

Dear Reader,

The cost of living has been on an upward trajectory over the last few months even as political campaigns intensify across the country. With these tensions building towards the general elections, most Kenyans feel uncertain of the social-economic outcome. In such times as these, maintaining optimism has proven to lighten the situation as it allows us to look at the brighter side and seek out practical solutions to the prevailing challenges. These solutions are amongst us, and to get to them, we must actively seek and share knowledge.

TOF Magazine keeps you on the know on current issues on farming such as policies, new technologies and techniques to tackle common challenges in the farm, as well as ideas to grow crops that are a nutritional resource for your family and a source of income. In this edition, we break down the latest developments on policies that govern use of pesticides in the farm, which is key in understanding the principles guiding availability and use of pesticides in the country. The edition also features an article on ways to manage weeds in the farm without affecting the soil quality.

Poultry diseases have been robbing farmers of their hard-earned capital as they lose their birds in large numbers. This edition features an article on early signs that show your birds are falling sick. These tips will help you manage the diseases from the onset before a larger population is affected. Are you wondering what fruits to grow in your farm? Passion fruits have benefits that you might not be aware of. Read on for these and many more informative articles.



Organic weed management

Grace Kinyanjui

Soil tillage is the dominant method used to control crop weeds in the modern agriculture. Primary tillage is usually done before planting, while secondary and tertiary tillage are practiced during the cropping season. Despite intensive tillage operations, weed challenges still persist on most farms thus driving farmers to apply synthetic herbicides in order to reduce weed pressure. In organic farming, however, herbicide spraying and other environmentally destructive practices are not allowed.

How can organic farmers control crop weeds?

In organic farming, farmers are encouraged to adopt an integrated weed management (IWM) approach. The aim of IWM is to integrate multiple control methods into a single management package that can suppress weeds and minimize their adverse impact on crop productivity. The key components of an IWM plan include cultural, mechanical and biological weed control methods.

A successful and sustainable IWM approach should mainly focus on the measures that prevent introduction and multiplication of weeds. Management of fully established

weeds should be discouraged because it provides short term solutions and promotes persistence of weeds on the farms.

Cultural weed control basically involves preventive practices such as:

- *Sowing of weed-free seeds: To prevent and reduce unnecessary introduction and spread of weeds on the farms.*
- *Varietal selection: To ensure crop types and varieties grown on the farms have a maximum competitive advantage over weeds.*
- *Use of mulch, cover crops or green manures in row crops: To prevent germination and growth of weeds in between the rows. Besides, cover crops and green manures help to improve soil fertility.*
- *Crop rotation: To interrupt weeds' life cycle and thus inhibit their growth and spread.*

Mechanical weed control involves physical practices that aim to destroy weeds and stop their growth. However, the control tactics currently employed by most farmers are ineffective because they allow weeds to emerge, grow and produce seeds for consecutive generations. These weed seeds build up and persist in the soil for a long period of time, and become a constant problem in

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the following cropping seasons. Organic farmers are thus encouraged to embrace good management practices that focus on reducing the number of viable weed seeds being added to the soil seed bank. These include:

- **Soil tillage:** To prepare land for planting. Intensive tillage, however, has negative effects such as significant disturbances of the soil fauna, increased soil erosion and decreased soil stability and structure. Therefore, conservation tillage systems (no-tillage, mulch tillage, ridge tillage and zone tillage) should be adopted.
- **Weeding:** To remove weeds within growing crops. This can be done using hand tools (shallow hoeing) or hand-pulling. Good weeding should be done before the flowering and fruiting stages in order to prevent seed dispersal and multiplication of weeds.
- **Slashing:** Grown weeds should be slashed before the flowering stage and used as mulch.

Biological weed control involves the use of natural enemies (biological control agents) to control crops weeds:

- **Grazing:** Domestic animals (goats, sheep and cattle) are allowed to graze on the harvested farms to help keep the weed levels low.
- **Disease causing organisms** (bacteria, virus and fungi) infect weeds with diseases that disrupt their growth. For example, a soil-borne fungus *Fusarium oxysporum* is effective in reducing the witch weed in cereal crops. However, biological control products are currently not available.

