdivide various portions of the land enabling farmers to diversify their production as well as practice crop rotation Short term trees are can be used as fodder and are also ideal for firewood. This way, farmers will allow the long term trees to grow to maturity.

Trees Come with Various Benefits

Some of them, like sesbania, are nitrogen fixers, and they therefore help in enriching the soil.

Trees are also a source of fodder for livestock, enabling farmers to reduce the cost of buying feeds for their animals since they can get it from their farm, example of agroforestry tree shrubs promoted for fodder includes calliandra and gliricidia sepium.

Additionally, trees prevent soil erosion as they reduce the impact of rain to ground. Their deep roots also help in holding soil firm. They also prevent soil erosion by acting as wind breakers.

Trees are a source of compost material. Their leaves and branches fall on the land, decompose and make organic compost which helps farmers to reduce the use of inorganic fertilizers and protect their environment. The compost not only enhances the nutritive levels of the soil but also helps in conserving soil moisture.

Bees, birds and other pollinators are very important in crop farming. By having trees, these and other important insects are hosted, thus, enhancing pollination. Additionally, farmers can put up hives and practice apiculture as an additional value chain, for their families' health and wealth.Fruit trees enhance food and nutrition diversity by contributing to the families' food security and increased income.

Common Agroforestry Tree Species

LONG TERM TREES		
	TREE SPECIES	**MAJOR USES**
1.	*Acacia polyacantha*	Fodder,firewood and bee forage
2.	*Acacia xanthopholoea*	Fodder,firewood and bee forage
3.	*Acrocarpus fraxinifolia*	Poles ,wind breaker
4.	*Albizia gummifera*	Firewood,bee forage,nitrogen fixing.
5.	*Anona senegalensis*	Fruits

LONG TERM TREES		
	TREE SPECIES	**MAJOR USES**
6.	*Azaderachta indica*	Medicinal ,good charcoal and firewood
7.	*Carica papaya(pawpaw)*	Fruits
8.	*Cassimiroa edulis*	Fruits
9.	*Casuarina equisetifolia*	Timber, wind breaker
10.	*Cordia africana*	Timber, firewood, soil fertility improvement and bee forage
11.	*Croton macrostachyus*	Timber, firewood, soil fertility improvement and bee forage.
12.	*Croton megalocarpus*	Firewood, shade
13.	*Dombeya goetzenii*	Soil fertility improvement
14.	*Dovyalis caffra(kei apple)*	Fencing
15.	*Eryobotria japonica*	Timber
16.	*Grevillea robusta*	Timber, firewood, poles
17.	*Juniperus procera*	Timber and firewood
18.	*Maesopsis eminii*	Timber
19.	*Markhamia lutea*	Timber, poles and firewood
20.	*Moringa oleifera*	Firewood, medicinal
21.	*Olea africana*	Timber,
22.	*Olea capensis*	Timber
23.	*Passiflora edulis(passion fruit)*	Fruit, firewood
24.	*Persea americana(avocado)*	Fruit
25.	*Podocarpus falcatus*	Timber, firewood
26.	*Prunus africana*	Timber, medicinal
27.	*Psidium guajava(guavas)*	Fruit, firewood
28.	*Syzigium cuminii*	Good in water catchment areas, firewood
29.	*Vitex keniensis*	Timber ,soil fertility improvement
30.	*Warburgia ugandensis*	Medicinal and firewood
31.	*Zanthoxylum gilletii*	Timber

SHORT TERM TREES		
	TREE SPECIES	**MAJOR USES**
32.	*Calliandra callothyrsus*	Fodder and firewood
33.	*Cajanus cajan*	Soil fertility improvement
34.	*Leucaena leucocephala*	Fodder and firewood
35.	*Mucuna puriens*	Soil fertility improvement
36.	*Sesbania sesban*	Fodder,nitrogen fixing and firewood.
37.	*Gliricidia sepium*	Fodder, nitrogen fixing, firewood and bee forage.
38.	*Tephrosia spp*	Soil fertility improvement

Source: VI Agroforestry

"Small holder farmers are increasingly adopting agroforestry as they have witnessed it as a pathway to sustainable food production," Elizabeth Mwiyeria – Country Manager, Vi Agroforestry

About the Author

Rachel Kibui is a Kenyan-based journalist and communication consultant. She is especially passionate about writing on Agriculture, Food Security, Nutrition and Development matters.

Rachel has written other publications including 'Farm to Fork' for EU-United Nations Development organisation. She has also consulted for other organisations including USAID.

Aside from that, Rachel publishes with the Nation Media Group, East and Central Africa's leading newspaper. In 2017, Rachel was given an honorary award by USAID for Excellence in Agriculture Journalism.

Besides writing from Kenya, Rachel has written from other countries such as Switzerland, Morocco and Italy.

Published 2021

Special thanks to:

Participatory Ecological Land Use Management (PELUM) Association - PELUM Kenya,
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