

## Dear Reader,

The year 2022 has been riddled with major changes in the country that are of importance to the farmer. The major one being the change of government following general elections held in the month of August, and the many decisions made impacting on actors in the agricultural sector. Further from the global incidents that have led to skyrocketing food prices, and high costs of farm inputs, to the government interventions on incentivized fertilizers to boost the poor production brought about by the effects of climate change. Not to mention the looming debate on importation of Genetically Modified seeds. All these have left the small holder farmer on unfamiliar grounds, seeking answers to challenges that seem beyond control. Yet, production has to continue in spite of all the emerging changes.

As we ponder over these changing tides, we take stock of the achievements made in the year, which are a mark of our resilience and drive to stay afloat even when challenges seemed to exceed opportunities. With what is available, farmers have proven that beneath each hurdle, is a layer of opportunity that only requires innovativeness to optimize.

This edition features a main story that documents the journey of farmers in Kirinyaga County in the process of reducing application of synthetic fertilizers and adopting integrated pest management approaches, within their reach. The edition also brings to the spotlight the eggplant, which few farmers in Kenya grow, despite its nutritional benefits and economic value. Read more to find out about 'Azolla' a nutritional fern that farmers know little about. This and much more, only in The Organic Farmer Magazine.



## Azolla farming

By Samuel Monene

Azolla, also known as mosquito fern, duckweed fern, fairy moss, or water fern, is a branched, free-floating aquatic fern that grows rapidly on the water's surface. It is a highly productive plant that doubles its biomass in a small growing area within 3-10 days, depending on the growing conditions.

### Growing Conditions and Physical Characteristics

Azolla floats on the surface of the water using numerous small, closely overlapping scale-like leaves, with their roots hanging in the water. The most common Azolla varieties grown are Azolla Nilotica, Azolla Imbricata, and Azolla Pinnata. Azolla Pinnata is the most common variety grown in Kenya. The following are the favourable conditions for Azolla cultivation;

- Soils with pH of 3.5-10. The best growth is observed at pH 4.3-7, while the best temperature ranges between 20 and 30°C.
- They are grown where there is access to full or partial shade, with about 25-50% access to sunlight daily and relative humidity of 80-90%.
- Fully composted manure is to be used. The manure is necessary to provide nutrients.
- Provide enough root space, about two feet, to hold manure and prevent roots from coming in contact with the soil for easy harvesting.
- Fresh water with a high phosphorus content as it is not tolerant of salinity and

phosphorus deficiency.

### How is it planted

- Create an artificial pond for growing Azolla by selecting a partially shaded area; too much sunlight will destroy the plant.
- Dig out the soil for the pond and level the soil. For smallholders, an area of 6 X 4 feet for Azolla cultivation can produce about one kg of supplemental feed per day. Spread plastic sheets around the ground to prevent water loss. Make sure the pond is at least 20 cm deep.
- The selected area should be cleaned and levelled. The side walls of the pond can be either brick or raised embankments with the excavated soil.
- Add a thin layer of soil uniformly to the plastic sheet in the pond. After spreading the durable plastic in the pond, ensure all sides are properly secured by placing bricks over the side walls.
- Azolla needs Phosphorus to grow well. You can use phosphorus supplements and cow dung slurry (1kg per week).
- Fill the pond with water to a level of about 10 cm, allowing the roots to float freely. Leave the pond for 2 to 3 days for the ingredients to settle.
- After 2-3 days, add Azolla culture to the pond by gently rubbing Azolla in your hands. It helps break Azolla into smaller pieces for faster multiplication. 500g of Azolla culture is required per square meter of the pond.
- Start harvesting after 2-3weeks. Plastic sieves can be used for harvesting.

### Care and maintenance

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## Eggplant production

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- Since Azolla grows rapidly, it's crucial to maintain biomass through daily harvesting to avoid overcrowding. Azolla can be harvested after every three days. It can be dried or fed directly to animals. Given that Azolla is highly perishable, it is good to consider drying it immediately in case of a surplus harvest.
- Add once in 5 days a mixture of organic phosphate supplement and cow dung to maintain mineral and nutrient levels.
- Replace 25 to 30% old water with fresh water once in 10 days; it helps prevent nitrogen buildup in the pond.
- Completely replace the water and soil at least once in six months, and add Fresh Azolla seeds.
- Remove any litter or aquatic weeds seen in the pond regularly.
- Make harvesting easier by maintaining the water level at 10 cm to prevent root growth in the soil.
- Harvested Azolla to be washed thoroughly to remove dirt and the smell of cow dung before feeding them to animals.