Despite their negative impact, organic farmers should not aim at total eradication of weeds because they also have some beneficial effects:

- **Edible weeds** (amaranth, nightshade) are a source of nutritious food. Certain weeds (Mexican marigold, black-jack) are medicinal, while others serve

as feed.

- Several weed species (clover, desmodium) assist in nitrogen fixation and help improve soil fertility. Wild sunflower (*Tithonia*) serves as green manure and also helps to improve soil fertility.
- Weeds generally provide habitat for insects and animals, enhance biodiversity and help in controlling soil erosion.

Finally, an organic farmer should be able to answer the following questions for proper weed management:

- **Which are the predominant weeds on my farm?** Identify the common weeds. Differentiate annual and perennial weeds. Differentiate damaging and beneficial weeds.
- **Why are weeds a never-ending problem on my farm?** Poor weed management methods encourage weed multiplication and continuous addition of weed seeds into the soil seed bank.
- **How do I effectively manage weeds on my farm?** Always act early. Destroy weeds before they produce and disperse seeds. Prevent or reduce germination of weed seeds for the annual weeds. Dig out and destroy the root systems and rhizomes of the perennial weeds. Use the IWM approach.
- **Can I manage an organic farm that is entirely weed-free?** No. An organic farmer should tolerate certain weeds that have important ecological functions. These weeds are integrated into the cropping systems, but a threshold for preventing their multiplication should be determined.

<https://infonet-biovision.org/PlantHealth/Weed-management>

Grace Kinyanjui is a plant pathologist and researcher at Embu University.

Email: gracekinyanjui11@gmail.com

Pest control product laws, what you need to know

Emmanuel Atamba, Food and farming systems expert, APSID

“Kenya has the best laws; the problem is implementation”, is a common phrase in Kenya. The phrase makes Kenyans feel good about their country and its systems. However, it has the negative impact of creating a dangerous habit whereby Kenyans do not participate in law-making processes because they trust “those in high offices” to do the right thing. The reality is that some of the Kenyan laws, especially those that touch on farming activities, are not as good as they are perceived.

One of the farming aspects guarded by stringent laws is pest control products (PCPs). All of these are bundled in the Pest Control Products Act of 1984, otherwise known as Cap 346. The Pest Control Products Board (PCPB) is tasked with the mandate to implement the laws. There are also seven additional regulations guiding different processes for pest control products. The processes include registration, labelling, advertising and packaging, license fees and additional charges, importation and exportation, premises and business licenses, and disposal. The primary purpose of these laws is to ensure public safety and health and the protection of the environment in the trade and use of PCPs.

There have been various concerns about the practicality of the Kenyan laws on agriculture and agrochemicals industry (businesses engaged in the manufacturing and distribution of PCPs given their evolution in the past few years. In addition, the use of pest control products has changed over time, calling for more attention, as potential impacts are higher with more use by farmers. Consequently, global policies on pest control products are changing to emerging issues on pest control products.





For example, the European Union introduced a hazard-based approach for the evaluation of pesticides for registration or re-registration. In the current period, pesticides that are toxic to non-target organisms, e.g. bees, and aquatic species, that either affect the nervous system or reproductive health, cause cancer, and mutation in unborn children are not allowed on the market. Consideration based on safe use practices is not used in this case.

This differs from the Kenyan approach, which follows a risk-based regime. In this approach, the level of exposure is considered rather than the toxicity. This allows the registration of some of the most toxic products with the promise of safe use. The big difference between these two approaches is that the Kenyan approach (risk-based) assumes exposure can be managed by pesticide companies and the final users of the product. Currently, over 188 products registered and used by Kenyan farmers have been withdrawn from the European markets.

The push for a change in the Kenyan laws to reflect the new issues and discussions being held globally and the new realities affecting Kenyan farmers is already creating a positive stir. Presently, PCPB has developed a draft bill and draft regulations that will replace the outdated 1984 Act and the regulations that come with it if they come into force.

