

Dear Reader,

The year is coming close to the end despite the many challenges farmers have had to tackle in their daily lives. Some of the odds such as the Covid_19 pandemic and the many disruptions that came with it and the unpredictable weather conditions characterized by poor rains, have pushed farmers to devise new ways of doing things to stay afloat. For some, investing in high value crops and diversifying sources of income has been the alternative.

Times have been challenging especially for the small holder farmer, with changing school schedules that have affected many families' financial stability. This has been caused by increasing financial demands such as short periods to acquire school fees and increasing cost of food. TOF Magazine, continues to inform you on affordable techniques to employ in the farm and make better yields to help you reduce costs of production and ensure that despite the challenges, your family enjoys nutritious meals from your farm. We also keep you informed on ventures you can try out to generate more income.



Managing common soil borne diseases in your farm

By Charei Munene

There are very many micro-organisms that live freely in the soil. These include fungi, bacteria and nematodes. Some are beneficial while others are harmful and cause plant diseases. In this article, we shall discuss soil borne diseases caused by harmful micro-organisms. Soil borne diseases are usually difficult to manage because most microorganisms can survive for long periods in the absence of the normal crop host. Some survive in many plants including weeds or can live on dead plant material.

Soil borne fungal diseases include;

1. *Root rots caused by Pythium, Armillaria, Phytophthora, and Rhizoctonia which cause the root system to decay. They affect legumes, cereals, fruit trees, and root crops such as potatoes. Their symptoms include wilting, yellowing, stunting, dieback and eventual death and can be confused with other problems such as drought and nutrient deficiencies.*
2. *Wilting diseases caused by Fusarium*

and Verticillium. Plants wilt off and die. It mainly affects sweet potatoes, tomatoes, legumes, melons, and bananas.

3. *Damping off disease mainly affects seedlings and is caused by Pythium, Phytophthora, Rhizoctonia and Sclerotium. They mainly affect many vegetable crops including pumpkin family, cabbage family, beans, beets, carrots, potatoes, tomatoes, capsicums, and onions.*

Soil borne bacterial diseases include soft rot disease caused by several bacteria including *Erwinia, Pseudomonas* and *Streptomyces*. Soft rot bacteria affects fruits, tubers, stems and bulbs of plants in nearly every plant family.

Nematodes feed directly on the root of crops or spread viruses. Crops infested by nematodes have swollen roots. The crop shows stunting and yellowing because nematodes draw nutrients from the roots. Root knot nematodes especially attack almost all crops worldwide.

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Management of soil borne diseases requires an integrated approach which involves the following;

1. Get a soil test to know the microorganism community in your farm. Some of the organisations offering soil tests include: KALRO Kabete, (NARL) along Waiyaki way in Nairobi, Cropnut in Kangemi, Soil Cares in Karen and Jomo Kenyatta University of Agriculture and Technology (JKUAT).
2. Plant resistant varieties using certified seed, check the label to confirm if the seeds are resistant to most soil borne diseases.
3. Apply organic amendments such as neem cake oil and castor. Buy soil amendments from reliable sources only to reduce introduction of diseases.
4. Apply manure to encourage beneficial microorganisms, research shows that farmyard manure reduces harmful microorganisms in the soil.
5. Ensure your soil is well drained by avoiding over watering.
6. Practice crop rotation which generally reduces harmful microorganisms; adopt 3-4 year rotation cycles for *Fusarium* and root knot nematodes.
7. Practice soil solarization to kill fungal soil borne diseases such as *Verticillium* wilt, *Fusarium* wilt, nematodes, and bacteria by laying a clear polythene paper over your planting soil for 2-4 weeks. You can also practice soil steaming.
8. Plant trap crops such as managu to reduce harmful nematode levels.
9. Biological treatments such as *Trichoderma* reduce harmful microorganisms in the soil.
10. Practice strict farm hygiene.

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Sustainable management of Fall armyworm

By Grace Kinyanjui

Fall armyworm (FAW), *Spodoptera frugiperda*, *viwavi jeshi* in Swahili is a highly destructive maize pest in Kenya. It also attacks other crops such as sorghum, rice, sugarcane, millet and vegetables and has a broad host range of over 350 plant species. Although many farmers use chemical control against the pest, application of synthetic insecticides pose a huge threat to our agroecosystems. Thus, there is a need to empower all maize farmers to practice alternative pest management methods that are sustainable and ecologically sound. Sustainable management of FAW requires an integration of several pest control options such as good agronomic practices, routine monitoring, push-pull technology, and the use of biological control agents and biopesticides.

