Biovision Africa Trust

THE ORGANIC FARMER

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Dear Reader,

HERE COMES THE last edition of this year. As we close the year, TOF Magazine appreciates your collaboration in reading and sharing the rich and diverse information featured in our publications. We look forward to continued support in improving livelihoods through learning new ideas and technologies.

The rains continue to pour uncertainly and farmers across the country are optimistic that the crops in the farms will not be adversely affected. Ensure to employ the water harvesting technologies featured in previous editions to conserve water for use during dry seasons.

This edition captures information on new technologies that will be valuable for you to try out within your household and in the farm. Discover a new way of growing vegetables that is not only space saving but also aesthetic.

Have you been keeping chickens without clear knowledge on how to go about housing, feeding and protecting them from diseases? An animal scientist, from KALRO Kakamega shares detailed information on proper poultry management.

Soil fertility is a concern of every farmer as without it, there is very little, or no reward for the resources and hard work put in planting crops. This edition has a compilation of three articles focusing on soil health; approaches that you can practice to enrich your soil, without incurring extra costs.

We also sample a few new technologies such as constructing a charcoal cooler to keep your farm produce fresh for longer; various methods of hay balling to preserve fodder for your livestock and a simple guide on black soldier fly rearing. These and much more in this month's edition of TOF Magazine.

SUSTAINABLE FARMING

Don quits employment to transform deserted piece of land through organic farming

In her quest for knowledge, she learnt about the TOF radio programs aired on Mbaitu FM. In one of the programs, Ruth Mutisya, a field officer working with Biovision Africa Trust in Machakos County, was on air sharing on organic farming

By Samuel Monene

KNOWLEDGE IS A powerful tool of transformation. This saying is demonstrated by Redempta Maithya's story who driven by the interest to change her idle piece of land from a dormant state to high yielding source of food quit employment as a lecturer to farm.

"I bought this land in the year 2000, in a very degraded state. The former owners did monocropping, year in year out and applied synthetic fertilizers every planting season for it to produce. By the time I was owning it, the soil was dead," she says. As years went by, Redempta who had been a lecturer at South Eastern Kenya University for several years, suddenly felt a desire to quit the town life and go to cultivate the piece of land she had acquired five years ago. And when she did, she was thirsty for knowledge on how to bring the dead soil back to life.

In her quest for knowledge, she learnt about the TOF radio programs aired on Mbaitu FM . In one of the programs, Ruth Mutisya, a field officer working with Biovision Africa Trust in Machakos County, was on air sharing knowledge on organic farming. From there, Redempta knew that she had found a solution for her two acre piece of land. Having noted down madam Ruth's contacts as the show was coming to an end, she made sure to find her for on farm training and guidance on how to practice ecological organic agriculture.

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Growing on a hanging kitchen garden

A hanging garden is a vertical structure that hangs from a wall, roof, boxes, terraces, or stands alone. It can be used as a garden to grow food as well as an aesthetic scenery PAGE 8

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Through Ruth's guidance, Redempta embraced sustainable farming practices including the use of water harvesting techniques such as Zai pits for efficient water usage, crop rotation, and innovative planting methods such as vertical bag farming and minimum tillage.

She started rearing chickens, rabbits, and sheep which provide a constant source of manure to enrich the soil. "I learnt so much about on farm resources that are useful not just as fertilizers but also as biopesticides," she says referring to the use of rabbit urine.

The fruits of Redempta's labor became evident after her first planting season. She harvested 5 bags of maize each weighing 90 kilograms from soil once depleted and lifeless, but now teeming with nutrients and vitality.

Her farm is a testament to her unwavering dedication and the transformative power of organic practices. One practice in particular that made her harvests bountiful was the use of a farming method known as the three sisters approach that leverages crop diversification.

The three-sister planting method engages a symbiotic relationship among maize, pumpkins, and beans. This collaboration reaps mutual rewards whereby maize lends support to fragile bean stems, while beans contribute nitrogen fixation to both maize and pumpkins.

The role of the pumpkin is diverse as it serves as a cover crop, reducing impacts of erosion and limiting water evaporation, functioning as a natural mulch, and effectively curbing weed growth.

With a visionary eye on the future, she plans to conduct soil testing to assess nutrient levels, paving the way for informed and sustainable improvements. These are the major techniques employed by Redempta to revive the soil and nurture it from a degraded state to a high-yielding potential:

- **Afforestation and reforestation:** Planting native trees and shrubs combats erosion, boosts biodiversity, and rejuvenates soil health. Around Redempta's farm, are trees suitable to the area which act as a buffer from strong winds among other benefits such as the provision of partial shading especially in extremely hot weather. Within the farm are various fruit trees.
- **Cover cropping:** Sowing legumes and grasses as cover crops prevents erosion, enhances soil structure, and enriches nitrogen levels.
- **Mulching:** Applying organic materials like straw, leaves, or wood chips preserves moisture, regulates soil temperature, and shields against erosion. After pruning trees in the farm, she uses the leaves as mulch which she also leaves to decompose as manure ploughing the nutrients back into the soil.