Goodies for the organic sector

The new laws will bring about new

ways of doing things, and here are some good proposed changes:

1. The current PCPB will transition from a board under the Ministry of Agriculture to an independent PCP Authority that will have more power and room to address pest control product issues. This creates a better and more efficient institution to handle pest control matters, including the registration of new products (including organic pesticides).
2. The proposed laws will require the proposed PCP Authority to support local innovation and research on pest control products, an area where organic farmers are struggling in. Having that provision in the law is a big win for the organic sector. However, it will require the stakeholders in the organic sector to be aware of the provision and make maximum use of it to push for alternatives to chemical pesticides.

What is still missing?

Some of the gaps in the legislation include:

1. There are no mechanisms for redress for users of PCPs in the event of failure of a product to deliver intended results (common also in inorganic pesticides) and in the event where the product causes harm to a farmer. This is a critical component to legislate, considering that some farmers have reported suffering severe health consequences because of using pesticide products.
2. The new laws do not change the approach to pesticide assessment from

risk-based to hazard-based. Unfortunately, this means that highly hazardous pesticides will still be in the Kenyan market.

3. Consumers are not represented in the proposed board composition – This is an area that needs critical public discussion. If consumers are the ones who bear the cost of pest control products as well as the negative impacts of pesticide use in food, then they need to be represented on the board that makes decisions on the same. Consumers continue to be significant drivers in the organic sector. Livestock producers are also not represented on the board. Pastoralists might not be directly engaged in the use of PCPs. Still, their enterprises are significantly affected by these products and therefore they need to be represented at the decision-making table.

As a farmer, pastoralist or any other stakeholder in the organic sector, it is crucial to be aware of the developments in the laws, as they are essential in determining how pest control products will be handled in the country in the future.

All farmers need to use all available opportunities to engage in such processes so that together, we can bring the change we want to see in the agricultural sector. If the laws are about our farms, our businesses and our food- then they are our laws, and we have all the reasons to be involved and make our voices heard.

atamba@apsid.org

Earn extra income from growing passion fruits

By Esther Mwoloi

The passion fruit tree commonly known as the climbing vine from its nature is one of the fruits that farmers should adopt growing to earn an income. Compared to other fruits, passions do not face lots of competition in the market and rather always have a ready market in both local and international markets. The fruit is rich in vitamin A which improves human eyesight and vitamin C which is essential in the growth and repair of the body tissues. The common types of passion fruits grown in Kenya include the *Passiflora edulis* (purple variety) and *P. edulis* var. *flavicarpa* (yellow variety). The purple variety has a small rind and the fruit is smaller in size with lots of vigorous vines. It is also perceived to be more acidic compared to the yellow variety. The purple variety is preferably grown in high altitudes areas such as the Mt. Kenya regions and parts of Laikipia.

The yellow variety is characterized by a yellow rind when ripe and the fruit is usually big. This variety is mostly grown in low altitudes areas such as the coastal region and is more resistant to pests and diseases. For farmers to get high yields regardless of the region scientists have propagated the fruit by grafting the purple variety with the yellow variety. The root stock of the yellow passion is used because it is tolerant to nematodes and farmers end up getting high yields hence more profits.

Planting

Passion fruits can be planted directly from the seeds by extracting seeds from the pulp and letting them dry up. Once they are dry 3 seeds are sown in plastic bags at a depth of 1cm and thinned leaving one behind after two months. When the seedlings get to almost four months they are ready to be transplanted. Cuttings can also be used. Prepare the land well by digging slightly deep holes because passion trees have deep roots. Space your seedlings by 2 meters from one row to another and 3 meters from one seedling to the other. Light but heavy sandy loams are the best soils for planting the seedlings because heavy

clay soils will require draining while the extremely sandy soils require a lot of manure.