**Benefits**

- **Livestock feed-** Azolla contains many proteins, amino acids, vitamins (vitamin A, vitamin B12), and minerals. Thus, it is an excellent nutrient supplement for livestock. Since Azolla has a low lignin content, animals easily digest it. It is also rich in minerals such as potassium, phosphorous, calcium, and magnesium. Azolla can feed cattle, sheep, goats, pigs, rabbits, and fish. Studies show that Azolla is incorporated into the diet of dairy cattle, pigs, ducks, and chickens. Moreover, there are reported increases in milk production by 15–20% when 1.5–2 Kg of Azolla was combined with regular feed. At the same time, the weight of broiler chickens and egg production of layers increased compared to conventional feed alone. A comparative analysis of the nutrient content of Azolla versus other fodder sources is depicted in table 1.
- **Bio-fertilizer-** Azolla fixes atmospheric nitrogen and stores it in leaves. They form a symbiotic relationship with existing bacteria in the water, which fixes atmospheric nitrogen. Therefore, it is effective when used as green manure.
- **Mosquito control-** Azolla restricts the mosquito breeding process by preventing the survival of larvae by making it difficult for them to reach

the surface and breath. It also hinders the laying of eggs on the water's surface.

- **Companion plant-** used in rice pad-



dies as a companion plant to fix nitrogen and block out light to prevent competition from other plants. Rice is planted, and Azolla is introduced when rice shoots are tall enough to poke through the Azolla layer. Rice farmers who incorporate Azolla have a higher rice production by 20%.

- **Weed control-** used as organic mulch in paddy farms. It forms a thick layer covering the water surface, preventing weeds' growth and hindering water loss through evaporation. Thus, the soil moisture content is conserved.
- **Bioremediation-** Bioremediation refers to any process where a biological system, such as bacteria, microalgae, fungi, and the plant, is used to remove environmental pollutants from the air, water, or soil, in natural or



artificial settings. Azolla can absorb, accumulate and degrade pollutants such as chromium, nickel, copper, zinc, and lead from effluents.

**Farmer growing Azolla**

Kennedy Kariuki, a passionate organic farmer from Murungaru, Nyandarua County, decided to venture into Azolla farming. With 2 Azolla farming ponds built on his farm, Kariuki can supplement his goat, rabbit and poultry feed using the Azolla harvested daily. "It is an ideal sustainable feed for my livestock. Not only can I improve the production of the farms, but it also helps me to save on money meant to buy feeds. This is because there is enough to feed my farm animals and a surplus to spare. I end up using the extra Azolla as a bio-fertilizer in the farm because of its high nitrogen content," explains Kariuki. Below is a brief overview of the requirements for starting Azolla farming.

**Conclusion**

Azolla cultivation requires less investment; hence it is a low-cost alternative for good animal feed and bio-fertilizer. Azolla culture can be obtained from neighboring farmers, local agriculture officers, or agricultural research organizations. However, Azolla is considered an invasive plant species in wetlands and freshwater lakes as it can substantially alter aquatic ecosystems and biodiversity. Therefore, it is advisable to cultivate it in a controlled environment, such as an artificial pond away from naturally occurring water bodies, as it can form dense mats of up to 30 cm thick and cover 100% of a water surface, preventing local insects and amphibians from reaching the surface.

No.	Item	Annual production of biomass (MT/ha)	Dry matter content (MT/ha)	Protein content (%)
1.	Hybrid Napier	250	50	4
2.	Sorghum	40	3.2	0.6
3.	Lucerne	80	16	3.2
4.	Cowpea	35	7	1.4
5.	Azolla	1,000	80	24

Table 1: Comparison of biomass and protein content of Azolla with other fodder crops

# Eggplant production (*Solanum melongena*)

By Carolyn Anaye



## Introduction

Eggplant belongs to the Solanaceae family which also comprises of the tomatoes, potatoes, black nightshade, sweet pepper and chili. Other common names include brinjal, Asian crop, aubergine, biringanya, garden egg and guinea squash. It is a perennial crop but grown commercially as annual. Eggplant has enabled farmers to take up horticulture and significantly increase their incomes especially when grown under irrigation in many counties in Kenya. The young and almost mature fruits are used as a vegetable. The fruit is a good source of vitamin A and C, potassium, phosphorous, calcium and iron deposits that help form the red blood cells. The fruits of the white varieties have medicinal value for diabetics.

