

Dear Reader,

THIS MONTH'S EDITION comes packed with insightful articles on a variety of topics ranging from tips to a successful poultry venture; the dos and don'ts of agroforestry establishment and management; the use of ash in making biopesticides among many others.

Do you grow the indigenous vegetables in your farm but wonder whether they have any dietary benefits? This edition elaborates the nutrition value of some common African leafy vegetables, that are gradually gaining popularity in most families and restaurants.



Often, we underestimate the effects of kitchen smoke on human health, yet studies reveal that a high number of chronic respiratory diseases are bred from inhaling smoke while cooking. Read on to find out new technologies developed to combat this situation.

Simple ideas revolutionize the world. This edition tells a tantalizing story of a firm that is keeping communities in the Coastal region clean, while creating jobs for women and youth by recycling coconut shells to make organic fertilizer that has become a favorite for many farmers in the region. Read more about these and much more in this month's edition of TOF Magazine.



## BIOGAS

### Install biogas system to save on energy costs

**Biogas is a gas generated from waste materials such as livestock manure, kitchen waste, sewage, and slaughterhouse waste. These materials are placed in a biodigester, a machine that processes them to produce biogas**

By Susan Wanjiru

FARMERS ACROSS AFRICA form the backbone of the economy because they produce food. However, lately, the very people who provide food for the country are plagued by little or no produce due to the increased occurrences of drought, erratic or little rain-fall coupled with high cost of fuel, energy, and feeds. Most of these challenges are often as a result of climate change. To reduce fuel costs, farmers are switching from electricity to biogas.

#### What is biogas?

Biogas is a gas generated from waste materials such as livestock manure, kitchen waste, sewage, and slaughterhouse waste etc. These materials are placed in a biodigester, a machine that processes them to produce biogas. Inside the biodigester micro-organisms that break down organic materials, in the absence of oxygen, and generates gas. The gas produced is 60 percent methane, 40 percent carbon dioxide, with some hydrogen sulfide. The gas produced is a source of energy that can be used to cook, light, heat water, charge power electronics such as televisions, refrigerators, and even farm machinery.

#### Construction of a biogas unit

Engage a reputable expert to construct your biogas unit. Ensure they construct a good foundation. Materials used to make foundations include well-burnt clay bricks, high-quality pre-cast concrete blocks, and stone or cement plaster. Choosing the correct materials and design for your digester improves its efficiency, safety, and durability. A well-constructed

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### The case of the Melon fly

The Melon fly has been in Kenya for almost six decades and is known as a pest of crops such as watermelon, cucumbers, pumpkins, and butternuts among others **PAGE 7**

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biogas digester can provide energy for many years.

The shape of your biodigester should preferably be dome-like so that the biogas produced collects at the highest point, making it easier to channel it out. Dome shapes distribute stress more evenly and can withstand internal pressure better than structures with sharp angles or flat roofs. They also require less construction material due to their curved nature. A biogas digester comprises of:

- i **Inlet/Feeding System:** This is where the feedstock (organic material such as manure, food waste, or plant material) gets into the digester.
- ii **Digestion Chamber:** This is the main component where anaerobic digestion takes place. It's a sealed container or pit where bacteria break down the organic material.
- iii **Agitation/Mixing Mechanism (in some designs):** This helps in mixing the slurry (a mixture of water and organic material), enhances the digestion process and prevents the settling of solids and the formation of a crust on the surface.
- iv **Gas Collection System:** Produced biogas rises to the top of the digester. This system captures the gas and directs it to a storage or utilisation point. Often, this is a dome or a floating roof in the digester, which collects the gas.
- v **Outlet/Slurry Removal System:** After digestion, the remains are removed from the digester through this system. They can be further processed and used as a nutrient-rich fertiliser.
- vi **Gas Storage System:** Biogas can be stored in inflatable gas bags or gas-holders and used later.
- vii **Safety Systems:**
  - **Pressure Relief Valve:** To release excess pressure from the gas storage.
  - **Gas Scrubbing or Cleaning System:** To remove impurities like Hydrogen Sulphate, a colourless corrosive, harmful, and flammable gas.



**The design and complexity of a biogas digester can vary significantly based on its size, type of feedstock, and specific requirements. However, the main goal is to facilitate the efficient breakdown of organic matter to produce biogas in a controlled environment**

- **Flame Arresters:** To prevent the accidental ignition of the biogas inside the system.

- **Monitoring & Control Systems:** These are instruments to monitor temperature, pH, gas production rate, and other parameters. Help maintain optimal conditions for digestion and maximizing gas yield.

viii **Heating System:** Some digesters operate at higher temperatures to enhance microbial activity and increase gas yield. A heating system ensures the digester remains at the desired temperature.

ix **Insulation (if required):** This helps maintain a consistent internal temperature.

The design and complexity of a biogas digester can vary significantly based on its size, type of feedstock, and specific requirements. However, the main goal is to facilitate the efficient breakdown of organic matter to produce biogas in a controlled environment.