Maintenance

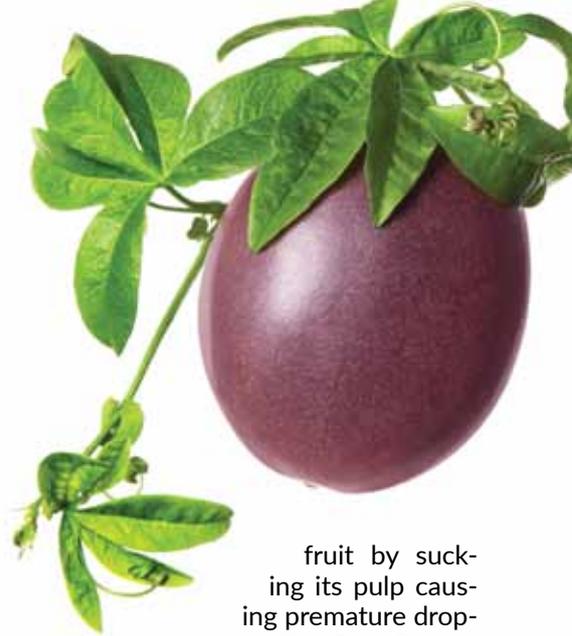
Water is a key requirement for the passion tree because it is a climbing tree and the vines grow very long. The water also helps in making the fruit grow big and sweeter. In areas with low altitudes watering should be done at least 3-4 times a week. Sunlight is another important aspect of the growth of the passion vine. To ensure that the vine receives adequate sunlight introduce hardwood or concrete poles which should be adequately spaced for the vines to climb through. Tie a galvanized wire across the poles. Avoid the use of any other wire to keep away diseases which may result from rusting of the wire. Pruning should also be done to allow an adequate supply of sunlight. This should not be done when the vine is flowering because the flowers might get injured and fall. Pruning can also take place after harvesting because the circuses which bore fruits are no longer important. Once the fruits have started forming introduction of foliar feed is necessary for making the leaves look healthy and to improve the quality of the produce.

Harvesting

A healthy vine can produce 15-20 kgs during harvest. Harvesting is done by collecting the fallen fruits on the ground and not by plucking. Completely ripe fruit falls when it's ready. Plucking can cause damage to some of the circus and can also result in the picking of fruits which are not ready. Once the fruits have fallen do not leave them there for long to avoid rotting. Mostly harvesting of passion fruits is done twice a year.

Pests and diseases

Nematodes are one of the common pests that attack passion fruits but can be controlled by grafting which is highly recommended by the use of a tolerant rootstock. Other pests and diseases that attack passion fruits are fruit flies and brown spots on leaves. With fruit flies, the larvae attack the



fruit by sucking its pulp causing premature dropping. The fruit fly also attacks the flowering buds. To control fruit flies you can install fruit fly traps on your farm, collect fallen fruits attacked by the fruit fly at least twice a week during the harvesting season and bury them, pluck fruits with dimples and the ones that ooze a clear sap and also wrap the fruit with a newspaper or a paper bag to prevent the fruit fly from laying eggs on it.

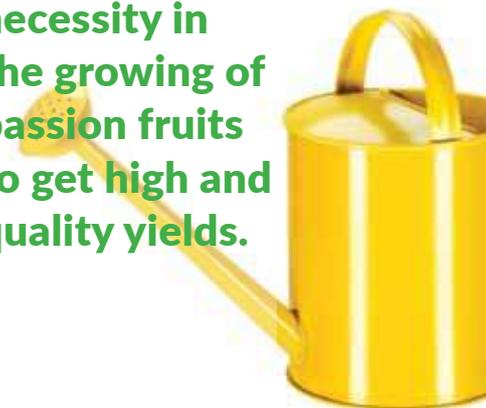
The brown spots on the leaves and fruits are another common disease. To control the diseases practice field sanitation and also prune the circus to reduce humidity within the crop and also to allow enough circulation of sun and air in the crop.

Value-added products

Besides the consumption of the passion fruit directly after harvesting and using it for cake decorations, several products can be obtained from the passion fruits. Such products include cosmetics, salads, yoghurt and juices.

<https://infonet-biovision.org/PlantHealth/Crops/Passion-fruit>

NB. Water is a very important necessity in the growing of passion fruits to get high and quality yields.



How to identify poultry diseases at early stages

By Mourice Barasa

Good organic animal husbandry is based on good animal housing, management, and feeding, which lead to good animal health and low disease incidences. It is premised on the idea of 'Positive Animal Welfare' (PAW). In the case of diseases, the organic farming rules clearly state that animals showing signs of disease or injury should immediately be isolated and given appropriate care. Additionally, diseases affect poultry breeds differently, and the urgency of treatment determines the flock's survival. Early identification is therefore paramount.