The fruits of Redempta's labor became evident after her first planting season. She harvested 5 bags of maize each weighing 90 kilograms from soil once depleted and lifeless, but now teeming with nutrients and vitality. Her farm is a testament to her unwavering dedication and the transformative power of organic practices

- **Composting:** Introducing compost enhances soil structure, nutrient content, and microbial activity in degraded soil. As earlier noted, Redempta practices mixed farming as she is rearing goats, chickens, rabbits and cows. From the livestock, she obtains manure and from the rabbits she gets the rabbit urine, which is not only a biofertilizer but also, as biopesticide applied in pest management.
- **No-till farming:** Minimizing soil disturbance through no-till practices conserves soil structure and mitigates erosion. With the cover crops and consistent mulch, weeds are not a problem, and this makes it possible for Redempta to practice no-till farming.
- **Intercropping:** From experience, she attests that diversity in the farm is a beneficial approach as it gives her different types of produce including cherry tomatoes, pumpkins, sweet potatoes, pigeon peas, cassava, maize, beans, cowpeas and fruits. Each of these crops have various benefits to the soil, as cover crops, nitrogen fixers, residue generators, etc. Redempta urges farmers to avoid monocropping as it not only denies them the benefit of a variety of food for consumption but also leaves the soil poorer.
- **Residue retention:** Residue retention is a major technique in her farm. After harvesting, she leaves the crop residue such as maize stalks to decompose in the soil further enriching it.
- **Water management:** Creating check dams, swales, and contour trenches captures rainwater, minimizing erosion and replenishing groundwater. Redempta's farm lies below the Mua hills of Machakos County, necessitating careful planning to capture run off water and settle it safely within the farm. She has dug swales all around the farm for this purpose. "Long after rains have gone, the soil beneath still holds moisture enabling the crops to stay resilient even in dry conditions," she says.

Conclusion

The journey to this farm's transformation began with a curious farmer who above all things, wanted to turn around the productivity of her barren land. With the single opportunity to hear from an expert through The Organic Farmer Radio, she found the knowledge required for this transformation; and the results exceeded her expectations.

Redempta's story is testimony that the knowledge farmers need to reap satisfactorily from their pieces of land without capital-intensive applications is available.

Biovision Africa Trust through its Farmer Communication Programme is quenching this undeniable thirst for this knowledge, and the fruits of this mission are palpable in the lives of farmers such as Redempta.

POULTRY CARE

All about housing, feeding and disease management in chicks

Providing suitable housing for your chicks is a crucial step in ensuring their survival and well-being. A well-designed chick shelter safeguards them from various threats, including adverse weather conditions such as rain, sun, cold winds, and chilly night-time temperatures

By Dr Ann M. Wachira

Choosing proper chick housing

PROVIDING SUITABLE HOUSING for your chicks is a crucial step in ensuring their survival and well-being. A well-designed chick shelter safeguards them from various threats, including adverse weather conditions such as rain, sun, cold winds, and chilly night-time temperatures. Moreover, it provides a comfortable environment conducive to their growth. The choice of chicken housing depends on factors like available materials, local weather patterns, and traditional practices.

When making your selection, it's essential to consider cost, durability, and the intended purpose of the housing. A straightforward option for housing chicks is the basket system, sized according to the chicks' age and number.

> **A straightforward option for housing chicks is the basket system, sized according to the chicks' age and number**

Another option is the hay box brooder, which is easy to make and does not need additional heating. Both the chicken basket and hay box brooder are regarded as environmentally friendly choices. The location of the housing is equally as important, with preference given to dry, flat ground or the possibility of elevating the house to avoid moisture build-up. Additionally, the site should be secured against potential threats from predators and thieves.

Preparation for chick placement

Getting ready for the arrival of your chicks is a critical step in ensuring tsurvival and well-being. Here's a step-by-step guide for preparing for chick placement:

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- Start by cleaning and disinfecting all equipment at least two days before use.
- Organize all necessary equipment and arrange the chick litter in advance to minimize stress for both you and the chicks.
- Set up the brooder ring prior to disinfection. Fill the ring with suitable litter material such as wood shavings (not sawdust) or straw, up to 4-6 inches thick from the floor. The heat source should be placed at the centre of the brooder ring. Expand the brooder ring regularly to create space for the growing chicks.
- Fix curtains on the open sections of the house to insulate from cold winds.
- Two days before the chicks' arrival, thoroughly disinfect the entire area. This proactive measure helps create a clean and sanitary environment, reducing the risk of disease transmission.
- At the entrance to the chick area, provide a foot bath containing lime powder or another suitable disinfectant. This will prevent potential contaminants from entering the chick's living space.

Chick Brooding

Newly hatched chicks lack the ability to effectively regulate their body temperature and require either natural or artificial brooding to provide warmth.

How you handle day-old chicks and manage their brooding program has a direct impact on the overall productivity of your chicken. Here are the key prerequisites for artificial brooding:

1. Brooding houses should be isolated from other houses containing older birds. An "all-in, all-out" program should be followed. Never mix birds of different ages.
2. All facilities must thoroughly be cleaned and disinfected before the arrival of chicks.
3. The brooder ring and heaters must be checked to ensure that they are working properly.
4. On arrival, chicks should be offered fresh feed and water containing an antistress or glucose.

Brooding Temperature

Maintain a brooding temperature of 32°C during the first week. Measure this temperature along the perimeter of the brooder guard. Regularly monitor the chicks and be prepared to make temperature adjustments, especially during cooler periods of the night. If thermometers are not readily available, observe the behaviour of the chicks as a practical alternative. Ensure that your chicks have sufficient floor space, feeding areas, and drinking stations. Ample space allows movement and access to feed and water without competition.

Chick Induction Guidelines:

1. Preheat the brooder one hour before the chicks' arrival to achieve a target temperature of 32°C within the brooding area.
2. Count the number of chicks upon their arrival.
3. Allow the chicks to drink water before introducing feed. You can use a designated chick feeding tray or a clean egg tray.
4. During the first three days, closely monitor the chicks every 2-3 hours to confirm that they have consumed both feed and water.

Feed Management

Allocate 1 chick feeding tray measuring 30 x 45 cm per 100 chicks. Place these trays strategically between the drinkers, adjacent to the heat source. This setup encourages the chicks to feed conveniently.

During the initial 7-10 days after placement, continue using open feeders. These offer easy access and acclimatize the chicks to the feeding process. Introduce round closed feeders for more controlled access to feed gradually.

For the first 8 weeks of the chicks' lives, opt for a high-quality chick starter or chick mash feed. This feed should be sourced from a reputable feed company to ensure its quality and safety. Look for a feed with a crude protein content of 18-20g/kg, and ME 2750 kcal/kg which is crucial for the chicks' early growth and development.