Eggplant is also a good source of fibers and acids for digestion. Fibre provides the body with sufficient roughage for proper digestion and bowel movement. In addition it stimulates the secretion of gastric juices that facilitate absorption of nutrients and processing of foods.

They may be roasted, fried, stuffed, cooked as curry or pickled. Cooking for prolonged periods will destroy most of the vitamins. In Kenya production is done throughout the year and the bulk of the crop is exported. In most cases however planting is from beginning of June to end of December to correspond with the export season from October to May. Eggplant has a cropping period of 4-7 months. There is therefore a need to encourage more farmers to grow eggplant to increase income.



## Eggplant varieties

Eggplant comes in different colours that include white, purple and green, but the purple variety (Ravaya) is the commonest for export. Seeds of Black Beauty, Florida High Bush, Ravaya, Long Purple, Early Long Purple varieties are commercially available in all seed companies in Kenya. Details of these varieties include;

- *Black Beauty* - It takes about 100 days from transplanting to harvest. The fruit is oval to heart shaped glossy purple to almost black. Fruit size is about 10 x 8 cm. It has a good shelf life. It is unsuitable in cold wet areas.
- *Florida High Bush* - From transplanting to harvest is about 100 days. Fruit shape is elongate oval. Fruit size is about 15 x 8 cm. It is unsuitable for cold wet areas.
- *Ravaya* - It is an early maturing (about 80 days), high yielding variety. The fruits are slender, purple coloured and borne in bunches of 3-4. This variety is popular for fresh export market.
- *Long Purple* - It is ready for harvest about 70-80 days after transplanting. Fruit shape is cylindrical. Fruit size is about 11 x 5 cm. It is unsuitable for cold wet areas
- *Early Long Purple* - From transplanting to harvest is 90 days. Fruit shape is long cylindrical. Fruit size is about 12 x 6 cm. It is unsuitable to cold wet areas.

## Ecological requirements

Optimum day temperatures are 25-35°C and night temperatures from 20-27°C. It does not tolerate frost and is tolerant to drought, however excessive rainfall limits growth especially when temperatures exceed 30°C, and where water logging occurs. When temperature and humidity are high, eggplant becomes more vegetative. It does best in well-drained, sandy loam soils and lowland (below 800m) areas with relatively little temperature variation. When grown at altitudes above

800 m, growth is retarded and yields reduced. The pH requirements range from 6 to 7 with the optimum being pH 6.4.

## Cultural practises

Eggplant is normally propagated by seed. Propagation by rooting of healthy shoots is also possible. Soaking the seeds in water for 24 hours speeds up germination. No treatment is needed when sowing fresh, vigorous seed in sterilised soil. Otherwise, soak seeds in warm water (50°C) for 30 minutes, rinse them in cold water, and dry them before sowing.

Hot-water treatment of seeds is used against the following diseases: bacterial blight; bacterial leaf streak; Anthracnose; bacterial spot; black leg; black scurf; black spot; common blight, black rot.

## Nursery preparation

The seeds are sown in a well-prepared raised seedbed with friable soil in rows 10 cm apart. Before sowing an application of 3 to 5 kg of good compost per m<sup>2</sup> is incorporated into the nursery seedbed. In tropical areas, seeds are sown in a shaded seedbed and watered regularly. The seedlings emerge after 8-10 days. The ideal transplant is a seedling with three to four true leaves, stocky and disease-free, and without flower buds. Reduce watering 6 to 9 days before transplanting to reduce transplanting shock. Thoroughly water seedlings 12 to 14 hours before transplanting to the field.