Early disease identification signs to watch for:

Early disease identification in poultry calls for regular observation of the flock to ensure that disease symptoms are diagnosed as soon as possible to initiate curative measures and prevent the spread of the disease to the rest of the flock members.

The following are some of the common early disease symptoms among birds;

- **Gasping for air and coughing;** Chicks will start gasping and coughing at an early stage of infection.
- **Drooping wings;** drooping wings indicate respiratory and nervous infection among poultry.
- **Dragging legs;** which may be a sign of nervous infection.
- **Twisted neck/head;** birds with twisted necks or heads are an early infection symptom.
- **Depression, circling, and paralysis;** birds with respiratory and nervous infections exhibit depression, circling, and paralysis behavior.
- **Reduction in egg production;** some infections in hens may lead to a reduction or stoppage of egg production. For Newcastle infected birds, early stages are accompanied by partial cessation of production, which leads to zero egg production if not controlled.
- **Swelling in the neck tissues and around the eyes;** some diseases cause birds to develop swelling in the early



stages.

- **Dull with ruffled feathers;** some birds abscond from eating and exhibit relaxed behavior at the early stages of infection.
- **Diarrhoea and excretion of fluids through the bird's openings;** body openings of the flock, such as nasal, ears, vent, and mouth releasing fluids signal the onset of an infection. Diarrhoea and sneezing are easily noted through a wet bird's body opening.
- **Misshaped, rough-shelled eggs and watery albumen;** In egg-producing hens, misshaped, rough-shelled eggs and watery albumen may signal the onset of newcastle disease.
- **Inconsistency in the colour and steadiness of the bird's droppings;** Different infections will have different colours of the droppings. For example, birds infected with newcastle will discharge greenish watery diarrhoea, while gumboro infected birds release whitish watery diarrhoea.
- **Swelling of the head and tissues around the eyes;** some infections lead to swelling of the head and tissues around the eyes in the early stages. Other diseases lead to the eyes' dryness and need medical urgency to reduce the virulence.
- **Feeding challenges and weight loss;** infected birds usually experience feeding challenges and deteriorated body weight during the disease onset. This may develop into bird paralysis, lameness, and body weakness as the disease progresses.

Some of the common poultry diseases:

1. New castle: It is a frequent disease in sub-Saharan Africa. New castle disease is transmitted by a highly contagious virus, which often infects the bird's nervous and respiratory systems. The disease virulence determines the mortality rate of the birds.

It is spread through direct con-

tact of the healthy birds with the discharges or droppings from new castle infected birds.

Commonly affected birds are; ducks, chickens, pigeons, and turkeys. However, chickens are the most vulnerable birds to new castle infection.

Infected birds show the following signs and symptoms; a rapid decline in egg production, sneezing and gasping coughs, nasal discharge, diarrhoea, and loss of energy that makes birds sit on their back hock joints. Hens suffering from new castle produce eggs with rough shells and are often shapeless.

2. Gumboro; A viral disease that affects chicks ranging from three to eight weeks. However, the disease may also extend to mature birds if early control is not taken.

The disease is caused by direct flock contact with infected birds or when the birds come in contact with infected faecal contaminated materials. For example, bedding materials, clothes, and feeding troughs.

Symptoms: Affected birds experience severe prostration, vent feathers become soiled, whitish watery diarrhoea, and inflamed cloaca.

3. Fowl typhoid: *Salmonella gallinarum* and *Shigella gallinarum* are the main microorganisms that cause fowl infection in birds. Birds often develop dull behaviour, and their feathers get ruffled.

Introduction of infected new birds, contaminated materials, and infected shoes or litter is the main means of fowl typhoid disease transmission.

However, it is challenging to notice the affected birds early because the symptoms develop after three days. Therefore, farmers must examine their flocks daily to know the changes.

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Symptoms; early signs of fowl typhoid include; dullness, the drooping head comb turning pale, pale-orange diarrhoea, and ruffled feathers.

4. Fowl cholera: Is transmitted by *Pasteurella avicida*, which undergoes rapid multiplication in the bird's blood and releases poisoning acid that affects the birds' health. It is transmitted by humans, wild birds, contaminated utensils, and the introduction of new infected birds in the flock.

