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Thank you for your continued partnership.

Dear farmer,

Since the beginning of the year, we have expressed our intention to start charging a small fee of Ksh 20 for the copy of **TOF** magazine starting from July 2017. For the last 12 years, **TOF** magazine has been freely available to you and we appreciate your continued testimonies of how the magazine has positively changed your life.

However, the production costs, which include research, writing, layout, printing and distribution of the magazine have continued to rise. In order to continue producing the magazine in future, we thought that farmers can partner with us in the cost of production by paying a small subscription fee.

We have no doubt that many farmers have benefited immensely from **TOF** magazine by practising most of the technologies we have featured every month. The magazine targets farmers in rural areas in the country who have no source of agricultural information to help them improve farming methods and to practise farming in ecologically sustainable ways that restore soil fertility for improved food production and a healthy environment.

This is why we decided to charge a small subscription fee of Ksh 20, which we feel every farmer can afford. Information is power. We believe that by giving small-holder farmers the right information packaged in simple and understandable language; it will empower them to improve their farming methods for improved yields and increased earnings.

If you have been receiving the magazine as a group, you can ask other farmers in your group to individually pay Ksh 240 annual subscription to our account as shown elsewhere on this page. If you pay this amount, you will receive your copy of the magazine for the next 12 months.

You can also choose to subscribe for three (3) or six (6) months, renew payment after the expiry of the period and you will receive your copy. Beginning January 2018, the **TOF** magazine will stop free distribution. This means that the publication will only be available to farmers who will have subscribed for their copies. We hope that those who have not yet paid for their copies will do so before the end of the year.

**We wish all farmers a Merry Christmas and a Happy New Year!**

## TOF magazine refined my passion

**Venter Mwongera** | The green landscape around Kiangi village, Mathira West District, Nyeri County is not only appealing to the visitors but also to the locals. Apple and grape trees, passion fruits, oranges, lemon, avocado trees and banana plantations are the different tree species that appear at each canopy with cabbages, carrots, arrowroots, spinach, kales among other indigenous vegetables comprising the undergrowth covering the soil.

Mr Geoffrey Gichuhi is an integrated organic farmer who has greatly contributed to the cultivation

of the environment described above.

He has practised poultry, dairy goats, cow and rabbit farming for over 15 years. "I like participating in creating what I consume. If I have a healthy family, why not practise holistic farming and sell the produce to enjoy an additional income from the sale of the produce?" He wonders loudly.

Mr Gichuhi oozes knowledge of organic farming which he attributes to **TOF** magazine. "For the past nine (9) years, I've been ardently reading, applying and filing each copy of **TOF** magazine. Grapes, poultry, rabbit farming besides land management are some of the techniques that I learnt." He affirms.

Mr Gichuhi has received more than 15 awards from the retired presidents Daniel Toroitich Arap Moi and Mwai Kibaki for rabbits' deliveries to the cooperatives in the categories of first and second delivery awards and an overall best rabbit farmer in Central Kenya.

As a rabbit breeder, Mr Gichuhi rears ear loop, Angola, New Zealand white and California breeds which are bought at the local and regional markets in Tanzania and Uganda.

### Regional recognition

"I'm grateful to **TOF** magazine for the timely and unique organic farming information. I was also trained by the Kenya Institute of Organic Farming (KIOF)." Mr Gichuhi says thankfully.



Mr Geoffrey Gichuhi, integrated organic farmer

Mr Gichuhi happily confesses that he didn't know how to house, feed and the general management of rabbits. He says, "I lost a herd of rabbit to preventable causes."

Today, farmers' groups and cooperatives in Tanzania and Rwanda invite Mr Gichuhi to train them on organic farming methods.

### Improved income

Mr Gichuhi generates his income from the sale of rabbits and training consultancies' fee. "I sell one to two-months-old rabbits from ksh. 1,000 to 1,500, three to four-months-old at ksh. 2,000 and from six-months-old and above at ksh. 3,000. Training consultancy fee within Nyeri County is ksh. 3,000 and in other counties I charge ksh. 5,000 per day excluding transport fees."