## Transplanting

Transplanting should be done in the late afternoon or on a cloudy day in order to minimise transplanting shock. Before transplanting, place a basal dose of 15 to 30 tons/ha compost or well-rotted farmyard manure in the planting furrows or planting holes and mixed with the soil. Transplant seedlings by digging a hole

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deep enough to bury a plant so that its first true leaf is just above the soil surface. Press the soil firmly around the root. Irrigate furrows immediately after transplanting. Watering newly transplanted plants well with compost tea or EM (effective micro-organisms) will give the seedlings a good start. To prepare your own compost tea, mix 1 part of compost with 6 parts of water. Leave the mixture for one week. Strain and spray on seedlings to control fungal pathogens and prevent infection.

### Husbandry

Side dressing with groundnut cake is recommended 40 days after transplanting. In addition, remove three nodes at the tips of the plants to improve branching and to increase the number of fruits. Weed control should be shallow, to avoid damage to the roots. Tall-growing cultivars will also require support. Supplementary irrigation is required during dry periods. Mulching with dried plant materials reduces moisture loss and weed problems. Apply well-decomposed farm yard manure and neem cake as basal fertilisers. The use of VAM can also be encouraged to increase uptake of other nutrients e.g phosphorus from the soil.

### Crop rotation

Eggplants should not be planted after tomato, pepper, potato, or other solanaceous crops to prevent a recurrence of the same pests and disease pathogens. Rotate eggplants with other crops like onions, cereals or legumes. Planting eggplant after rice reduces the incidences of bacterial wilt and nematodes.

### Pests and Diseases Management

Common pests that attack eggplants include whiteflies, root-knot nematodes, budworms and cutworms. To control these pests, practice crop rotation, mixed cropping and the use of neem products.

Common diseases include powdery mildew, bacterial wilt, Fusarium wilt, Late blight, Anthracnose and Phytophthora fruit rot. To eradicate these diseases, use plant-resistant varieties, neem products, or practice crop rotation.

### Harvesting

This occurs 60-90 days after planting when the fruits are about two-thirds of their maximum size and before their flesh becomes tough with seeds hardening inside. Harvesting is done once or twice a week by cutting the fruit from the stem and leaving a short piece of stem on the fruit. For seed production, harvest only fully mature fruits from healthy and productive plants. Yields of 20 to 25 tons/ha of immature fruits can be expected

### Markets

In addition to the Fresh Produce Exporters Association of Kenya. Mkulima Young is an online marketplace for farmers developed by a Farmer for farmers.

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

## How to ensure hc

By Susan Wanjiru

Mixing your animal feeds at home can reduce costs. However, the following measures will help ensure that they are nutritious and safe for consumption.

### 1. Get an animal nutritionist to help you come up with a good formula.

Poor formulation of feeds can result in poor growth, reduced production of milk or eggs, increased incidences of disease, and malnutrition. To mitigate this, engage an animal nutritionist to train and help you avoid expensive mistakes. Experts charge for their services so consider coming together as farmers and sharing the costs.

### 2. Consider the animal's age/class, weight, the purpose of feeding, and nutrition requirements.

- *The age or class of the animal:*  
Animals have different diet requirements at various ages. For example, three-month-old calves will consume different feeds from heifers.
- *Weight of the animal:*  
A good feed ration should provide the animal with adequate nutrients. An animal's weight can guide you on the amount of feed required. Inadequate nutrition can cause low live-weight gain, infertility, low milk yields, and other health issues.
- *The purpose of feeding the animal:*  
Animals require feed nutrients for the following reasons: -

- For their growth and maintenance*
- Synthesis of products such as milk and eggs*
- Use as sources of energy for work done, both metabolic (heat increment and maintenance) and physical such as walking and feeding.*

### 3. Use available raw materials and buy from reputable suppliers.

Use raw materials that are available in your area. If soya is accessible, use it instead of trying to get canola which may be scarce. Available feeds are often cheaper with consistent supply, and reputable suppliers will supply quality raw materials.

### 4. Avoid contaminated raw materials

Contaminated raw materials will result



# Some made feeds are safe for animal consumption



in contaminated feeds. Contamination can happen before harvesting, during storage and when transporting materials, if they are exposed to extreme weather conditions.

#### • *Mycotoxins and aflatoxins:*

These are naturally occurring toxins produced by certain moulds or fungi that grow on different crops and foodstuffs like cereals, nuts, and spices that cause contamination in the crop. They can occur before or after harvest, during storage, on/in the food when stored in warm, damp, and humid conditions. They can penetrate deep into the food and do not just grow on the surface.