### What feedstock can you put in your biogas digester?

The feedstock chosen can enhance gas production. Common feedstocks that enhance biogas production include:

#### Manure:

i. **Cattle manure:** Is one of the most common feedstocks for biogas production, especially in rural settings.

ii. **Pig manure:** This has a higher biogas potential compared to cattle manure.

iii. **Poultry litter:** High nitrogen content but might need to be balanced with carbon-rich substrates.

#### Energy Crops:

i. **Corn Silage:** One of the most popular energy crops in some countries for biogas.

ii. **Sugar Beets:** Can be used as a co-substrate with other feedstocks.

iii. **Grass Silage:** Easily available and can be combined with other substrates.

iv. Agricultural residues such as wheat, rice, or barley straw can be used.

#### Crop Residues:

Stalks, husks, and shells from various crops.

#### Organic Waste:

i. **Food Waste:** Offers high biogas potential due to its composition.

ii. **Green Waste:** Grass clippings, leaves, and garden waste.

#### Industrial Waste:

i. **Brewery Waste:** Spent grains and wastewater.

ii. **Dairy Processing Waste:** Whey and other residues.

iii. **Slaughterhouse Waste:** Blood, fats, and other organic waste.

iv. **Sewage Sludge:** From wastewater treatment plants.



**60%**

Methane gas produced from biogas. 40 percent is carbon dioxide, with some hydrogen sulfide

**Fats, Oils, and Grease (FOG):** Often from restaurants or food processing units. These have high energy content, but should be mixed with other feedstock to prevent problems in the digester.

**Glycerol:** A byproduct from biodiesel production, glycerol can significantly enhance biogas yields.

#### Advantages of Biogas include:

- It is a renewable energy source produced from organic waste, unlike fuel from wood and charcoal.
- Utilising agricultural residues, manure, and organic wastes for biogas production aids in waste management.
- When organic waste decomposes in open air, it releases methane into the atmosphere. Capturing this methane in the form of biogas, prevents its release, thus mitigating greenhouse gas emissions.
- Economic Benefits: Biogas production can be a source of income for farmers and communities. It can also lead to job creation in the collection, digestion, and distribution processes.
- Biogas can provide energy for cooking, heating, and electricity generation. It can be further processed to produce fuel for your vehicle.
- It reduces incidences of women getting health complications from smoke inhalation when using fuels such as wood and charcoal.

#### Challenges:

- The initial investment can be expensive.
- One must use a professional to avoid getting a poorly constructed or designed unit that can result in gas pressure problems.
- Getting good quality organic waste can be difficult and can affect biogas production.
- Storing biogas requires appropriate infrastructure that can be expensive, and distributing it can also be complicated.
- Poor maintenance can lead to low production. Always get a qualified technician to teach you about maintenance.
- Acceptance problems- biogas is seen as dirty by some people due to cultural perceptions.
- Limited water supply will compromise production.
- Poor after-sales support can lead to farmers abandoning the initiative.

In conclusion, biogas use is on the rise. While challenges exist, its multiple advantages –

#### POULTRY SELECTION

## Selection criteria for day-old Chicks to start a poultry enterprise

When embarking on your poultry farming journey, take the time to delve into your supplier's practices to ensure your flock's well-being. Inquire about their management practices, feeding regimen, health history, and vaccination program. Well-vaccinated chicks are less likely to get sick

By Dr Ann M. Wachira

SELECTING HEALTHY DAY-OLD chicks is crucial for a thriving poultry farm. Begin by locating a reputable hatchery or supplier recognized for their high-quality chicks. Seek advice from local livestock professionals or poultry farmer associations. When inspecting the chicks, ensure they have bright eyes, clean beaks, and clean, fluffy feathers. Avoid chicks with swollen eyes or dirty beaks, as well as those with crooked limbs and infected or unhealed navels.

They should all be approximately the same size and actively moving about, pecking at objects, and chirping.

When embarking on your poultry farming journey, take the time to delve into your supplier's practices to ensure your flock's well-being. Inquire about their management practices, feeding regimen, health history, and vaccination program. Well-vaccinated chicks are less likely to get sick.

During transportation from the supplier to your farm, it's essential to keep the chicks in a clean, well-ventilated container with suitable bedding. This helps reduce stress during this critical period of adjustment. Upon arrival at



**During transportation from the supplier to your farm, it's essential to keep the chicks in a clean, well-ventilated container with suitable bedding**

your farm, consider quarantining the new chicks separately for a few weeks. This allows you to closely monitor their health and prevent potential disease spread to the rest of your flock. It's a precautionary measure that can save you from future headaches. If you encounter any issues, don't hesitate to consult a poultry health expert. Their guidance can be invaluable in ensuring the well-being of your flock. Remember that the health of your day-old chicks is the foundation of a successful poultry operation.

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For further inquiries on biogas systems call: Mr John Ochoki  
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**Pricing and source guide for day-old chicks**

In 2023, Kenya introduced pivotal livestock regulations that have significant implications for the poultry industry.