Economical impact of the FAW

Yield losses caused by the pest vary depending on the climatic conditions. FAW tends to breed faster in warmer areas with a lifecycle of 30 days. The pest is known to affect up to 100 percent of the crop yields if not well managed thus threatening

the food and economic security of households and the country.

How to control FAW

The first step is to ensure production of healthy maize plants that can withstand pest attack, through soil fertility management. Soil organic matter can be improved by the application of organic fertilizers and manure at the time of planting to improve soil structure and supply nutrients to the maize crops. Other ways of increasing soil organic matter include the use of cover crops and reduced or zero tillage practices.

Routine monitoring of crop fields for the presence of FAW and its damage symptoms is highly recommended. Infested maize leaves have window panes of translucent patches and ragged-edged holes, feeding damages on developing tassels and corn ears, and sawdust-like larval frass (droppings) on leaves, funnel, and all other infested plant parts. Immediate action such as application of biopesticides should be taken once the FAW is detected. Observed eggs and caterpillars of FAW should be hand-picked and crushed.

Good agricultural practices reduce FAW infestations and damage. These include the planting of quality seeds, early planting at the onset of rains, frequent weed control, and mulching. Crop rotation of maize with non-cereal and non-target crops also helps reduce the build-up of FAW in a farm.

Intercropping practices improve soil health and productivity, regulate FAW populations and enhance the diversity of natural enemies. Maize plants are best intercropped with cassava, yam, and legumes such as beans, soybeans, cowpeas, pigeon peas, and groundnuts. The *icipe's* push-pull technology also controls FAW. This involves intercropping maize with insect repellent legumes such as *Desmodium* and planting attractant trap plants such as *Brachiaria* or Napier grass as border crops.

Biological control of Fall armyworm

There are several natural enemies including predators, parasitic wasps, and pathogens that attack eggs and caterpillars of FAW. There is a need, therefore, to conserve them to enhance their function in the natural regulation of the pest. Several parasitoids that are effective against eggs and early larval stages of FAW are currently being mass reared at *icipe* and periodically released in maize fields across Kenya to contribute to the sustainable management of this pest.

Application of both botanical and microbial insecticides is effective against fall armyworms. *Icipe's* Mazao Achieve® is commercially available in Kenya and kills both eggs and early larval stages of FAW. The commonly used botanical insecticides include neem (*Azadirachtin*), chili pepper, and garlic extracts. Commercially available neem-based biopesticides are available in the agrovets.

Farmers have also become creative in formulating homemade solutions that are effective against FAW. Examples include wood ash, charcoal powder, soil, slurry of soil and water, a mix of red chili pepper powder and wood ash, a solution of red chili pepper and salt, and soapy solutions. All biopesticides and homemade solutions should be directly applied to the infested maize funnels. A mix of these methods will help reduce FAW damage, improve soil fertility and increase maize yields.

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<https://infonet-biovision.org/PlantHealth/MinorPests/Fall-armyworm>



Mastitis: Signs to watch out for

By Susan Wanjiru

A few years ago, I met a dairy farmer in Uasin Gishu, whose cow would often suffer nasty bouts of mastitis. The infections would always start from the same teat and spread to her other teats. Eventually, the vet advised the farmer to sterilize the cow's udder. The farmer proceeded to fatten the cow and later sold it for slaughter.

Though the disease affects both sexes in all animals' (yes, males can also get mastitis), its economic significance is felt in the dairy industry.

Despite research on the causes, treatment, and control of mastitis, it remains the most common disease ravaging the dairy sector.

Mastitis affects the best producers in a herd and hits them at a time when they are producing the most milk. It results in reduced milk production and is expensive to treat.

Causes of Mastitis

Bacteria from diverse families are the main causative agents of mastitis. However, fungal mastitis can also occur. The microorganisms enter the udder through the teats from the environment or during milking. Once in the udder, they produce toxins that affect the udder tissues and the cells that produce milk, causing changes in

the milk. In some cases, it manifests itself as part of a systemic infection within the animal body.

Poor milking techniques can injure the teat and increase the chances of the disease developing.

The chances of mastitis occurring increase with the change in seasons (more common in rainy seasons), breed of animal (some animals are more predisposed), and stage of lactation (occurs more during periods of high production).

Signs of mastitis

Mastitis can be subclinical or clinical. With subclinical mastitis, there are no signs of the disease in the animal. It is only evident from the abnormal milk produced by the affected quarter of the udder.

It can gradually spread undetected and adversely affect other animals. Animals with this type of mastitis act as carriers of the bacteria.