Most mycotoxins will survive food processing and thus will be found in animal feeds if raw materials are contaminated. They harm animal species such as poultry, dairy, pigs, pets like dogs and cats, horses, and humans.

One common mycotoxin affecting human and livestock health is aflatoxin. Aflatoxins are a poisonous chemical produced by a fungus known as *Aspergillus flavus* and *Aspergillus parasiticus* that grow in soil, decaying vegetation, hay, and grains. The fungus attacks crops in the field and after harvest if they are poorly dried and stored.

#### **Conditions that encourage mycotoxin contamination include:**

Moisture content above 13% in

grains, poor storage, high humidity, crop stress, and insect attacks create conducive environments for the growth of mould-producing toxins.

Humans get toxins after consuming contaminated animal products like milk. Exposure to high levels can result in acute poisoning (aflatoxicosis), liver cancer, stunted growth in children, and sometimes death. They also suppress the immune system decreasing resistance to diseases.

In animals, aflatoxins damage animal organs which reduces their performance and production. When toxins from different fungi species interact, their effect is more damaging.

Affected animals will exhibit: -

- *Diarrhoea and metabolic disorders;*
- *Poor digestion due to disruption of gut microbes;*
- *Poor performance and production;*
- *Immune suppression (poor immunity);*
- *Reduced feed intake; and*
- *Swollen legs.*

**NB:** The presence of the fungi does not necessarily imply that mycotoxins are present, and the absence of fungi does not mean the absence of mycotoxins.

The following will reduce the health risk from mycotoxins:

- *Inspect whole grains and discard any that look mouldy, discoloured, or shrivelled;*

- *Avoid damage to grains before and during drying and storage, as damaged grain is more prone to invasion of moulds and consequently mycotoxin contamination;*
- *Buy grains and nuts as fresh as possible;*
- *Make sure that foods are stored in dry areas, free of insects and not too warm; and*
- *Do not keep foods for extended periods before use.*

#### **5. Always use mycotoxin binders when formulating feeds:**

These bind mycotoxins and prevent them from being absorbed through the gut and into blood circulation. When other preventive measures against molds and mycotoxins fail, mycotoxin binders can resolve the problem.

#### **6. Poor or no labeling**

Clearly label all raw materials. Keep records of purchase, when, where, and from whom to help you trace ingredients used in case a problem arises.

#### **7. Environmental hazards**

If you are growing the raw materials, ensure that hazards or contaminants do not pollute your environment. For example, your source of water should

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# Knowledge, attitude and practices of tomato farmers in Kirinyaga: Where are we?

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be clean. Water bodies where industrial companies drain their waste may have chemicals that will be present in your crop if you use such water. Avoid using chemicals on your farm that can remain in the plants and eventually in your feeds.

## 8. Proper mixing of ingredients

Thoroughly mix all raw materials to avoid inconsistencies in the feeds.

## 9. Equipment

Equipment such as weighing scales, mixers, and crushers will make your feed mixture more balanced. Two or three well calibrated weighing machines of different sizes, are required because some ingredients are needed in small quantities and others in large amounts. Too much or too little of a particular product can result in unbalanced feeds, wastage and varied performance of your herd or flock.

Mixers thoroughly blend feeds while crushers ensure ingredients such as soya cake and omena that are chunky, are ground to small particles.

## 10. Producing in bulk

Raw materials purchased in bulk are cheaper. Small scale farmers should combine their resources to enjoy price advantages that can further subsidise their production costs.

### Sources of information:

- *Good practices for the feed sector Implementing the Codex Alimentarius Code of Practice on Good Animal Feeding, manual 24* Published by: Food and Agriculture Organization of the United Nations and International Feed Industry Federation Rome, 2020
- Biovision Infonet
- Kiambu Poultry Framers Cooperative

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<https://infonet-biovision.org/AnimalHealth/Animal-nutrition-and-feed-rations>



*A tomato farmer in Kirinyaga, applying synthetic pesticides without the use of personal protective equipment*

## By Dr. Shepard Ndlela

At the beginning of the year 2019, the International Centre of Insect Physiology and Ecology (*icipe*) surveyed Kirinyaga to determine what tomato growers knew about the devastating pest of tomatoes: Tuta absoluta. This marked the onset of the implementation of the project Integrated Sustainable Production of Tomatoes (ISPOT) in Kenya funded by the Biovision foundation for ecological development. It has been an intense three years of working with farmers in the five sub-counties of Kirinyaga and soon, another survey will be conducted to gauge the strides of progress. In this article, we revisit the findings before project implementation.