He plans to subscribe to **TOF** magazine from January 2018 to ensure its continued production.

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# Water your crops efficiently using drip irrigation

Drip irrigation is a climate smart irrigation system that delivers water directly to the plant roots.

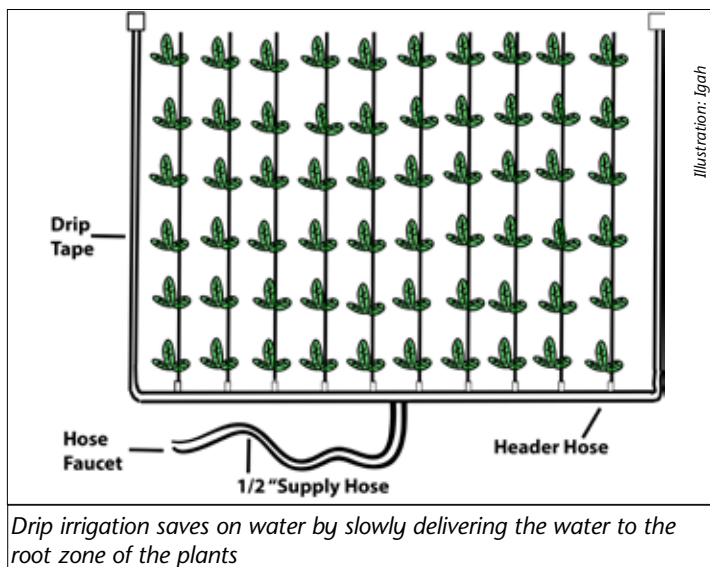
**Joan Mukiri** | In most parts of Kenya, irrigation remains a necessity in crop production. Even with the rainfall, some crops still need irrigation especially in the arid and semi-arid regions. Intense heat and dry climatic conditions can be a big challenge for proper crop growth and development. As much as irrigation is crucial, using too much water can cause problems such as leaching nutrients, reduced root growth, water-logging, salt build up on the root zone as well as reduction of plant quality and yield.

The one type of irrigation that has managed to save farmers money and increased their yields is drip irrigation. Drip irrigation is a type of irrigation which saves on water by slowly delivering the water to the root zone of the plants. So to ensure that you have proper plant growth and high yields, one can install a drip irrigation system.

## Benefits of a drip irrigation System

A drip irrigation system is better than other irrigation systems such as sprinkler irrigation for numerous reasons.

- Drip irrigation is the most efficient method of irrigating because the emitter delivers water directly to the plants minimizing wastage. Drip irrigation systems use 30 to 50 percent less water than conventional watering methods, including most sprinklers.
- A proper irrigation system supplies small but constant quantities of water, which creates ideal growing conditions for most plants. More efficient watering means less weed growth. The plants maximize water use since the water is delivered at the base of the plants. This leads to improved seed germination,



Drip irrigation saves on water by slowly delivering the water to the root zone of the plants

increased crop yields and fewer weeds since there is only little water available for them.

- Since water is applied locally, leaching is reduced, fertilizer or nutrient loss minimized. This means that fertilizers can be used with high efficiency, reducing waste.
- Operation costs are reduced.
- Soil infiltration capacity is increased.
- Fertilizers and ground water is not mixed.

## Limitations of drip irrigation

- Initial investment capital is mostly higher than other systems such as sprinkler irrigation.
- Management requirements of drip irrigation systems are higher because of its sensitive layout.
- Rodent, human and insects are potential sources of leaks.
- A water filtration is necessary to prevent your drip lines from blocking

## Drip irrigation maintenance tips

For a drip irrigation system to work well, the farmer needs to take care of the system at all times to ensure the plants are well-irrigated. The following maintenance tips can help farmers to keep the system working well:

- Use clean water at all times.
- Be careful while working in farm with a drip system to avoid damaging the water pipes, hoses and drip pipes.
- Inspect the system on a regular basis so as to detect any destruction from pests such as termites, rodents, blocked emitters and leaks that cause water loss.
- Ensure the filters are cleaned regularly.
- Make sure the system is well-stored when not in use to stop damage.
- Use mulch (dry material like grass) between the plants to reduce water loss through evaporation and reduce the growth of weeds.