Symptoms: yellowish droppings at early stages that are preceded by either greenish or yellowish diarrhoea. Birds also experience sleepy and feverish behaviour. In the late stages, infected birds become droopy.

5. Pullorum disease; its main causal agent is *Salmonella pullorum*. It commonly affects the ovaries of the hens. The bacteria can also reside in the chicken's intestine. If allowed to hatch, eggs produced by infected hens can spread the disease to chicks.

Symptoms; signs are observed between four and ten days. They include: drowsiness and ruffled feathers, birds uttering squeaky chirps and the vent soiled with faecal discharge.

6. Fowlpox; affects the bird's skin. The infected bird develops pox lesions that appear like warts or scabs on the face. Additionally, the face develops combs and wattles. Direct contact with scabs from birds with fowl pox transmits the infection. Blood-sucking insects such as mosquitoes and ticks can also transmit fowlpox among birds.

Symptoms; development of yellow blisters at an early stage but later turns dark on the face, comb, eyelids, and wattle.

7. Coccidiosis: multiplication of the coccidian in the bird's intestine increases the severity of the disease. Birds aged eight to ten weeks are the most vulnerable to coccidiosis. It is deadly because its early stages are expressed in acute and chronic forms.

Symptoms: the birds become unthrifty, droopy, and ruffled feathers. Shanks and pale beaks. Production of bloody droppings by infected birds.

barasa561@gmail.com

<https://infonet-biovision.org/AnimalHealth/Chicken>



Common challenges facing organic farmers and their solutions

Introduction

Farmers are facing various challenges arising from change of climate among them severe droughts, heat waves, extreme weather conditions that affect crop growth, livestock keeping and unpredictable weather patterns. There are efforts being made globally to reduce these adverse effects of climate change and environmentally sustainable farming methods is one of them.

In organic farming for instance, farmers adopt farming methods that make them resilient to effects of climate change by building on soil health through enriching it with organic matter and employing other techniques such as crop diversification, rotation and agroforestry. Healthy soils have higher retention of water and nutrients even in the face of adverse weather conditions. This makes farmers practicing organic farming much more resilient besides reducing carbon footprint that contributes to a large extent to climate change. This is because in organic farming, farmers not only avoid application of synthetic fertilizers on soil, but also practice integrated pest management approaches that do not involve application of wide spectrum synthetic insecticides, which contribute largely to carbon emissions. These characteristics make organic farming the ideal approach to sustainable food production, and a safe

method that shelters farmers from climatic and economic shocks.

Most farmers shy away from embracing organic farming for various reasons. Below is a list of common challenges that hinder farmers from adopting organic farming and how to manage them.

Common challenges:

- i. **Production Risks:** Climatic and weather patterns influence the growth and health of the crop. Adverse weather conditions such as wind, drought, hail, and floods lead to the destruction of crops. Prolonged droughts encourage the outbreak of pests and diseases that attacks both young and mature crops. Additionally, poor irrigation techniques in drylands affect the soil's organic nutrients and soil-water holding capacity leading to poor crop production.
- ii. **Contamination risks from genetically modified organisms:** Weather fluctuation exposes organic farming to contamination risks by GMO products. With most farmers participating in mixed farming, protecting organic crops and animals might be challenging. For example, pollen grains from GMO products might be transferred to organic crops, leading to a hybrid production.
- iii. **Input risks:** Farmers are uncertain of the credibility of the organic inputs such as the seeds and pesti-

cides. The use of not organically certified seeds might lead to losses since they cannot withstand the weather changes. Accessibility to organic farm inputs, especially during an outbreak of pests and diseases, might be challenging to farmers.

iv. Market risks: Weather and climate change have led to diversified agricultural production globally. Large scale farmers have ventured into conventional and modified farming approaches, which are cheaper than organic farming. Conventional farm products pose staunch competition to organic products because of their cheaper prices.