### Tomato production is profitable but...

As expected, growers reported that tomato production in Kirinyaga was a profitable enterprise with a gross margin (net sales minus production costs) of close to Ksh400 000 per acre. However, most farmers were unable to attain such profit levels due to losses inflicted by insect pests and diseases. For example, farmers reported losses of up to 64% by the invasive tomato leafminer Tuta absoluta which in some cases rose to 100% if the pest was not controlled. Other insect pests caused losses of approximately 25% every season. The major insect pests were

Tuta absoluta, followed by white flies, red spider mites, and thrips in that order. Cutworms, bollworms, aphids, leaf eaters, and other leafminers other than Tuta absoluta were reported as minor pests with insignificant damage to tomatoes. The major diseases were early and late blight as well as fusarium wilt and bacterial wilt.

### The use of synthetic pesticides has negative consequences!

To combat insect pests and diseases, farmers reported that 80% of the total cost they spend on pesticides is targeted at ameliorating the Tuta absoluta menace. This is not surprising as it is the most devastating of all. It was pleasant to note that in as much as tomato growers were extensively using broad-spectrum pesticides, some of which were not registered for use on tomatoes, 77% were concerned about the effect of pesticides on water-dwelling organisms such as fish, 78% on surface groundwater pollution, and more than 85% were concerned about the short and long term effects on human health. Their concerns are supported by hundreds of publications on the negative effects of synthetic pesticides on human and environmental health. To make matters worse, over 55% of farmers reported that they lack personal protective equipment (PPE) when applying pesticides. This predisposes the workers to harmful chemical fumes and spills.

## Huge knowledge gaps on alternatives to synthetic pesticides

Less than 10% of the farmers interviewed, were aware of safer ways of controlling insect pests such as the use of pheromones/lures, traps, sanitation, and use of biological control mechanisms. More than 70% were aware of the benefits of crop rotation as a means of controlling pests and also managing soil health but were unable to practice it because of the small size of land that they own. When asked whether they were ready to adopt environmentally friendly ways of controlling pests, 95% were eager to test new ways while 5% were not sure whether they were ready to try new methods. We figured that the intended introduction of integrated pest management (IPM) to farmers was overdue and adoption rate would be high if ideal logistics were put in place. Agro dealers who participated in the study were positive, with 82% reporting that they were willing to stock integrated pest management components such as biopesticides.

## There have been huge behavior changes

The findings of this study assisted icipe in implementing the project on the safe production of tomatoes from 2019 to 2022. The information became our baseline to compare with future assessments to measure the effectiveness of interventions and change-related behaviors. The project included partners such as the County government of Kirinyaga, and the private sector particularly suppliers of integrated pest management materials such as traps and lures. In the coming months, we shall be reporting the success stories following the implementation of safe production practices in the tomato production value chain.

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# Avoid chemicals and use neem biopesticide on your farm

## By Evelyne Night

To an inexperienced eye, farming might seem a straightforward affair; planting, weeding, and harvesting. However, most farmers might agree that for a good harvest, effective pest management is key. The most notorious plant pests remain to be insects, mostly of the butterfly and moth descent (Lepidoptera), aphids, and weevils. Butterflies and moths mainly lay their eggs on plant leaves, these hatch into numerous larvae (caterpillars, armyworms, leaf, and stem borers) that heavily feed on the leaves and essential growth parts leading to the destruction of affected plants. Without pesticides, a farmer may lose up to 80-100% of their produce. Not to run into losses, most farmers find themselves opting for chemical pesticides for their fast knock-out properties as well as their availability.