## Cost of a drip irrigation system

According to an irrigation expert, Mr. Bramwel Mullamah, the quantity of drip pipes needed per acre depends on the type of crop to be planted but the ideal one is 400m/ha. Spacing is usually done at 60cm interval but also varies with the type of crops. It's advisable to have a tank that can hold at least 5,000 litres to ensure there is enough water for irrigation. For French beans, watering is done for 45minutes to 1 hour intervals three times a day. Fertigation (fertilizer application through drip lines) is also encouraged when one is doing drip irrigation.

## Irrigation in sloping land

Irrigation on a slope can be a big challenge since most of the water ends up on the lower side, leaving little or no water on the upper part. To solve this problem, one needs to lay out the main pipe followed by gate valves at intervals. Intervals between valves depend on the slope and the water pressure. Mr. Mullamah also points out that another common challenge in drip irrigation systems is blockage of drip emitters which occurs from time to time. He added that this blockage is mainly due to soil particles when farmers fail to filter the irrigation water or salts in cases where no coagulants are used.

## Choose drip equipment carefully

Farmers need to be careful when purchasing drippers to ensure that they get good quality drippers. There are two kinds of materials used for drippers: rubber and plastic. The prices of plastic drippers normally range from Ksh 12 - Ksh 15 per metre while the rubber ones go for Ksh 25 to Ksh 30 per metre. The rubber drippers are better compared to plastic ones because they can withstand varying climatic conditions and can be used for up to 5 years.

**Irrigation expert: Mullamah**  
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*The Organic Farmer* is an independent magazine produced monthly for the East African farming community. It promotes organic farming and supports discussions on all aspects of sustainable development. The articles in the *The Organic Farmer* do not necessarily reflect the views of ICIPE nor Biovision Foundation or Biovision Africa Trust (BvAT).

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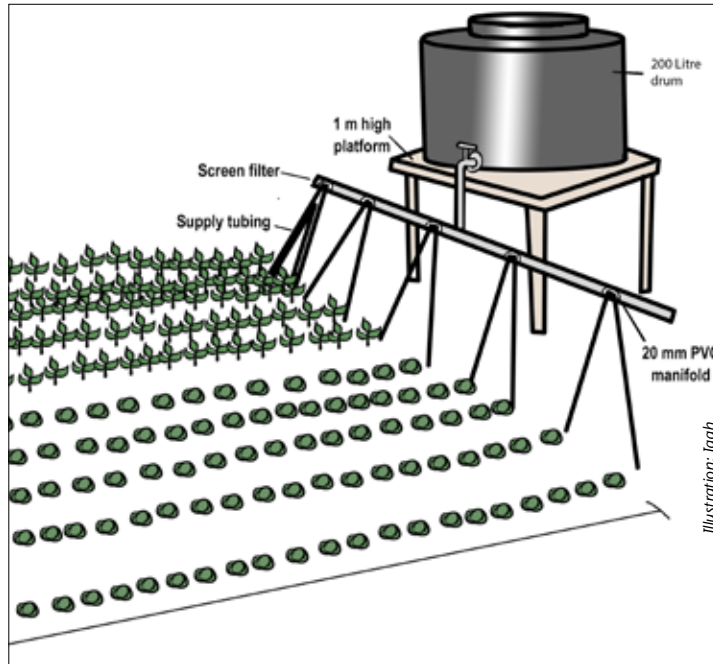


# How to choose the right drip irrigation system

Farmers need to carefully choose the type of drip irrigation system for their farms, depending on the crop to be planted. Always seek expert advice before buying your irrigation system.

**Joan Mukiri** | The best approach in choosing a drip irrigation system is to choose the simplest and efficient system that will require minimal maintenance. Installing an irrigation system requires expert advice. To start with, you need to have a design. Long, straight bed design are more efficient, have economical watering and easier installation process.