These regulations specifically state that any hatchery involved in the supply of day-old chicks must be licensed. This licensing process aims to ensure that hatcheries adhere to quality standards and maintain the health and welfare of the chicks they produce. It also provides a level of oversight and accountability within the poultry industry, benefiting both producers and consumers alike.

To make it convenient for farmers and poultry stakeholders, hatcheries in Kenya have established a network of agents in major towns. These agents serve as distribution points, making it easier for people to access and purchase day-old chicks without having to travel long distances to the hatchery itself. This decentralized approach helps promote the growth of the poultry sector by increasing accessibility to quality chicks. Make sure to buy all your chicks from authorized dealers.

Now, let's delve into the details of pricing. The cost of day-old chicks will vary depending on the breed. Layer chicks, mainly bred for egg production, are currently priced at an average of KES 120 per chick. Meanwhile, broiler chicks, which are raised for meat production, have a price range of KES 80 to 90 per chick. On the other hand, if you are in search of dual-purpose or slow-growing broiler chicks, you can expect them to be priced within the range of KES 90 to 120 per chick.

It's important to recognize that chick prices can fluctuate due to various factors including demand and season. High demand during peak times or specific seasons may lead to higher prices, while lower demand or off-season periods can result in more competitive pricing. Farmers should be aware of these fluctuations to make informed choices when purchasing chicks for their poultry operations.

Below is a compiled table, listing some major commercial hatcheries for day-old chick production:



Hatchery	Location County	Type of chicks
Kenchic Ltd	Kajiado-Agents in most major towns	Layers, broilers & Slow growing broilers
KALRO	Nakuru, Kakamega	Dual-purpose breeds
Isinya chicks	Kajiado- Agents in most major towns	Layers and broilers
Muguku poultry farm	Kajiado, Nairobi	Layers and broilers
Kenbrid	Nakuru-Agents in Mombasa, Nairobi, and Kisumu	Layers and broilers
Western seed	Trans Nzoia	Broilers and Dual-purpose breeds
Kukuchic	Uasin Gishu	Slow growing broilers
Yegen farm	Uasin Gishu	Slow growing broilers

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BIOPESTICIDES

## Make your own biopesticide at home using ash brew

**Ash brew is typically made using wood ash from burned organic materials like wood or plant residues. Wood ash contains alkaline compounds like calcium carbonate and potassium carbonate, which can have insect-repelling properties and can help protect plants from certain pests**

By **Mourice Barasa**

**MAKING ASH BREW** as a biopesticide involves creating a natural and environmentally friendly solution to control pests in your garden or on your crops. Ash brew is typically made using wood ash from burned organic materials like wood or plant residues. Wood ash contains alkaline compounds like calcium carbonate and potassium carbonate, which can have insect-repelling properties and can help protect plants from certain pests. Here's an essential process for making ash brew as a biopesticide:

**Ingredients**

**Wood ash:** Collect wood ash from a clean and safe source, such as from your fireplace or wood-burning stove. Avoid using ash from materials like treated wood, painted wood, or materials that may contain harmful chemicals. It is also critical to avoid use of ash collected from an incinerator since the ash may contain harmful components from plastics.

**Water:** You will need water to create a solution with the wood ash. Use clean water with less chemicals to prevent chemical reactions with ash components.

**Container:** A large bucket or container with a lid is suitable. The container is used for collecting the ash solution.

**Bar soap:** Bar soap is critical since it helps to bind the solution on the plant.

**Steps to Follow**

**Gather the materials:** Collect the wood ash and ensure it is free from any large debris or foreign materials.

**Prepare a container.** Choose a large container, such as a bucket or a barrel, to mix the ash brew. Make sure it is clean and has a lid to cover the mixture.

**Measure the ash:** The ratio of wood ash to water can vary, but a common ratio is 1 part ash to 10 parts water. Start by adding a measured amount of ash to the container before adding water. For example, if you have 1 cup of wood ash, add 10 cups of water. Starting with ash first helps to speed up the rate of mixing to reduce floating of ash on water.

**Mix thoroughly:** Add the water to the container with the wood ash, and stir the mixture thoroughly to create a consistent solution. Smooth ash particles will dissolve in water.

**Let it soak:** Allow the mixture to soak for a few days to a week. This gives time for the ash to release its compounds into the water. The duration also depends on the type of tree used (soft or hardwood).

**Grate the soap:** Keep the ratio of bar soap to ash 1:10. Grate the soap into small pieces and add it into the ash brew.



**Boiling:** Put the solution on heat and boil it for up to 30 minutes while stirring to enhance melting of the soap. Allow the mixture to cool for one to two hours.

**Strain the mixture:** After the ash has settled, carefully pour the liquid (the ash brew) into another container, leaving the settled ash behind. You can use a fine mesh strainer or cheesecloth to filter out any remaining ash particles.