Light Management

During the initial 24-48 hours after placement, provide continuous lighting for the chicks. This facilitates the chicks' orientation and encourages them to locate their feed and water sources.

Chick Vaccination schedule

Chicks are vulnerable to a range of diseases, and administering vaccinations at the right time can greatly diminish the likelihood of losses. Here is a vaccination guideline outlining the key vaccines, timing, and mode:

Age	Vaccine	Mode of administration
Done at Hatchery	Mareks Newcastle Disease+Infectious Bronchitis	Mareks; aerosol spray for Newcastle Disease+Infectious Bronchitis
14 days	Gumboro or Infectious bursal disease	Oral via drinking water
21 days	Newcastle Disease	Drinking water, eye drops
25 Days	Gumboro or Infectious bursal disease	Oral via drinking water
21 days (in hotspot areas) Other at 42 days	Fowl pox	Wing stabs along wing web
Day 56	Fowl typhoid	Breast/thigh injection
Day 63	Newcastle Disease	Drinking water, eye drops

N.B:

- Do not vaccinate chicken that are already sick.
- Always seek guidance from your local animal health service provider to gain a better understanding of your local vaccination program.
- Always adhere to your suppliers vaccination schedule

Charcoal Cooler Technology

The charcoal cooler is a simple method designed to provide an environment which lowers temperature and provides a high level of relative humidity for storage of fresh produce

By Carolyne Anaye

POST-HARVEST LOSSES of fruits and vegetables in developing countries are due to lack of proper cold storage facilities. The shelf life as well as their quality can be increased by keeping them in a cool environment which allows more time for marketing and reduces the rate of deterioration. Refrigerated cold stores are the best option but they are expensive for most small scale farmers hence there is need to develop simple low-cost alternatives such as the charcoal cooler. It is a simple method that is designed to provide an environment which lowers the temperature and provides a higher level of relative humidity for the storage of fresh produce. It works on the principle of a porous structure such as charcoal to which water is added and as air flows across the wet wall, air temperature is decreased due to the loss of heat through the evaporation of water.

The cooler is basically a small room with a charcoal wall. Charcoal is selected because it has a very porous structure that can hold water and is easily found in most developing countries. The size depends on the storage need of the farmer.

Size and construction:

The standard dimensions of the charcoal cooler are 2.0 m long x 1.5 m wide and 3.0 m high. The construction of the cooler can be conducted in stages, starting with the main frame.

- The ground should first be cleared before putting in the main frame which can be made from wooden poles approximately 10 cm diameter.
- Four poles are needed, one for each corner of the room. A fifth pole is used to provide a support for the door and the distance to the next pole depends on the size of the door.
- The poles are fixed directly into the ground using holes 40 – 50 cm deep. If termites and ants are a problem, the ends of the poles should be treated with a preservative or insecticide or grease or used engine oil to prevent ants from getting to the food.
- The soil around each pole should be well compacted so that the pole is firmly anchored.
- The charcoal walls are constructed from timber and wire netting separated by about 10 cm with the interior being filled with charcoal.
- The charcoal walls on all four sides are filled up to the top 15 to 20 cm below the roof, with this space being left open so as to allow air circulation.
- The cooler has a door for security purposes and the roof should be made preferably with thatch or other material that provides a cool shade.
- The floor can be simple ground that is compacted or a more durable floor such as cement or bricks can be constructed.
- The use of wooden pallets on the floor is advisable for large coolers as this will keep produce off the ground and reduce infection of produce by soil borne pathogens and moulds.
- The poles of the main frame act as vertical ends of the walls. Horizontal wooden strips on either side of these poles are attached at regular intervals going up the poles so as to create a frame for a wall with the width of the poles.
- The wood strips used should be sawn timber with dimensions of 25 mm x 40 mm, as this size of timber is easier to work with. These wooden strips facilitate the fixing of the wire mesh since this can be nailed tightly to the wood which is at the bottom,

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middle and top of the wall.

- The distance between the wood strips up the poles is about 80 cm which is about the width of the wire mesh, which makes attaching the fence easier.
- Additional strips of wood can be used if needed for strengthening the wall or preventing the charcoal from sagging.
- The frame, poles and roofing timber should be painted with a good quality oil paint to protect the wood from water which may result in rotting.
- The inside strips of timber may cross each other at the corners and to make a tidy and even intersection, notches can be cut out of the timber at the point where they will cross and then be fitted together to make an interlocking joint.
- The cooler has a slanting roof, the angle between the front and rear of the cooler being adjusted to accommodate the type of material employed for the roof.
- Tiles require the roof to be steeper with a height of 2.6 m for the front. If thatching is used for a cover, the height can be lowered to 2.2 m for the front and 1.8 m for the rear of the structure.
- Careful considerations are also made on the site on to which a cooler is to be built.
- Water is required for the cooler to be operational and so the site should be located near a water source since charcoal is periodically or continuously wetted to provide the evaporative cooling effect.
- The cooler should be accessible to producers and markets of fresh produce.
- A shady location and exposure to the wind will help in the cooling effect, it will also assist farm produce reach a low temperature fast.
- A metal cone is included to deter rodents and a coating of grease on timber frames to prevent ants from getting to the food.
- The top is usually solid to prevent flying insects.
- A wind driven ventilator can be mounted on the roof to assist in the cooling effect.