How to manage these challenges:

The following practices can help organic farmers to manage the above challenges:

Enhance soil organic nutrient conservation; Soil management enables the soil to hold nutrients for longer. Organic nutrients can remain in the soil for longer regardless of the harsh weather and climatic conditions. Soil fertility conservation prevents both erosion and leaching of nutrients. Organic farmers are therefore encouraged to carry out the following practices to conserve soil nutrients;

1. Conservation tillage; sustainable tillage reduces the exposure of fertile soils to harsh temperatures, wind, and runoff, hence reducing erosion risks. Conservation tillage involves zero tillage and contour ploughing in erosion-prone areas.
2. Cover cropping protects the soil from erosion agents, hence protecting the fertility and soil moisture. Farmers should plant cover crops such as fodder which provides food for their animals and conserve the soil's organic matter.
3. Crop rotation: it's advisable to practice crop rotation to balance the nutrients in the soil. Crop rotation is also essential in pests and disease control.
4. Timely land preparation and mulching practice; ensure that the land is prepared early to reduce the risks of weeds and soil pests before planting. Additionally, mulching should be done to conserve both soil nutrients and moisture.

a. Biological pests and disease control; Weather changes influence the outbreak of crop and livestock pests and

diseases. Adopting ecological pests and disease control approaches reduces the possibilities of the disease agents and pests adapting to chemicals. Planting of pest-resistant crops such as chia crops and basil keeps away pests, hence high crop production.

b. Agroforestry practice: Heavy winds and hails during rainy seasons contribute to heavy farming losses. Adopting agroforestry farming practice provides windbreak and shelters young shoots from strong hails. Agroforestry in organic farming also provides a buffer for the crops, reducing crop contamination by the GMO products from neighboring conventional farmers.

c. Proper input selection and availability; Accessibility to organic farm input is important to counter weather risks. It is important to set aside capital for emergencies when practicing organic farming. Ensure that all inputs are high quality and verified to reduce the risks of using conventional inputs. For organic fertilizers, ensure that they are stored under the shade to reduce direct rains and sunlight since they affect the maturity of the manure. Shades also reduce the leaching of nutrients from manure. Crop variety selection is also key to enhancing crop adaptation to weather changes.

d. Sustainable drip irrigation; Organic farming involves controlled water usage by the crops. Adoption of drip irrigation enhances water usage since every drop is directed to a specific crop. Drip irrigation reduces wilting risks and cases of early crop maturity that farmers witness during drought seasons. The approach ensures that soil fertility and moisture are maintained to support the crop.

e. Good storage and marketing practice; Good storage practice is fundamental in reducing post-harvest losses. Ensure that the organic products are stored separately from conventional farm produce to reduce contamination. Enhance proper storage conditions to maintain the viability of the products. Packaging and labeling are key to marketing organic products. High-quality organic products should be available to the market while fresh to avoid post-harvest losses caused by delayed transport to the market. It is always helpful to identify markets for organic farm produce even before harvesting.

The use of potato waste in black soldier fly rearing

By Mellen Nyabuto

The black soldier fly, a medium-sized fly with a black body is one of the native species in the family of flies known as Stratiomyidae. The black soldier flies in their adult form can be found in places such as animal excrement, organic matter, damp soil and on tree barks. The Black soldier fly is characterized by four life cycles that last close to 45 days namely; the egg stage (4 days), larvae stage (18 days), pupae stage (14) and the adult stage (9 days). The adult female lays about 200-300 eggs, which are deposited above or adjacent to manure or compost to hatch. The larval form makes use of organic matter as its feed. Less feeding occurs during the pupa stage as it enters the adult stage.

The fly is a great source of protein in its larval stage and is thus used as animal feed by farmers. They also can be used as decomposers, in the production of grease and chitin and rarely as human food. Its importance has impressed many farmers causing an increase in the demand for its rearing. The fly is reared on mainly organic waste such as bakery waste, dairy products waste, beer waste and sugar pulp wastes. The fly feeds on these wastes, decomposing them into high-value products such as proteins and oils.

In addition to the above, potato waste has also proven to be efficient in rearing the fly due to its high carbohydrate and starch content. Potato peelings and potato

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Kisumu	105.3
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Kericho	90.5
Eldoret	91.1

Tuko Mbele Pamoja!

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chips for rearing can be mixed with other kitchen waste and animal manure to yield high nutrient content for the fly larvae.