**Application:** Transfer the filtered ash brew into a spray bottle or a garden sprayer for easy application. Be cautious not to get the settled ash into the spray bottle, as it can clog the nozzle. If the solution is so strong, it is advised to dilute it in water before its application. Dilute it in 5/100.

**Apply as a biopesticide:** Spray the ash brew directly onto the leaves, stems, and surrounding soil of the plants you want to protect. Focus on areas where you have noticed pest activity. The alkaline nature of the ash may deter certain pests.

**Repeat as needed:** You may need to reapply the ash brew after rain or as the effectiveness diminishes. Monitor your plants for any adverse reactions, as some sensitive plants may be negatively affected by the alkalinity of the solution.

#### Important Considerations

- Always wear appropriate protective gear, such as gloves and safety goggles, when handling wood ash or any other substances.
- Test a small area of your plants before widespread application to ensure they can tolerate the ash brew.
- Be cautious with the use of ash brew on acid-loving plants, as the alkalinity can interfere with their growth.
- Avoid using ash from materials like treated or painted wood, as it may contain harmful chemicals.

#### CAUTION

Always wear appropriate protective gear, such as gloves and safety goggles, when handling wood ash or any other substances.



#### TECHNOLOGY

## New Cooking Technologies That Aid Fuel Efficiency

By Dr Carolyn Anaye

MANY HOUSEHOLDS WITH low incomes in developing nations depend on traditional biomass fuels such as wood, dung and charcoal for cooking. These open fires, which burn poorly lead to the following:

- Annual deaths and respiratory diseases as a result of inhaling the smoke.
- Consumption of **500 million** tons of non-renewable wood every year.
- Energy is a contributor to climate change, accounting for around **60%** of total global greenhouse gas emissions. Global emissions of CO<sup>2</sup> have increased by more than **46%**.
- Low productivity, time and income-generation opportunities for women.
- **30-50%** of household incomes being spent on the purchase of cooking fuel.
- Safety and security concerns when people must walk long distances to gather fuel.
- Low fuel efficiency and high pollution emissions.

The demand for energy is also increasing due to a growing population and a developing economy. Efforts have been made globally by governments and non-governmental organizations to make the use of biofuels more sustainable, where strategies include:

- Forest conservation
- Planting of trees
- Promoting fuel-efficient stoves

The Kenyan government through the Sustainable Energy for All initiative in 2016, has an objective to provide universal access to clean energy by 2030, in line with Sustainable Development Goal (SDG) 7 which advocates for affordable and clean energy. Access to reliable and sustainable clean energy will simultaneously enhance the achievement of SDG 3 which is good health and well-being, eventually this will;

- Reduce deaths of children under five years of age as well as air pollution related deaths.
- Socio-economic development, on both a commercial and household level.
- Secure livelihoods and decrease in poverty.

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Kenya ratified the Paris Agreement on Climate Change and set itself the target to reduce total national greenhouse gas (GHG) emissions by 32% until 2030. Following a development pathway that is fully aligned with the Paris

Agreement implies that global emissions from the energy sector must reach net-zero by the mid of this century. Fuel-efficient stoves are designed to isolate heat.

They can be of different models but their main aim is to reduce the amount of biomass needed compared to when cooking over open

fire. In addition they have the potential for contributing to improvement in both the society and the environment. The overall objective of a clean and efficient cook stove is to improve combustion efficiency and transfer the heat to the cooking device more efficiently to reduce emissions.

**TYPES OF FUEL**

**1. Solid fuel cook stoves**

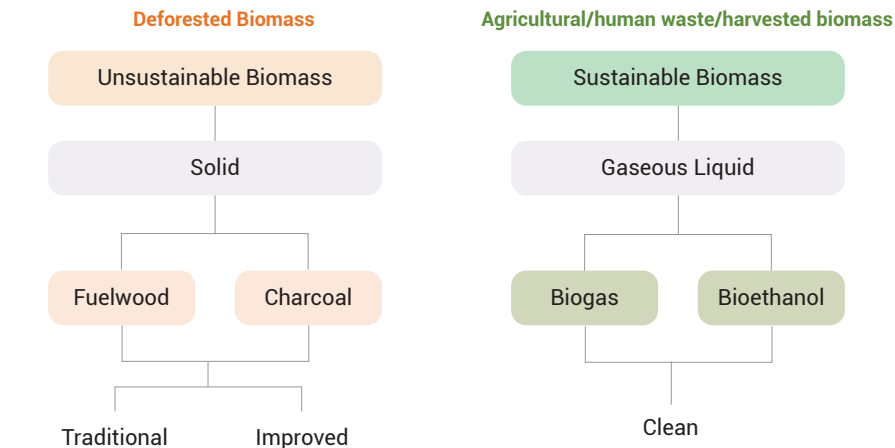
They are constructed by adding insulation and shielding around fire and pot, using a grate under the fire and ensuring a good draft through the fuel and pot. The aim is to reduce overall costs of cooking, reduce time in acquiring fuel and reduce household air pollution. These types correspond to an improved efficiency and rely on a fan to circulate air through the burning chamber as the air improves combustion. Locally sourced firewood and charcoal are commonly used fuels in many developing countries.