Advantages of a charcoal cooler

- It is cheap to construct and maintain as compared to the refrigerated cold stores
- Farmers can preserve fresh produce for 4-6 days and tomatoes for up to 14 days as they supply to the markets
- Water can be recycled for reuse or used to irrigate crops in the field
- It can reduce post-harvest losses between 80-90% depending on the type of produce

Rearing black soldier flies for livestock feed

As an essential decomposer, the black soldier fly reduces the volume and weights of any waste obtained, reduce potential pollutants such as organic chemicals in manure, prevent houseflies from laying eggs in the waste, cause a significant reduction of E. coli and Salmonella enterica in chicken manure and are not attracted to human habitation and foods

By Faith Maiyo

Black soldier fly (BSF) *(Hermetia illucens)* is from Stratiomyidae family in the Diptera order. It is one of the most beneficial and most widespread form of insect farming in the world. The larvae are an excellent source of food for many animals like poultry, bait for fish and pigs. At different stages of their life cycle, especially at larvae stage, the following activities are observed; they consume large quantities of food wastes, agricultural waste products are decomposed and eventually converted into manure which restores soil fertility besides the maintenance of a healthy environment. As an essential decomposer, the black soldier fly reduces the volume and weights of any waste obtained, reduce potential pollutants such as organic chemicals in manure, prevent houseflies from laying eggs in the waste, cause a significant reduction of *Escherichia coli* (E.coli) bacteria and Salmonella enterica in chicken manure and are not attracted to human habitation and foods. They inhibit flies and houseflies from flying around.

Life cycle of black soldier flies

BSF has five growth stages in its lifecycle: egg, larvae, prepupal, pupae and adult. The larval stage is further divided into phases called instars. An instar is defined as the period between each molting of their exoskeleton. BSF has five instar stages. All the adult fly's nutritional requirements are obtained during its larval stage and adult flies survive on their fat reserves obtained as maggots. BSF, have an estimated life cycle of 38 - 40 days from egg to adult. Once they hatch, they migrate down into the fresh rearing substrate (chicken manure, cow dung, rabbit dung, pig manure, market waste, kitchen waste etc.). Waste consumption rates appear to depend on the larvae size and stage as larvae in the first and second instar feed more.

Characteristics of instars

- The 1st instar is white in colour and its segment is not clear.
- The 2nd instar the segment is visible.
- The 3rd instar is off white in colour, but the segments are not clear.
- The 4th instar is white cream in colour, segments are well visible, and the larvae has a protein content of between 42-47%.
- The 5th instar is beige in colour and the larvae has a protein content of between 42-50%.

The prepupal stage

This is a breeding stage, and the pupa is black in colour. At this stage, the pupa does not feed and does not moult.

The Pupae stage

During this stage, the pupae is rigid and dormant.

Mating and Oviposition

After the adult emerges from the pupal case, mating can occur. At this stage, the adult does not feed on anything. They survive on the fat reserves, and they suck water which facilitates successful flying and mating process and enough light and preferably sunlight is required. Egg laying usually occurs 3-4 days after mating at a temperature of between 28-30^{0}C. Females have a long and sharp tail that aids in laying eggs and seeks out an area that is secure and close to a food source to deposit their fertilized eggs. Thus, farmers

are required to provide the adult cages with containers holding the egg laying devices (concrete pipes or wooden materials which are commercially available) with odour producing substance to attract females BSF to laying there.

BSF adults have a lifespan of between 14-16 days. A single female BSF would deposit a mass or cluster of about 1000 to 1500 bunch of eggs. In absence of good lighting there will be low egg production. The laying mediums are usually positioned vertically over an oviposition attractant, to prevent the laying mediums from getting soaked in the substrate, such as wet kitchen waste or well-moistened poultry layer mash for wild trapping as well as in laboratory colony. They are also provided with clean drinking water soaked on cotton wool to prevent them from drowning.

Breeding cage for mating process

Black soldier flies require well-lit cages. The best cage made of the mesh is important since it allows proper ventilation and protects the flies from predators. For lighting purposes, it is advised to be reared in a greenhouse to mimic a natural source of light.

Procedure for harvesting eggs

Eggs collection can be done daily. However, the traps can be checked regularly or weekly if not collected daily until sufficient numbers of BSF larvae are found feeding inside the containers.

i. Untie the net
ii. Shake the net to prevent flies hoovering around not to escape
iii. Access the inside of the net through a slight opening, mostly a zipped side to keep the flies from flying out.
iv. Start by removing the water trough and remove flies that could be in the trough
v. Remove the feeding trough, and make sure there are no flies hoovering around it or which are tuck inside the troughs.

After harvesting the eggs, they are weighed in analytical scale(g) and sold or transferred to hatching trays that are labelled date of egg collection and hatch date and contains moist feed. Eggs take about 4 days to hatch, and then the larvae will take roughly 21 days to pupate. Pupae take 14 days to emerge as adult BSF's.

Larvae formed starts feeding on the moist feeds by sucking the substrate, the moisture content of the resource is important as it affects BSF development. Moisture contents outside the optimum range will cause adverse effects. The larvae require approximately 12 - 14 days to complete development. They happen to feed on any waste until they reach the 5th instar. At the 5th instar, the pupa is harvested and moved into the adult cages.