Clinical mastitis

The disease can progress to be clinical or chronic (after two months of infection). Infected animals will have a painful swollen udder or redness that is visible to the naked eye.

The milk also changes in colour and may have clots. In some cases, the animals may develop a fever and stop feeding. Lastly, animals with chronic

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mastitis can suffer from prolonged infection periods that make the affected quarter hard and inconsistent.

Treatment and Control

- Engage a qualified vet to examine your animals.
- Where possible, milk samples should be taken to the laboratory for culture and sensitivity tests to determine the most effective drug to treat the condition.
- Farmers should avoid purchasing intramammary tubes and self-treating their animals. Improper treatment can cause resistance by microorganisms which can compound the situation making treatments ineffective.

Preventing Mastitis

You should always maintain high levels of hygiene and ensure that milking equipment and surroundings are kept clean and regularly disinfected. The following practices will help control mastitis:

1. Dip teats in an antiseptic solution before and after milking.
2. Properly clean and maintain your milking equipment.
3. Keenly observing your animals helps you detect the disease early and start treatment before it's too late.
4. A cow can get mastitis when a farmer is drying up his cow before she calves down. To avoid this, a farmer should consult a vet to ensure that the process is carried out correctly.
5. Cull or selectively slaughter chronically infected animals.

<https://infonet-biovision.org/AnimalHealth/Udder-health-and-Mastitis>

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Consider applying green manure in your farm to enrich the soil

By Mourice Barasa

Green manure is undecomposed green plant material that is applied on the farm to improve soil fertility and structure. It is made of crops cultivated and eventually plowed under the soil to add and fix nitrogen in the soil. Green manure is obtained from different crops depending on their nutrient content. In some cases, it is obtained by isolating uprooted crops on the ground to wither in large quantities and serve as mulch, which eventually releases nutrients into the soil while still in green form.

Green manure crops are planted between main crops or as cover

crops to play a major role in the improvement of farm productivity for a smallholder farmer as they are fast-growing hence accumulating high biomass within a short period.

Types of Green Manure

In organic farming, green manure is often obtained from legumes to improve the nitrogen but non-leguminous crops can be used too.

Leguminous Green Manure

This is the type of green manure obtained from legumes as they consist of nodules that contain specific bacteria responsible for fixing nitrogen into the soil in a form that the crops can absorb.

They fix nitrogen from the air and fix it into the soil thus promoting healthy growth.

Some of the legumes used are; desmodium, purple vetch, velvet bean (*mucuna*), beans peas, and clover.



They also control weeds like Striga and prevent soil erosion by acting as living mulch.

Factors to consider when choosing green manure

- i. *The cost of seeds or seedlings to be planted.*
- ii. *It should have the ability to enhance and attract atmospheric nitrogen into the soil.*
- iii. *It should be easy to be incorporated into the soil.*
- iv. *It should have an easy decomposition rate.*
- v. *It should be a crop that can do well in infertile soils.*
- vi. *The crop used as green manure should be pest and disease resistant.*

Advantages of Green Manure

Enhances Nitrogen fixation - Green manure enhances Nitrogen fixation since green manure from leguminous crops such as vetch is rich in symbiotic bacteria responsible for fixing nitrogen into the soil.

It acts as a soil acidifier - In areas where the soil pH is more alkaline, green manure is used to release the acidic nutrient content in the form of acetic and humic acid. pH regulation is vital in enhancing crop production.

Water retention - Green manure also improves soil water retention capacity and is also critical in controlling soil erosion since it strengthens soil structure and profile.

Nutrient transfer - It enables the transfer of crop nutrients from green manure crops to the succeeding crops. Additionally, green manure increases the abundance of soil microbial responsible for the soil nutrient cycle and aeration.

Humus - decomposition of green manure to release nutrients leads to leftovers which dry and form the upper soil layer called humus that later gets decomposed by micro-organisms to improve soil fertility and structure.

How to Prepare Green Manure

Plowing - Prepare your garden well in accordance with the crop type you are planning to use in the preparation of green manure. A properly prepared farm enhances healthy and vegetative growth of the green manure crop; hence quality and quantity manure is produced. Sowing or transplanting green manure plants should be done properly to ensure a high survival rate.

Weed the crop to enhance plant vegetativeness. Give it time to grow until the flowering stage. For non-flowering green manure crops, allow them to grow until the leaves show maturity signs.

Cover the crops under the soil - Once the crop is at the flowering stage, plow the field with the crops, turning them into the soil. Cover them under the soil. Alternatively, cut down the crops, dig lines to about 30 cm deep. Then place the crops in and cover with topsoil.