Photo: Awamu Biomass Energy

**4. Solar cook stoves**

They work on the main principle to capture and convert the energy from the sun to heat. Light from the sun is reflected from a mirrored surface and transferred to a cooking container where it is absorbed as heat. As solar cook stove is fuel and smoke free, it benefits the household economy as well as the users health. In addition, it also increases cooking time.



**2. Liquid fuel cook stoves**

They are designed around a small container where the liquid fuel is held and above which the fuel vapour burns. Alcohol cook stoves that are designed so that the vaporizing alcohol burns in controlled jets underneath the pot. The heat can be regulated by adjustments of open surface and alcohol



evaporation. These cook stoves burn without constant tending, allowing the cook to reduce the time spent on adjusting the fuel. Additionally alcohol fuel burns controllably, cleanly and completely, making it one of the cleanest and safest cook stove fuel options available. Ethanol and methanol produced from sugar, starch, agricultural wastes and cellulosic feedstock. The process comprises several steps such as grinding, fermentation, distillation etc. Alcohol fuels can be found in hydrous and anhydrous form and can be processed into gel or liquid form, depending on user preferences. A key benefit is that ethanol production is scalable and can be done by small communities or large commercial companies.

**3 Biogas fuel cook stoves**

They use the fuel produced by anaerobic digestion of organic matter. The gas is directly fed into the cook stoves from the digester. The biogas cook stove is constructed so that a pipeline from the biogas digesters is connected directly to the stove in the kitchen. When in use, the gas is lit and the temperature is easy to adjust on the stove, allowing users to cook efficiently and with a clean burning flame. Biogas is usually used directly from the container, where the mix of domestic waste like food scraps and agricultural waste is placed. Water and manure is added to the mix and starts a decay process that produces biogas. The biogas is separated and a gasholder system provides the cook stove with biogas. The decomposed organic matter can in turn be used as fertilizer. Biogas also improves sanitation and reduces time spent on collecting fuel and cooking.





## From Water Melons to Tomatoes: The case of the Melon fly

**The pest is widely known as *Bactrocera cucurbitae* but this name was recently revised to *Zeugodacus cucurbitae* to reflect current knowledge regarding its classification. The Melon fly has been in Kenya for almost six decades and is known as a pest of crops in the Cucurbitaceae family such as watermelon, cucumbers, pumpkins, and butternuts among others**

**By Dr Shepard Ndlela**

The Melon Fly is an invasive fruit fly species whose native home is Asia but is currently known to occur in several African countries including Kenya. The pest is widely known as *Bactrocera cucurbitae* but this name was recently revised to *Zeugodacus cucurbitae* to reflect current knowledge regarding its classification. The Melon fly has been in Kenya for almost six decades and is known as a pest of crops in the Cucurbitaceae family such as watermelon, cucumbers, pumpkins, and butternuts among others.

### **Damage in cucurbits**

The Melon fly causes massive damage, particularly in watermelons, where it pierces the melon and inserts its eggs just below the skin using its sharp ovipositor. This pierced point usually turns brownish and is visible. The eggs hatch into tiny maggots which begin to eat their way into the inner parts of the melon causing extensive damage. Affected melons start to rot and become unsuitable

for sale and for consumption. Pumpkins and butternuts are damaged in the same way. If such melons are left on the farm, the maggots continue to develop and then exit to pupate in the soil. They form a brown-cased structure called a puparium in which the pupa is enclosed for protection. The pupa later breaks out of the shell as an adult fly which flies away to look for partners to mate with and the cycle of laying eggs begins again. The whole cycle can be completed within 14 to 28 days depending on temperature and other factors conducive for development.

### **Sudden liking of tomatoes**

Though it has always been known that the Melon fly can attack tomatoes and be able to complete its life cycle, the level of damage has never been alarming. Recently, farmers have been reporting increased damage on tomatoes which necessitated icipe to investigate. Infested tomatoes were collected from farms and it was confirmed that the Melon fly had developed a liking for tomatoes. The mode of damage is similar to melons and pumpkins. The points of egg insertion turn brown making the tomato unsightly. The maggots eat the inside flesh of the tomato giving it a watery appearance. The sudden

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liking of tomatoes by the melon fly is a common occurrence with invasive pests. Most of the invasive insect pests attack a wide variety of plants which gives them an advantage with respect to survival.

The melon fly is different from the fruit fly attacking mangoes. Farmers may be tempted to use traps and lures they are already using to control the Oriental fruit fly *Bactrocera dorsalis* in mangoes. This will not work as the two are different. They respond to different attractants. Their maggots look similar but the adults are different. The wing markings are quite distinct to those who look keenly.

#### Double trouble: Melon fly and *Tuta absoluta*

Tomatoes farmers now face double tragedy from two devastating invasive insect pests. *Tuta absoluta* has been the main pest of tomatoes but with the emergence of the melon fly, losses have already risen. Currently, the losses are high as most farmers still think they are fighting the usual enemy: *Tuta absoluta*. There is a need to upgrade and enhance the fighting arsenal so that both pests can be managed effectively.