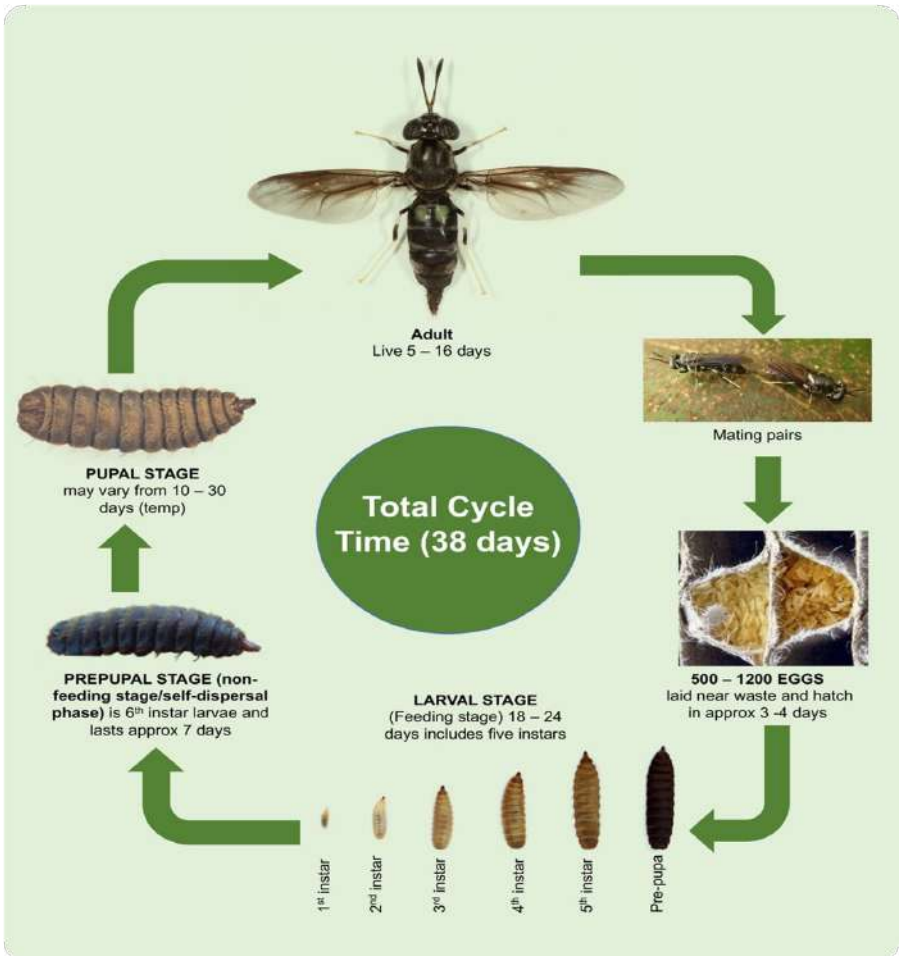
Harvesting of larvae

The adult BSF lays its eggs in rotting fruits, vegetables, manure or other agricultural waste. Within two weeks, the eggs hatch and turn into mature larvae. Once the larvae have developed completely, through the six stages, they enter a stage called the prepupa. While this stage, they stop to eat, empty their stomachs and their mouth parts change to an attachment that helps in climbing.

During this period, they prefer dry sheltered area to pupate. More often, such dry places are in compost bins where self-harvest of the mature larvae can be done. These containers have holes on the sides to allow the prepupae to climb out of the compost bin and drop into a collection area.

Black soldier fly value addition

Black soldier fly larvae (BSFL) are used to compost waste or convert the waste into animal feed. Fly larvae are among the most efficient animals at converting biomass into feed. Black soldier fly can also be formulated into feeds for poultry, pig, and fish.



Conserve water and grow more With a hanging kitchen garden

A hanging garden is a vertical structure that hangs from a wall, roof, boxes, terraces, or stands alone. It can be used as a garden to grow food as well as an aesthetic scenery

By Vincent Kipyegon

The cost of living has been on a rising trend over the past few months, weather patterns have changed and vegetable prices have skyrocketed in Kenya. Urban households have turned to kitchen gardens, multi-story gardens, and hanging gardens to grow their own food in an effort to reduce the cost of these essential food items.

A hanging garden is a vertical structure that hangs from a wall, roof, boxes, terraces, or stands alone. It can be used as a garden to grow food as well as an aesthetic scenery. It is an essential garden in small spaces to grow vegetables like kale, spinach, spring onions, and corriander (dhania) and herbs (aloe vera, Mexican marigold), flowers, and short-term fruits like strawberries.

Irrigation is one of the challenge with hanging gardens; gardeners have a difficult time getting water to the roots of the plants use of hand-held sprinklers to irrigate them can take a long time. One workaround is to improvise a straightforward drip irrigation system using suspended plastic water containers on top of the plants, which will water plants in drips. (pictured above).

A drip system for a hanging garden comprises of 3 to 5 litres plastic containers suspended by a rod or rope directly above the plants. The containers have a tiny hole drilled on the bottom that will water the plants in drips over time. The containers can be refilled without removing from them rods.

Additionally, the irrigation system may be used for fertigation, a method of delivering soluble foliar fertilisers to plants by combining them with water. Over time, the fertilisers will be absorbed by the plants, resulting in optimum plant growth and development.

In conclusion,a hanging garden is an ideal form of gardening for urban homes to produce sufficient food making use of small spaces and readily available household materials to ensure that crops receive the best ecological conditions including water, sunlight and nutrients.

Turn old trousers into a kitchen garden

Did you know you can convert old used trousers into a creative and efficient kitchen garden by hanging them on tree sides, fences or walls. This method is perfect for people with limited space, as it doesn't require any ground area. Fill the trousers with soil and plant vegetable gardens producing food such as spinach,kales, corrianders and herbs.

Creating trouser garden:

1. Seal the open ends of the trousers together by sewing or tying with a rod.
2. Fill the trouser with soil and compost.
3. Create uniform holes on the trouser for inserting seedlings.
4. Erect the trousers on a tree trunk, wall side or on a fence post.
5. Plant your vegetables and herbs.