Decomposition - Allow the buried green crop to ferment for about a month. This will form slippery green manure under the soil. Cover the soil with polythene paper, if possible, to speed up decomposition. Give them time to decompose before sowing or transplanting seedlings into the garden.

Application

All green manure should be incorporated in the soil while still soft and green and should be done near the surface of the soil, traditional deep plowing is not advised. In heavy soils, dig in 5 to 15cm; in light soils 10cm to a maximum of 20cm.

After burying the soil and allowing them to form compact manure, cut to pieces and place in holes or beds. Give the manure a grace period of about one week before transplanting the seedlings or sowing the seeds.

<https://infonet-biovision.org/EnvironmentalHealth/How-improve-soil-fertility>

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Non- leguminous green manure

Non-leguminous green manure crops are grown to improve soil-nutrient retention and increase soil fertility. Examples include millet and oats and their main purpose is to strengthen the soil structure, especially in poorly developed soils.



Keeping rabbits for profits

By Esther Mwoloi

When the Covid_19 pandemic hit the country early March 2020 and students had to take a break from school, some got creative and decided to use the time they would be spending at home productively. Mary Mpayo a third-year student at Moi University pursuing Food Science developed an interest in rabbit rearing after visiting a friend who was keeping rabbits. "My friend had started a venture in rabbit rearing, she was keeping the local breeds and when I visited, she was motivated by my interest in adopting her idea, so she gifted me three of her rabbits," says Mpayo. However, due to her lack of knowledge on housing and feeding, the rabbits died two weeks later. Nonetheless, her interest did not diminish and she was even more determined to see the venture flourish despite the set back. She decided to purchase improved breeds and seek information on how she should rear them.

"I bought two females Havana and Californian, and a Flemish giant male. The two females were purchased from one farm while the male was purchased from a different farm," this she says would help in cross breeding to reproduce kits of improved traits.

After one month the Havana gave birth to nine kits while California gave birth to



six kits and the business blossomed from then on.

At the moment Mpayo has a variety of different breeds such as the English Angora, Chinchilla, Dutch, Chequered rex, Flemish Giant, New Zealand white, Earlobe, and the Californian.

Feeding the rabbits

Rabbits mostly feed on rabbit pellets which are made from grains, bran, pollard, hay, and grass. They can also feed on vegetables such as cabbages, carrots, root vegetables, and potatoes during the wet seasons. In the dry seasons, they can feed on hay from green leafy plants which have been bound, and hung to dry in the wind as drying in direct sunlight is highly discouraged. This aids in retaining the green color which is an indication of high nutrient content. Plenty of water is very important to the rabbits since two-thirds of their body contains water which is necessary for digestion, absorption of food, and removal of waste. Rabbits can sometimes fail to eat but water is a crucial element in their diet.

Housing

Rabbits can be housed indoors in a cage or outdoors in hutches made of metal and wires. It is im-

portant to make sure that the house is clean and well ventilated to maintain hygiene and prevent diseases. The size of the hutch or the cage depends on the size of the rabbits and the availability of enough space to hold food and water feeders. Ensure that the cage is well ventilated to allow enough light which is a source of vitamin D for the rabbits. Avoid housing your rabbits in areas prone to loud noise because rabbits are among the animals which are sensitive to noise. Exposure to noise can result in hypertension and heart failure. It is a good habit to clean the rabbit cages at least once a day by removing the droppings, leftover foods, and water before refilling the containers. Farmers should ensure that they do not keep rabbits next to poultry especially chicken because some of the diseases that affect chicken can also attack the rabbits.

Reproduction and care for the kits

When the doe is mature enough, it is usually taken to the buck for mating to enhance the chances of reproduction. Touching the doe's belly after two weeks often discloses the presence of the kits. The pregnancy usually takes 28-32 days. When the doe is about to deliver, the farmer should introduce a nest for the mother. It should be enclosed and open at the top to avoid the mother from taking



the kits out. It should also be lined with hay. The kits should stay inside for up to three weeks until they can come out by themselves. During these three weeks, kits should only feed on their mother's breastmilk after which weaning can be gradually started. Avoid putting the doe and the buck together because the doe can easily get pregnant even after giving birth.

Benefits of rabbits

Rabbit keeping has benefits to the farmer as it provides meat, fur, skin, manure, and urine. Rabbit meat is white, rich in protein, and very delicious and highly suitable for human consumption. Some rabbit breeds such as the Angora provide wool used in cloth making. The droppings and urine can also be used in making organic fertilizers used in improving plant health.