#### Management of the Melon fly

Farmers are already used to using broad-spectrum insecticides to control insect pests. For *Tuta absoluta*, *icipe* has been advocating for the use of ecologically friendly management tactics which are non-damaging to the environment, the health of the users/farmers, and the health of consumers. Biovision Foundation has been funding the promotion and upscaling of an integrated pest management package for *Tuta absoluta* comprising the use of traps and attractants, biopesticides, sanitation, visual color sticky traps, and the use of natural enemies. A similar approach will also work for the Melon fly. The use of traps attractants, and sanitation remain among the best options to manage the fly. When placed early, traps and lures can eliminate all male fruit flies before mating with the females occurs. For *Tuta*, we encourage the deployment of traps and attractants before transplanting so that moths are removed from the system before the young plants are transplanted. In the same manner, traps for the Melon fly must be deployed before the formation of the baby melons. All melons showing signs of harbouring maggots must be picked and destroyed by burying them. Watermelons must not be grown on the same piece of land where tomatoes were grown in the previous season. Rotation must be done with a crop other than in the Cucurbitaceae (watermelon, cucumbers, pumpkins, and butternuts) or Solanaceae (potatoes, eggplant, chilies, and tomatoes) families. Once harvesting is complete, the farmer must plough down all remaining crop residues. This kills all surviving stages of *tuta* and the melon fly and also adds compost to the soil. *icipe*, is already capacitating farmers on how to manage the Melon fly. Consistent use of ecologically friendly management options holds the future of human and environmental health.

Dr. Shepard Ndlela is the Project Manager, of the *icipe* led and Biovision Foundation Funded project "Integrated Sustainable Production of Tomatoes (ISPOT) in Kenya". He can be reached on +254719052274 or email [sndlela@icipe.org](mailto:sndlela@icipe.org)

#### SYLVIA'S DIARY

## Shifting Focus to African Green Leafy Vegetables

By Sylvia Kuria

I REMEMBER GROWING up in a family where my parents cherished indigenous foods. My parents lived upcountry all their lives and only came to the city after Kenya gained independence. As a young child I remember my mother always sharing with us fond memories of how she grew up enjoying our indigenous foods from Western Kenya especially the African indigenous leafy greens. Due to my ignorance as a child, I used to think we were not privileged because our daily meals consisted of ugali, indigenous leafy greens and fermented milk. Our neighbors and friends in the city had lots of white rice, cabbages bread and margarine to their fill.

I am now a full-grown adult and I have learnt my lessons all too well that our local indigenous foods are extremely nutritious, adaptable to our environment and our heritage that we need to preserve. Early this year I went to our local seed shop to look for seeds for indigenous leafy greens. At our outlet Sylvia's Basket, Africa Leafy Greens (ALV's) are the top selling items. We always ensure that we stock ALV's so as to satisfy the customer demand.

It has been very interesting to observe that if we do not have ALVs at our retail shop, we struggle to sell other items. Farmers should realize that there is a huge demand for ALVS and the prices are stable all year round. Buying prices range between 30-60 KES per kg.



**During transportation from the supplier to your farm, it's essential to keep the chicks in a clean, well-ventilated container with suitable bedding**

Kenya has suffered a devastating drought for the past two years and this has affected crop production at all levels including the production of seeds for ALV's. Most of the local seed shops I visited in January this year did not have any seeds stocked.

I was quite disheartened to learn that seed companies have really struggled to multiply seeds and local farmers like myself lost most of our seeds during the drought. Ironically, hybrid seeds of exotic vegetables are readily available and it's obvious that we have not put in efforts to ensure that we preserve our local seeds.

I eventually decided to reach out to research institutions and ended up at Jomo Kenyatta University of Agriculture and Technology. Professor Mary Oyiela Abukutsa-Onyango is a humanitarian and agricultural scientist from Kenya who specializes in olericulture, agronomy, plant physiology. She is a professor of Horticulture whose work focuses on African indigenous food crops. Through





her research she has established a seed bank for ALV's that are sold affordably to the general public to make sure that these seeds are always readily available as well as to encourage farmers to multiply them.

ALV's are extremely nutritious and according to a report by Research gate 2020, on African Green Leafy Vegetables Health Benefits Beyond Nutrition, African green leafy vegetables (ALVs) are rich sources of nutrients and health-promoting bioactive metabolites that possess

antioxidant, anti-inflammatory and anticancer properties that will assist in reducing the development of noncommunicable diseases. Irrespective of their reported health-promoting properties, ALVs face challenges of their use in food systems particularly the mainstream markets/urban consumers due to poor insights and lack of knowledge on their health benefits.

The chart below details the nutritional value of common ALV's in East Africa.