The next step is to categorize your plants into groups with similar watering needs for easier organizing of the watering system. It is hard to plan for precise planning that suits each and every plant. But, some general guidelines can be used to create and organize an efficient watering system. There is need to know the type of soil before installing the drip irrigation system.



Regular maintenance ensures that the irrigation system runs efficiently and save money

## Installation of a drip irrigation System

In addition to the parts above, one needs a hose puncher (to attach emitters to the tubing), plugs for plugging unwanted punch holes, a tape measure and metal stakes to secure the

drip lines.

Installation starts by using a water valve in connecting the main water tubing to the water source. This is followed by laying out the tubing depending on the layout selected then punch holes where emitters will be put and close to the root zone

of the plant. The tubing is then secured into the ground using tubing stakes.

Finally, test the system by turning on the water to let it flush out any dirt from the system. Then close the tubing with an end cap.

## Drip system maintenance

An irrigation system needs to be maintained regularly by cleaning or replacing filters, draining water lines using a compressor, checking emitters for blockage, leaks and soil wetness to adjust the watering pressure and schedule promptly. Regular maintenance ensures that the irrigation system runs efficiently and save money.



Checking emitters for blockage

# Know the basics of an irrigation system

An irrigation system consists of various parts but the entire system should be simple, functional and efficient. Some of the essential parts of an irrigation system include the following:

## Valves

Valves allow you to turn water on and off from the primary water source. A valve with a backflow preventer and pressure regulator prevents contaminated water from running back into the initial water source and regulates the water pressure keeping it constant.

Valves are used at various points of the irrigation system and will enable you to shut down some parts of the irrigation system but still water the rest of the farm.

## Filters

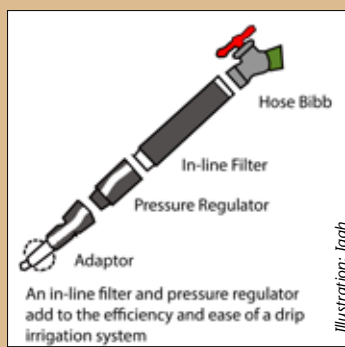
Irrigation systems get clogged. Therefore, one needs to have a filter between the water source and irrigation line. Filters are even more crucial in cases where the water source is unfiltered such as from water ponds.

## Drip tubing

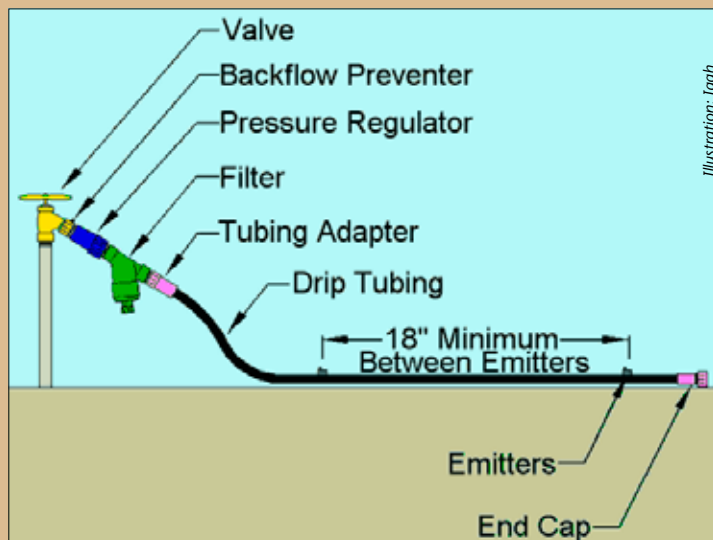
One or more drip tubings can be used to carry water to the plants. Thinner, flexible tubings can be installed to deliver water from the main tubing line to each individual garden bed.

## Tubing adaptor

One should connect a few watertight tubing adapters at different parts in the system.



An in-line filter and pressure regulator add to the efficiency and ease of a drip irrigation system



Adaptors can be used between tubing and emitters to reduce water loss.