In addition, rabbits are a source of income. For Mpayo, rabbit keeping has become a hobby which she enjoys mostly because it generates income for her. She says that a mature rabbit aged between five to seven months costs between Ksh2000 and Ksh2500 while a rabbit aged eight months goes for Ksh3000.

Even though the market is not consistently available, there is often a buyer looking to start a rabbit keeping venture, or a buyer looking to supply rabbit meat to hotels.

"I plan to expand the enterprise by introducing other breeds as I have noticed sometimes the demand is higher than supply from farmers," says Mpayo.

For more information on how to rear rabbits visit:

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

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TOF Radio answers farmers' questions

Growing tomatoes organically

"How can I produce tomatoes organically?" David Too from Uasin Gishu.

By Charles Kimani

In most Kenyan homes, a meal is not complete without tomatoes making tomato growing an attractive venture for most farmers in agribusiness. However, tomato growing has its fair share of challenges especially since they are highly susceptible to pests and diseases. Farmers need to be adequately informed as lack of information can leave the farmer using synthetic pesticides indiscriminately and this has adverse effects on human beings and the environment.

David Too an avid listener of Kili-mo Hai, a radio program aired every Thursday at 7.30pm on Radio Maisha recently called in to inquire how he can grow tomatoes organically, after realizing that dependence on pesticides is not only expensive but also hazardous to human health.

Common pest management

The common tomato pests in the East African region are red spider mites, russet mites, fruit worms, whiteflies, leaf miners and thrips. In Organic farming, adopting preventive measures and good farming habits is key if one is to realize better yields. The following are effective cultural control of the pests:

- *Early elimination of weeds at least 2 weeks before transplanting.*
- *Use of biopesticides such as pepper to control pests and viruses.*
- *Plough and harrow the field before transplanting. This will expose cutworms to natural enemies.*
- *Plant repellent plants such as chia seeds, marigold and chives around the plantation.*
- *Conserve natural enemies such as ants that help in controlling cutworms.*
- *Dig near damaged seedlings, this destroys cutworms.*
- *Make barriers to protect the transplanted seedlings. Barriers can be made by wrapping paper, alumin-*

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Location	Frequency
Taita	107.4
Narok	102.3
Nyeri	105.7
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Makueni	
Kitui	
Meru	105.1
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Location	Frequency
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Kisumu	105.3
Mombasa	105.1
Kericho	90.5
Eldoret	91.1

Tuko Mbele Pamoja!



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ium foil, thin cardboard or similar materials around the base of plant stems. Toilet rolls are handy as cutworm collars since they are readily available and are bio degradable.

Controlling Tomato Diseases

There are three main diseases that affect tomatoes: blight, bacterial wilt and black-end rot.

a) Tomato Blight

Tomato blight is one of the most devastating diseases in tomato production. A major symptom of the disease is dry brown lesions on stems, leaves and fruits. Affected fruits appear rotten and fall prematurely. Tomatoes are most susceptible to blight during cold and wet weather. This is due to high levels of moisture on the leaves for a prolonged period, which is a conducive environment for the fungal spores to germinate and spread rapidly. Preventive spraying using organic fungicides is the best control measure but once the disease has set in, there is nothing much a farmer can do. The loss incurred could be 100 percent.

b) Bacterial Wilt

This disease is caused by bacteria. Tomato plants attacked by bacterial wilt wither and then dry up even when the

weather condition is wet. In organic farming, certified seeds and crop rotation are used to control the disease.

Culturally, these diseases are controlled using the following approaches:

1. Use of certified seeds and avoiding establishing of the seedbed on the fields that are infected.
2. Encourage crop rotation, pruning and staking for air circulation to reduce humidity as humid conditions are favourable for late blight.
3. Avoid overhead irrigation and provide space between crops as required.
4. Plant more resistant tomato varieties.

c) Blossom-end rot

The disease is manifested on the fruits where the blossom ends appear rotten, and water soaked or rotten and dry. Blossom end rot is not caused by any organism. It is a physiological disease caused by:

- Too much nitrogen in the early stages of growth
- Irregular or infrequent watering
- Calcium deficiency in young fruits.

The disease can be controlled through:

- Regular watering
- Top dressing the crop with the right amount of nitrogen
- Application of calcium compounds in the soil.

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

FARMERS' FORUM

Charles Githaiga from Mukurweini, Nyeri is selling Bracharia grass.

Mary Mpayo from Kitembela is selling rabbits.

To reach them call 0715 422 460



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