### Jute Mallow Mrenda/ Mrere

Contains Vitamin A which helps in improving eye sight. They also contain Vitamin B6 and folate which prevents loss of vision and eye disorders. The fiber contained in Mrenda helps with digestion. Mrenda can also help in regulating menses especially if they are irregular.



### Spider plant Tsaga

It contains essential amino acids such as valine, histidine, threonine, leucine, isoleucine, lysine, methionine, phenylalanine and tryptophan. Spider plant is a rich source of minerals such as phosphorus, potassium, sulfur, calcium, magnesium, iron, manganese, copper and zinc



### Amaranth Terere

Amaranth is a great source of protein, fiber, manganese, magnesium, phosphorus and iron. It helps keep your digestive system regulated, build your strength, and reduce the risk of fracture or broken bones.



### Slender Leaf Mitoo

Mitoo is a slender leaf vegetable that provides your body with dietary nutrients such as beta-carotene, vitamin A, Iron, calcium, phosphorus, potassium, and zinc. Their health benefits include immunity boost, blood pressure control, nourished skin, improved eyesight, and strong bones.



### Malabar Spinach Nderema

Nderema used to play a crucial role in the food systems of some rural Kenyan communities. Its leaves are rich in iron and vitamin A, thus making it a food with invigorating and restorative properties. For these reasons, it was traditionally part of the diet of children and pregnant women.

### Black Night Shade Managu

The main nutrients contained in Managu include folic acid, which is very useful during pregnancy, vitamins A, B and E, beta-carotene and vitamin C, which boosts immunity and helps heal cuts and wounds, as well as iron absorption.



### Pumpkin leaves Kahurua

It contains essential amino acids such as valine, histidine, threonine, leucine, isoleucine, lysine, methionine, phenylalanine and tryptophan. Spider plant is a rich source of minerals such as phosphorus, potassium, sulfur, calcium, magnesium, iron, manganese, copper and zinc



### Ethiopian Kale Kanzira

This wild vegetable is laden with numerous nutrients such as magnesium, potassium, dietary fibre, beta-carotene, calcium, zinc, iron, phosphorus, copper, manganese, and riboflavin.



### Cow pea leaves Kunde

Vitamin A and C and polyphenols in cow-peas have antioxidant properties, which reduce inflammation and the risk of chronic diseases, such as cardiovascular diseases, diabetes, and certain cancers. They also encourage collagen synthesis, which improves skin repair, reduces age-related signs, and enhances the glow.



## ARBORICULTURE

# Key Tips in Establishment and management of Tree Nurseries

By **Bramwel Soita**

A tree nursery is an area/ place where young trees (seedlings) are given special care.

- i) **Temporary or flying nursery:** can be used for a season or two, a year or two.
- ii) **Permanent nursery:** Is meant to serve for a long period of time. In this case seedlings are raised from year to year.

### Factors to consider when deciding on the type of nursery

The number of plants, required period the demand is likely to last and availability of transport/market.

When selecting a nursery site, consider the size, location, availability of water, skilled labor force and market for the seedlings.

On flat land with good drainage, the area should be shaded and protected, close to source of permanent water supply, good and easy access, and good supply of suitable soil materials.

The number of seedlings produced in the nursery, is determined by;

- **Own needs:** Consider the size and use of your land.
- **Commercial use:** Know the demand for seedlings and which species are required by your neighboring villages.

The size of the nursery will depend on the 2 factors above and the number of seedlings needed in the field.

The number of seedlings needed in a particular farm area, depends on size and farming system considering plant spacing.

### Nursery establishment

**Preparation of sowing beds:** Seedbed can be used to test viability before filling too many containers and wasting resources.

**Direct sowing:** Is when sizeable (large sized seeds) are directly sown into containers or to the field.

Depending on the conditions in your nursery, including the tree species (size of the seed), number of plants to be produced and labor availability, a combination of direct sowing and use of seedbeds may be your best way of operating. Most nurseries use seedbeds to germinate seeds.

### Materials needed for nursery establishment

In all these, nursery operators are encouraged to use locally available material where feasible e.g., Jerry cans, hoes, basins, winnowers, pangas, tins and banana fibers, poles, timber, grass, mats, and nails.



### Nursery lay out

To obtain the maximum effect of the shade, beds should be orientated to run East- West to avoid direct sunshine. During March to September when the sun is in the northern hemisphere the shade should slope towards the north and the rest of the year when it is in the southern hemisphere, it should slope towards the south.

### Prepare the mixed media

- To assist the growth of seedlings and support a healthy root system with enough oxygen, nutrients and water.
- The proper mixed media required is: - forest soil, topsoil from garden, rice husk and compost manure.

### Nursery Management

There are several recommended operations and activities while carrying out proper management of a tree nursery.

**Watering:** The regular supply of clean water is essential to plant growth. Plants are made of more than 90% water. The amount of water that seedlings require depends upon; Seedling age, amount of sunlight, soil type and turbulence (presence of wind).