Below is a step guide the farmer can follow in rearing Back Soldier fly larvae using potato waste.

Steps

1. Preparation of materials

The following is a list of the materials that the farmer will require.

- Clean protective clothing i.e. gloves, gumboots, overalls.
- Basins or crates for rearing the larvae. The number of the basins will depend on the farmer's target.
- Scale for weighing the potato peels, other kitchen waste and manure.
- Labels and markers for labelling the basins.
- Sieve to separate manure, skins and ready larvae.
- Potato peelings and other kitchen waste are cut into smaller pieces.
- Five-day old larvae.

2. Preparation of the feed

Mix the cut potato peelings with other kitchen waste i.e. fruits, dairy or rice waste. Add the mixture to animal manure in the crates and mix thoroughly. Ensure that your mixture is not too wet or too dry. It is also advised that when mixing animal manure should be at least 60% and potato waste mixture 40%.

3. Growing the larvae

Add the five-day-old larvae into the prepared feed on the crates. Stack the crates together or cover each crate with a net to prevent contamination.

Monitor the larvae development.

4. Harvesting of the larvae

Use the sieve to separate the beige coloured larvae from the manure. Collect the manure into clean trays or containers. While separating ensure to shake the sieve well.

5. Processing

The processing will depend on the intended use. Harvested larvae for animal feed should be boiled in water to clean and kill bacteria and allowed to dry in the sun. The dried larvae can now be fed to animals.

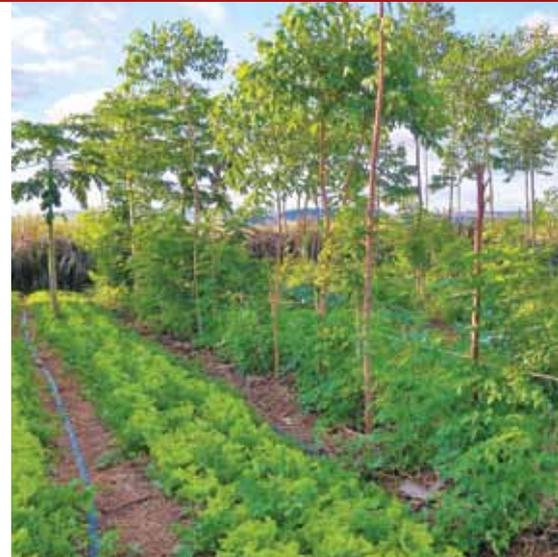
The collected product after sieving (frass) can be composted by using the heap method for 5 weeks to obtain quality manure. Stable frass that can be used as organic fertilizer.

In a case where the farmer intends to continue with the next rearing cycle, the collected larvae can be reared to their prepupal stage which is required in the egg rearing stage.

6. Harvesting eggs

In the case where the farmer is interested in harvesting the eggs, the farmer will be required to do the following:

- Set up a fly net cage for the pre-pupated larvae to emerge to the adult form that lay eggs. Inside the cage put your pupating larvae. Ensure to maintain the ideal temperature and humidity in the cage (temperature of 24 degrees, humidity at 30%-90%). Set up a watering point in the cage for the flies to feed on after they emerge from the larvae. The second important stage in the cage is the bait points which will attract the flies to lay eggs on those points making it easy to locate them during harvesting. The bait should contain rotten



organic waste and eggies or small egg trays on top. The strong smell from the bait will attract the flies and they will lay eggs on the eggies. This stage will take about 6 weeks long.

- After the 6 weeks, harvest the eggs that have been laid by removing the bait with the eggies or egg trays. Place all the eggies into prepared crates with your substrate and place the crates in a nursery section where the eggs will hatch to larvae. Five-day old larvae can be collected for the next cycle.

7. Cleaning

After all the harvesting, ensure you clean the materials with warm water and soap. Allow them to dry before using them again.

FARMERS' FORUM

Mbugua Dennis from Ndeiya is selling Rabbits

To get his contacts call us on **0715 422 460**

Partner organizations



To contact us on the "tusemezane" platform or ask a question, kindly call or sms +254 715422460. Mail to: feedback@biovisionafrica.org

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