The garden is then managed by regularly watering the plants and weeding. In the end,the garden will produce fresh and healthy food sufficient for cutting the cost of buying vegetables for home consumption

By Mourice Barasa

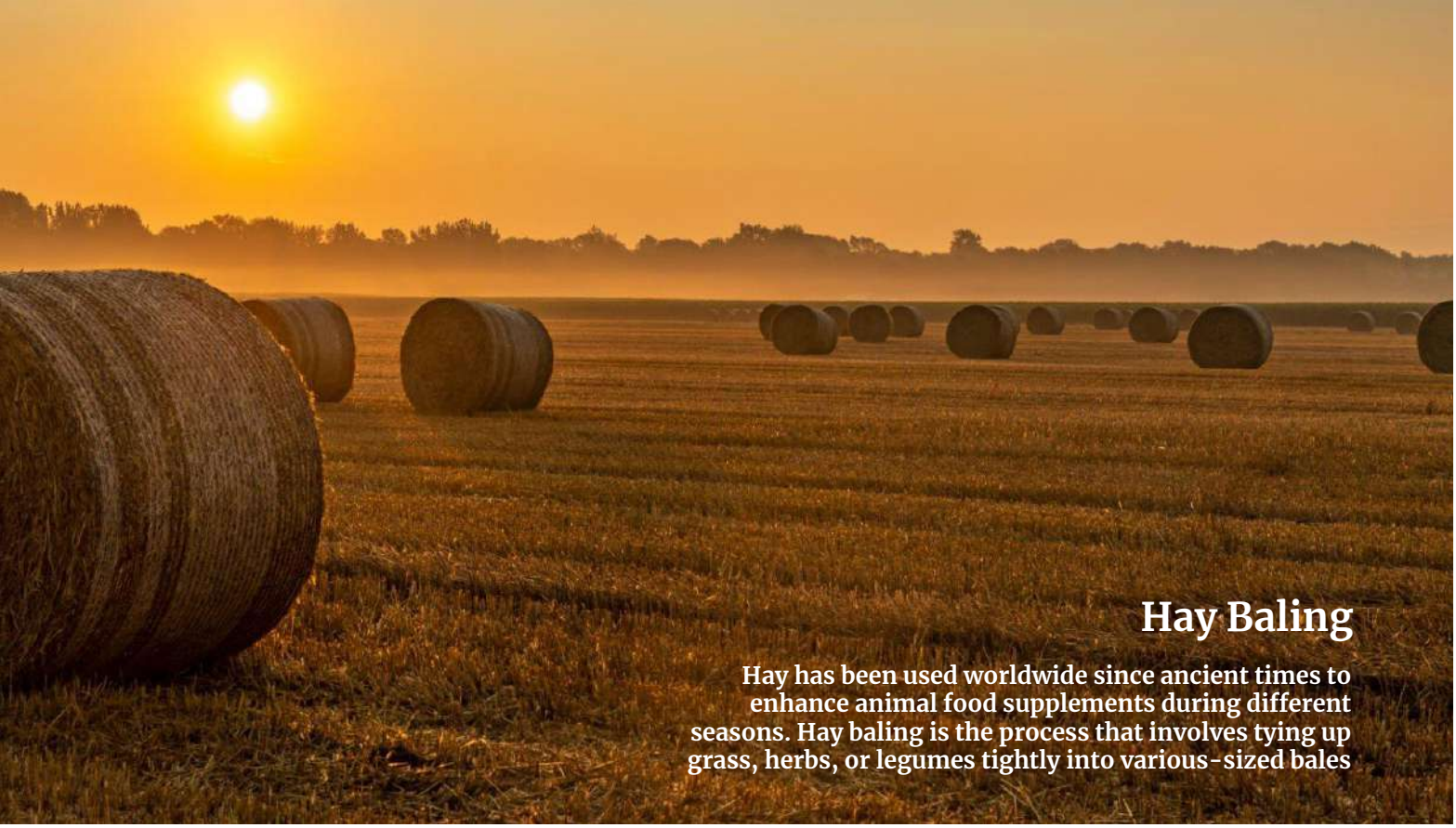
Hay refers to grass, herbs, or legumes planted or naturally grown, cut and dried, and stored as animal fodder. Hay has been used worldwide since ancient times to enhance animal food supplements during different seasons. Hay baling is the process that involves tying up grass, herbs, or legumes tightly into various-sized bales. Baling may apply stationary or movable equipment depending on the farm's size and the farmer's choice.

Baling Process

The following are steps to follow in baling hay: Mowing/cutting, tedding, raking, and finally, baling.

Mowing- It involves cutting down the preferred hay to allow it to dry. Ensure that mowing is done during the dry season to enhance favorable weather conditions for the drying process. Drying young-cut hay may take two to four days during the dry season. Mowing may involve the use of rotary disc or sickle mower equipment.

Square bales are easier to handle, which makes them most preferred by farmers with fewer animals. If your farm is large and has more animals, use round bales because they are efficient and not susceptible to damage



Hay Baling

Hay has been used worldwide since ancient times to enhance animal food supplements during different seasons. Hay baling is the process that involves tying up grass, herbs, or legumes tightly into various-sized bales

A sickle mower has five to seven long bars with various cutters fixed at the edges of the bars. Sickles work even with small tractors. Their main challenges are being susceptible to clogs and unable to squeeze the hay for an efficient drying process.

The rotary disc mower on the other hand, works well at higher speeds and can windrow the cut hay. The rotary discs are often mounted with small knives that rotate at high speed and are placed parallel to a mower.

The cut hay is allowed to pass through the conditioners, which helps to crush the stems to enhance the effective drying process.

Tedding- It is a process where the cut hay is lifted and fluffed thoroughly using implements to speed up the drying rate. Tedding is critical in minimizing molding and spoiling of the bales caused by baling moistened hay. It lifts the bottom of the windrows to the top to facilitate adequate air circulation. Tedding time depends on the weather conditions, humidity, and the type of hay the farmer uses. Avoid too much tedding since it may damage the leaves.

Raking- It is where the hay undergoes final drying and gets pulled into the windrows for baling. Different rakers are found in the market. However, wheel and rotary rakes are the commonly used ones. Since wheel rakes are made for speed, it is preferred for hay drying due to their efficiency. However, the farmer must tension it well to prevent soil from pulling into the windrows. Rotary rakes are relatively expensive than wheel rakes because of their ability to use power. Rotary can handle both wet and heavy hay. If the farmer wishes to have uniform bales with less soil content, he/she should use rotary rake.