## Drip tubing

One or more drip tubings can be used to carry water to the plants. Thinner, flexible tubings can be installed to deliver water from the main tubing line to each individual garden bed.

## Water emitters

When getting emitters, consider the flow rate and coverage (spray diameter). Emitter can be non-pressure –compensating drippers (the lower the flow rate, the lower the pressure, the lower the flow rate), pressure compensating drippers (flow rate remains constant despite the change in pressure) and adjustable sprayers which are suitable.

## End cap

An end cap is placed at the end of the tubing line to stop the water flow once the system is successfully installed.

For more information on Drip Irrigation <http://www.infonet-biovision.org/Environmental-Health/Water-irrigation>

# Push-Pull farmer proves that disability is not inability

After she adopted the Push-Pull technology, Beryl Atieno has seen improved maize yields and fodder for her family's dairy cows including income from milk and maize.

**Amina Day Ojijo** | "No one works harder, longer, to produce so much, for so many, with so little like the African woman," says Greg Mills.

The above statement is true for Maseno Depot Self-Help Group in Western Kenya region. The group is composed of disabled women farmers who support and encourage each other.

One of the members is an extraordinary young woman who has just completed a certificate in General Agriculture from Sigalagala National Polytechnic. Ms Beryl Otieno hopes to advance her knowledge in agriculture with a diploma in General Agriculture. She first heard of the Push-Pull technology when it was introduced to Maseno Self Help Group by researchers from the International Centre of Insect Physiology and Ecology (ICIPE) at Mbita.

## Developed interest in Push-Pull

It is clear from the lush green vegetation in her farm that Ms Atieno has put in a lot of hard work and long hours in her plot. This is evident since her maize farm stands out in the many farms dotting the Maseno landscape.

Says Atieno, "I am a second-born in a family of five children and I was born with this form of disability. I used to really feel bad seeing my siblings and other children run and climb trees and I couldn't join them. But surprisingly, this never kept me down for long because I knew I would find something that I would have a passion for and celebrate like others."

After sitting for her KCSE, she started attending meetings of the Maseno Depot Disabled Group. It is at this meeting that she realised that disability wasn't a barrier since many members of the group lived with disabilities and were successful farmers.

## Adopted Push-Pull

She was surprised at how much the farmers harvested at the end of every season from their small plots. "The group members



Ms Beryl Atieno, a passionate organic farmer and a member of Maseno Depot Self Help Group

encouraged me to believe in myself and not to depend on other people for my happiness." Ms Atieno confessed happily.

Atieno was particularly interested in Push-Pull farming technology which she applied on her family's 2-acre farm. Several members of the group were practising Push-Pull technology in their plots and Ms Atieno got the opportunity to visit their farms to see how their maize was performing.

## Improved livelihood for farmers

From spending time in the farms with the farmers, Ms Atieno discovered more about how the technology works and how the increased yields from the farms were helping in improving livelihoods for other small-scale farmers.'

She decided to try out the tech-

nology back at home. The first attempt she made to convince her parents to let her practise Push-Pull farming in part of the farm was met with resistance.

"My parents thought that due to my disability I would not be able to undertake the demanding tasks the vigorous farming activities. But, when my parents realised that I was not going to relent on my mission, they finally agreed to give me a 10 x 25m plot, as a trial for my farming venture."

## Improved livelihoods for the family

With sheer determination, Ms Atieno has been able to transform a plot full of weeds into a lush green garden. Over the years, her crops have steadily improved in maize yields and soil fertility. Previously, she could only manage to harvest 10kgs of maize from the plot. But, after adopt-