Chemicals however are not safe for the following reasons:

- *They pose a dangerous risk to non-target species; humans, animals, beneficial insects, and soil microorganisms crucial for crop health.*
- *The target insects sometimes develop resistance to the active ingredients in the chemicals in due time, such that the farmer has to keep looking for the most potent formulations.*
- *Some of the active ingredients found in chemical pesticides might take too long to completely break down in the environment hence consumers are exposed. When ingested, chemical pesticides might affect crucial body processes.*
- *Chemicals are expensive especially when used over a large area, or in intense infestations. In such cases, the farmer uses a lot of money.*

## But, you do not have to use chemical pesticides

Indeed, though chemicals have become the popular option for most farmers, it is not the only interven-

tion against crop pests. Biopesticides are natural and organic plant, animal, microorganism, and mineral-based options that disable, chase away, or even kill their targets.



## Neem is an excellent biopesticide

Also known as *Azadirachta indica* or *Muarubaini*, neem is an ever-green, fast-growing tree inhabiting most parts of Asia and Africa. Neem's most abundant phytochemical is azadirachtin, a compound that has pesticide properties. Azadirachtin can be obtained from leaves, bark, and seeds of the neem plant although it is most abundant in seed oil. Moreover, neem contains more than 200 other compounds with pesticidal properties that make the tree a strong source of natural pest control products, or biopesticides.

## Insect pests affected by neem extracts

Research shows that neem compounds are effective biopesticides against several pest species including African armyworm, African bollworm, aphids, banana weevil, cabbage moth, cabbage webworm, coconut mite, cutworms, diamond-back moth, and giant looper. Also, unofficial reports by farmers in Tanzania indicate that neem extracts and seed oil also are effective against the devastating fall armyworm.

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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!

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### How does neem control insect pests?

- Suppresses feeding sensation in insects: even low volumes of neem extracts are able to make the target crop unpalatable for the insect pest, hence protecting it.
- Anti-feedancy; disrupts the movement of food through the stomach of the insect pest as well as blocks the production of digestive enzymes. The insect then starves and dies a few days later.
- Disrupts the growth and development of immature insects by interfering with their natural ability to lay eggs and molt.
- Repels adult insects from ovipositing (laying eggs) on the sprayed target crop.
- When sprayed, neem extracts might get absorbed into the target crop thereby providing internal protection against mining insects that cannot be controlled through foliar spraying.
- Neem seed cakes, which are by-products of neem oil production are excellent nematicides (against plant pathogenic nematodes) and fertilizers.

### Extracting neem biopesticides at home

Neem phytochemicals are more soluble in organic compounds and alcohols compared to water. However, because only low concentrations are needed for efficacy, both water and alcohol extraction processes are equally

important.

#### I. Leaves:

- Harvest fresh neem leaves from the tree by cutting off the branches then removing single leaves by holding the branch upright and sliding your hands through until all the leaves are freed.
- Crush the leaves on a mortar and pestle, you may also chop them finely, or grind them in a food processor.
- Place the fine leaves in a large container and add regular tap water for approximately two-thirds of the amount of leaf paste.
- Tightly cover the container and let it sit for about three days.
- After three days, sieve out the leaves and the neem juice. You may use the leaves as compost.
- Add equal amounts of cooking oil and dish soap to the juice. The oil binds the juice and prevents excess run-off during application while the soap serves to break down the oil molecules.
- Load the mixture in your sprayer and apply it on the foliage of your tree or cereal crops.

#### II. Seeds

- Harvest the ripe yellow neem fruits and clean out the flesh to remain with the seed.
- Dry the seeds out in the sun to reduce their moisture content, this process also concentrates the oil in the

seeds. Discontinue the process once they turn brown.

- Shell the seeds to remain with clean kernels. Pound with mortar and pestle to remove the shells. Winnow to separate seeds from kernels.
- Crush the kernels to obtain a clean product. Winnow to remove impurities.
- Pass the pulp through a very fine mesh sieve to result into a greenish-brown powder.
- Thoroughly mix 250grams of neem powder with regular water, cover and let it sit for 24 hours.
- Add about 20 grams of soap and mix thoroughly.
- Load up your sprayer and apply it on your farm.

### What you need to consider before spraying

- You need to test your plants first before spraying the whole farm. Some plants react against neem's bioactive agents hence spray a few leaves first and observe the response.
- If spraying a vegetable patch, direct the biopesticide onto the old leaves at the base of the plant, the ones you will not consume. This will still be sufficient in warding off pests.

<https://infonet-biovision.org/PlantHealth/MedicinalPlants/Neem>



#### Partner organizations



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

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