**Regular supply of clean water is essential to plant growth. The amount of water that seedlings require depends upon; Seedling age, amount of sunlight, soil type and wind presence**





**Pot filling:** This is the filling of polythene tubes with soil. This should be done under a shade near the heap of the soil at the site of the transplant bed. The soil should be moist enough to run freely into the tube and easily firmed to form the bottom of the tube.

**Pricking out:** This is the act of lifting seedlings from the seedbed into the transplant bed or pots and is done when the seedlings have two leaves fully open and if delayed, the rooting structure will be affected. Here we use a piece of wooden stick to remove the seedlings and place the seedlings on wet containers or materials.

After pricking out, transplants require full shade for the first 2 – 3 weeks, then ½ shade for 1 week, after which no shade should be necessary. As the shade is decreased, the intensity of watering must be increased.

**Weeding:** This is the operation of removing weeds to reduce competition for water and nutrients.

**Root pruning:** Is the cutting back of the actively growing roots of the transplants. Root pruning is carried out so as: to avoid the roots of the seedlings inter – twining, to enable the transplants to develop a well-established root system fit for easy establishment in the field and for the transplants not to penetrate the soil and get established within the nursery site.

**Hardening off:** This is the process of creating hard conditions to the seedlings towards the planting season. Reduce the amount of water 4 weeks before seedlings are planted out.

#### Nursery hygiene practices

Good hygiene of the nursery site leads to healthy and quality seedlings produced in the nursery.

#### Nursery records

To have an effective nursery management, you have to keep an up-to-date nursery record.

#### Tree improvement practices (grafting, budding)

Grafting is a form of vegetative propagation, which involves the union of two separate structures, usually woody parts of two plants. The upper part is the scion, and the lower part or root is called stock or rootstock, and both must belong to the same plant species. All methods of joining plants are called grafting, but when the scion part has only a single bud, the operation is called budding.

#### Why grafting and budding?

The fruit quality in the grafted tree will be exactly like that from which the scion was collected, trees that produce seedless fruits can be propagated by this method, grafted trees start producing fruits much earlier than those grown from seed, good quality fruit trees whose root system are usually damaged by soil pests and diseases or unsuitable to some soils can be grafted on a resistant rootstock and makes it possible to change tree product variety.

When choosing the scion consider quality of the fruits, productivity, early or late maturity, resistant to pests and diseases of the aerial parts, and shape of the tree canopy. The stock plant determines the vigor of the plant, development of the root system and resistance to pests and diseases of the stem and roots.



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Location	Frequency
Webuye	95.9
Garissa	88.7

Location	Frequency
Taita	107.4
Narok	102.3
Nyeri	105.7
Machakos	93.8
Makueni	
Kitui	
Meru	105.1
Marsabit	88.3

Location	Frequency
Nakuru	104.5
Gilgil	
Kisii	91.3
Kisumu	105.3
Mombasa	105.1
Kericho	90.5
Eldoret	91.1

Tuko Mbele Pamoja!

## RECYCLING

# Recycling of coconut shells in the coastal region

## Coconut Shells Transformed into Organic Fertilizers, Create Jobs for Women and Youths in Coastal Region

By Vincent Kipyegon

Coconut is one of the popular fruit among tourists visiting the coastal region of Kenya. Both the milk and the flesh of the coconut are edible. However, after being consumed, the coconut shell, which generally takes up to a year to decompose, is discarded along the roadsides, streets, and coastal beaches, causing an unattractive scene for the environment.

Africa Activated Carbon is a Mombasa based company on a mission to recycle the coconut shells and create organic materials. The company buys the shells from local communities at ksh10 per kilogram therefore helping low-income households put a meal on the table.

The company has collaborated largely with women, local farmers, youths, and former drug users in the region to earn extra income by collecting waste coconut shells from the coastline townships, beaches, and their villages, according to Sally Omollo, the company manager. "We provide an incentive to the communities as a motivation to collect shells from their neighbourhoods, the incentive they earn can help them cushion tough economic times, says Ms. Omollo.

The processing firm converts the coconut shells into activated carbon for gold extraction, coco peat for organic fertilisers, and fibre from coconut husks for creating local fibre products. The coconut shells are also used to produce beauty and pharma-



ceutical products. Coco peat is a an organic fertilizer rich in phosphorus essential for growth and development of plant's roots. In addition, seedling propagators use coco peat as a substitute to soil due to its high organic content and lower susceptibility to pests and diseases. Coconut husk fibre is used to make ropes, doormats, baskets, and animal feeds. Crops are mulched with dry coconut husks to stop moisture loss.

The coconut variety grown in the coastal region take long time to mature. In order to ensure continuous availability of coconuts, the company is introducing short term hybrid "pemba dwarf" coconut seeds variety to farmers. It intends to align itself in promoting coconut farming, enhancing green economy through reduction of carbon emission in processing the shells, empowering vulnerable communities in the coastal region by providing income for coconut shells

gathering while ensuring the environment is conserved. [vince.kipyegon11@gmail.com](mailto:vince.kipyegon11@gmail.com)

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