Baling- Baling depends on the farmer's choice on the types of bales. Some farmers prefer square bales, while others prefer round bales. The shape of the bales also depends on the kind of animals the farmer has. Square bales are easier to handle, which makes them most preferred by farmers with fewer animals. If your farm is large and has more animals, use round bales because they are efficient and not susceptible to damage. Round bales allow shading of water, hence complete drying.

Round-Bale Making

1. Ensure the baler is in good condition by checking its core components before starting.
2. Pull the hay (dried from the rakes) into the baler.
3. Allow the baler to wind and roll the fodder into the required size.
4. Apply the net or wrapping the bale to preserve its shape and size.
5. Once binding is complete, allow the bale to drop from the rear wheel.
6. The farmer can collect the bale later or immediately using a bale spear mounted on a tractor.

Square-Bale Making

1. The reel should be well maintained to prevent spoilage of the bales.
2. Lift the dried hay from the rakes and place them into the reel.
3. Fell it well and pack it into the bale chamber designed on the baler's sides.
4. The movement of the plunger and the knife at the bale chamber's front fits and compacts the bale into the required size and shape.
5. The flywheel in the bale chamber exerts pressure on the bale that is vital to fill and pack into the chamber.
6. Wrap the bale well once it gains the required size to maintain its shape.
7. Eject it from the bale chamber for collection.

Manual-Cube/Rectangular/Cylindrical-Bale Making

1. Construct a box using either timber or metal walls of required measurement—for instance, a square pack of 50 cm by 50 cm by 50 cm. A cylinder of given diameters could also be constructed, fitted with a circular washer to enhance easy ejecting of the bales.
2. Lay four overlapping ropes in the cube before filling it with fodder. For the cylinder, seal one end with a washer. The washer should be of the same internal diameter as the cylinder and able to move freely in the cylinder.
3. Fill the box/cylinder with fodder and ensure continuous pressing to remove air.
4. Tie the ropes tightly once the box/cylinder is filled and adequately compressed.
5. Finally, remove the hay from the box.

Storage

After baling, allow the bales to dry before collecting them in storage. Store the bales in barns/sheds to enhance quality and the bale's protection. Alternatively, farmers may stack and tarp the bales in case they do not have storage facilities. Ensure that the storage facility is dry and far from rodents.

RESIDUE RETENTION

Residue Retention for Healthy Soil

Residue retention refers to the practice that, involves leaving behind the remnants of previous crops on the farm after harvest. This practice aims to optimize the benefits offered by these organic materials when they decompose in the soil while also conserving the environment around us

By Mellen Nyabuto

FARMING IS THE backbone of most communities. It's the source of food, provision, and sustenance. In the recent years though, extensive and certain farming practices have often left a noticeable change in the farm, and environment and in some cases led to degradation of soil quality and contributing to various losses in the farm such as low yields and crop losses.

To address these issues there has been a growing awareness of the need to implement good farming practices that can reverse these adverse effects and contribute to the increase of farm productivity, and one such practice is residue retention.

In this article, we will discuss the concept of residue retention in farming, its benefits, practices, and environmental impact, and offer a guideline on how a farmer can implement this practice.

Residue retention refers to the practice that, involves leaving behind the remnants of previous crops on the farm after harvest. These remains can include stalks, leaves, roots, and other plant materials. This practice aims to optimize the benefits offered by these organic materials when they decompose in the soil while also being a practice that conserves the environment around us.

There are several advantages that result from practicing residue retention in the farm. Below is a description of some of the benefits.

Soil Health Improvement

Plant remains act as a natural mulch, protecting the soil from being washed off and also compaction. They also help to maintain moisture levels, reducing the need for excessive irrigation. Over time, residue retention can enhance soil structure and fertility, promoting healthier and more productive farmland.

Nutrient addition

When crop residues are left on the farm, they gradually decompose, releasing essential nutrients back into the soil. This process reduces the need for using synthetic fertilizers, which is costly and harmful to the environment when overused.

Weed Management

Residues create a physical barrier that inhibits weed growth. This can significantly reduce the need for the use of products such as herbicides, leading to decreased chemical inputs and preservation of our environment.

Environment and climate protection

Residue retention plays a role in carbon balance in the atmosphere, capturing carbon dioxide from the atmosphere and storing it in the soil. This helps in managing our climate by reducing excess greenhouse gas emissions that contribute to a greater portion of global warming issues and severe climate change.

Increased microbial activity

The presence of decomposed crop remains provides habitat and food for beneficial insects and microorganisms to grow and thrive leading to improved soil health.

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With all the benefits that accompany this practice, it is important to note that other accompanying practices can be coupled with it to make it more useful to the farmer. Implementing residue retention may require planning and management. Some of the key practices that can be coupled to residue retention practice may involve:

1. **Reduced or no-till farming-** This involves minimal disturbance of the soil, which preserves residue cover, minimizes erosion and helps maintain the soil structure.
2. **Crop Rotation-** This practice involves alternating crop types from season to season. This helps manage crop residues effectively. Different crops produce varying levels and types of residue, and crop rotation can prevent excessive buildup of one type of residue.
3. **Planting cover crops-** This practice involves the planting of crops primary for the purposes of soil protection. This practice helps maintain residue covers by adding to the amount of stalks or residue crops that will be left behind. Once these cover crops decompose they further improve soil health.

While doing residue retention, the farmer should be careful to balance the amount of residue being retained for its maximum ben-

efits and ensure it doesn't hinder planting and crop emergence in the next planting season. Here are descriptive steps a farmer can follow to practice residue retention on their farm:

1. Choose crops that are suitable for residue retention. Some crops, like wheat, rice, and maize, produce are better at producing more residue than others, making them ideal for this practice.
2. Ensure your farm equipment is appropriate for residue retention. You may need to make adjustments to your plows, tillers, and seeders to handle the impact that will result from residue retention.
3. During harvesting, be mindful of the cut stalk heights, leaves, and plantlets left after harvesting, as leaving some of them is essential for residue retention.
4. After harvesting, the farmer can now manage the crop residues in the following ways:

a. Leave the crop residues on the field. Let the crop residues remain where they are after harvest.
b. Use equipment like residue spreaders to distribute the residues evenly across the field to avoid clumping or bare spots in some areas of the farm.

5. Reduce unnecessary soil disturbance, such as excessive plowing or tilling. No-till or minimum tillage practices are more suitable for residue retention.
6. Regularly monitor soil health indicators like moisture levels, organic matter content, and erosion rates. Residue retention should improve these aspects over time.
7. Over time be prepared to make adjustments based on your farm's specific conditions and needs. Different crops and soil types may require varying residue management strategies.
8. Always seek to learn and stay informed about the latest studies and best practices related to residue retention. Farmers are encouraged to attend farmer workshops, and field days, and consult with local agricultural extension services for even more guidance.
9. It's encouraged that farmers should keep records of their residue retention practices, including crop types, residue management methods, and any changes in soil health. This information will help them make informed decisions in the future.

In conclusion, residue retention in farming is a beneficial practice that offers a range of benefits for soil health, nutrient management, and also the environment.

However, it's also keen to note that it may require some careful considerations depending on the type of soil, current health state of the soil, adaptation to local conditions and also recommendations from expertise in the area of agricultural services.

COMPOSTING

Vermicomposting

Using this simple technique, you can turn your kitchen waste into nutrient-rich compost that will have your garden looking beautiful, green, and healthy

By Susan Wanjiru

VERMICOMPOSTING (WORM-COMPOSTING), is the process of using worms to turn organic waste, such as kitchen waste, into nutrient-rich compost. The worms eat the waste and excrete nutrient-rich excrement known as worm castings - a rich, dark, crumbly form of compost loaded with nutrients.

This method of producing compost is encouraged because it is a sustainable, low-cost, and environmentally friendly way to turn household and agricultural waste into high-quality compost.

Vermicomposting is usually done in a smaller scale than your regular compost pit. Therefore, you will not be able to put in debris from your farm such as dried leaves, twigs, etc. Feed your worms with waste like potato peels, cabbage, and carrot peels, amongst others. Avoid giving them oily foods or one kind of food. They will do better when you provide a variety of foods. Also, avoid giving too many citrus foods as they are very acidic and can kill your worms.

Benefits of Vermicomposting:

1. Worm castings (black gold) contain higher amounts of nitrogen, phosphorus, and potassium than traditional compost.
2. It reduces the amount of organic waste that goes into garbage sites, thus reducing the production of methane- a potent greenhouse gas.
3. If done correctly, a vermicomposting system produces minimal odour and does not attract pests.
4. Worms can consume waste equivalent to their body weight every day. Thus, a well-maintained worm bin can produce compost faster compared to some of the usual traditional methods.
5. Vermicomposting is usually done indoors and outdoors, making it an ideal composting option for urban and rural settings.

How to Start Vermicomposting:

1. **Selecting a Bin:** Look for a plastic container, purchase a worm bin, or make a wooden or plastic box. When deciding on the size of your container, consider the amount of waste you generate from your kitchen. If you get about 1/4 kg-1/2 a kg of waste daily, the bin should measure 2ft wide x 3ft length x 1ft deep. Put about 0.5 -1 kg of worms in it.
2. Put holes for aeration and drainage at the bottom of your bin and on the side around the perimeter about an inch from the top.

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Kericho	90.5
Eldoret	91.1

Tuko Mbele Pamoja!

CONTINUED FROM PAGE 11

3. **Bedding:** layer the bottom of the bin with shredded newspaper, cardboard, or coconut coir as bedding. Ensure your beddings are moist but not soggy.
4. **Worms:** Purchase the worms from a reputable supplier and put them into the bin. Though some people have used the regular earthworm to populate their bins, the best worms are the small red worms known as red worms, or red wrigglers.
5. **Feed the Worms:** Add small amounts of organic waste (fruit and vegetable scraps). Avoid meat, waste from dairy products, and oily foods. Gradually increase the quantity of food as the worm population grows.
6. **Maintenance:** Keep the bin in a dark and cool place. Maintain moisture levels and turn the bedding occasionally to provide aeration.
7. **Harvesting:** In a few months, the bin will be full of worm castings. You can then harvest the compost and start the process again. Worms increase in number very quickly. When fed correctly, their numbers will double every month.

Challenges:

1. **Overfeeding:** This can lead to odor and pest issues. Feed your worms according to their consumption rate.
2. **Temperature and moisture extremes:** Worms are sensitive to temperature and moisture. Keep the bin where temperatures remain between 13°C - 25°C. Adjust moisture by adding dry bedding or sprinkling water as needed.
3. **Predators and Pests:** Occasionally, bins might attract pests or predators like fruit flies and ants. Addressing overfeeding and maintaining the correct moisture levels can help reduce these problems.

Points to note:

- Ideally, harvest your worm castings every 3 to 6 months. To do this, place fresh food on only one side of the bin. Your worms will migrate towards the food. Worms will migrate when the food gets finished on the side without food. Following their migration, gently scoop out your worm castings from the side they have migrated from.

Vermicomposting is a means to produce high-quality compost beneficial to plants By understanding the basics and maintaining the right conditions, anyone can turn their waste into a valuable resource for your farm

- To use, place your worm castings on the top of your potted plants and let the nutrients seep down as you water them, or mix them with topsoil when preparing your planting soil.
- Worm castings are rich in nutrients, for that reason, use them as you would utilise a highly nutritous fertiliser. Avoid using too many worm castings. If, for example, your soil is already nutrient-rich, do not add more.

In conclusion, vermicomposting is an environmentally friendly way to handle your organic waste. It's also a means to produce high-quality compost beneficial to gardens and plants. By understanding the basics and maintaining the right conditions, anyone can turn their waste into a valuable resource for your farm.

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