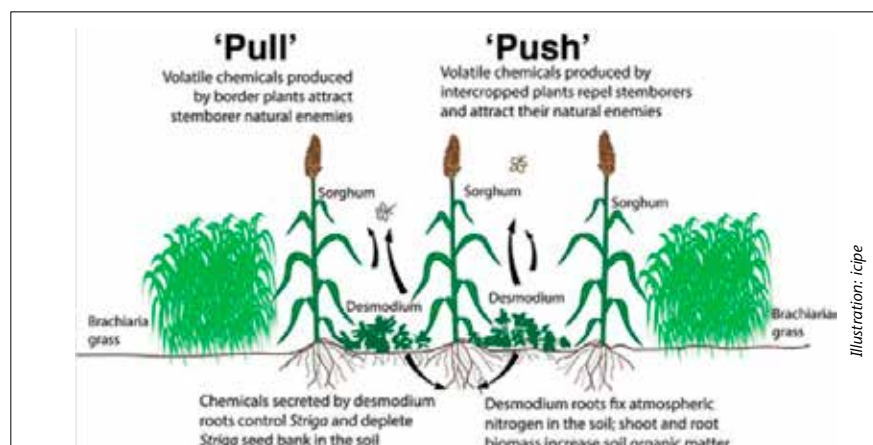
ing the Push-Pull technology, she harvests an average of two (2) bags every year.

She also contributes part of her maize harvest for family consumption and the surplus is sold to meet other family needs. Learning from her success, her family has also adopted the Push-Pull method where the animals feed from the Push-Pull crops and the family has saved the money meant for buying fodder for their dairy cows. Her family has changed from using Napier to brachiaria since it produces more fodder and it is resilient to drought.

## Farm now a demo plot

Ms Atieno's hard work and passion for farming has also seen her become a champion farmer in the region. Her plot is used as a demonstration plot for the Push-Pull technology. This has seen her receive visitors from within Kenya and abroad who have changed her life drastically. She has also travelled to Europe, Switzerland to talk about her experiences as a Push-Pull farmer.

"My advice to farmers is to concentrate on the things they can do very well and not keep on regretting on their past failures." says a jovial Atieno.



Push-Pull technology represents a platform around which livestock keeping and other new income generation activities can be integrated

# Feed your child well for improved health and productivity

Proper feeding is the best investment a parent can make to secure the future of their children, families and nations. Getting the right food during the first five years lays the foundation of a child's health and development later in life.

**Linah Njoroge** | Every year, millions of children under 5 years of age die. In almost half of the cases, malnutrition plays a key role, while unsafe water, sanitation and hygiene are other contributing factors. Child malnutrition comes in many forms and is associated with death and disability worldwide. Child malnutrition can be in the form of stunting, overweight and underweight.

Lack of access to highly nutritious foods is a common cause of malnutrition. Poor feeding practices, such as inadequate breastfeeding, poor diet and feeding habits and inadequate nutritious food, contribute to malnutrition. Infection also undermines a child's nutritional status particularly if it is frequent or persistent. This includes infections such as diarrhoea, pneumonia, measles and malaria.

## Poor feeding interferes with a child's development

Malnutrition at this age can also lead to high susceptibility to infection, disease and increased risk of developing illnesses like diabetes, heart disease and certain types of cancers later in life. Malnutrition in children may also cause poor physical and mental development as well as irreversible damage to children's brain development. Poor feeding can also cause poor performance in school.

Malnutrition in children does not only affect the household but also translates to a large economic burden for countries, which costs billions of dollars due to lost productivity and associated health care costs.

The impact of poor nutrition early in life also has transgenerational effects. For instance, a malnourished woman gives birth to a malnourished girl child who may grow up to become malnourished themselves or even have complica-



*A child feeding on nutritious food after six months of birth*

tions during pregnancy and delivery especially if they were born underweight.

## Causes of malnutrition

The causes of malnutrition can be linked either directly to inadequate dietary intake as well as disease, or indirectly to many other factors. Some of these factors include household food security, maternal and child care, environment and health service delivery.

**Food:** Diets lacking in a variety of healthy, nutritious foods.

**Care:** Poor infant and young child feeding practices, care-giving and hygiene.

**Health:** Poor health access, certain diseases, and unhealthy or unsanitary environments.

**Poverty:** Poverty is a root cause of malnutrition. Poor families often have limited access to nutritious foods, quality health-care, and information about best practices. They are especially vulnerable to malnutrition in times of crisis.

**Inequality:** In many parts of the world, it is women and marginalized populations and ethnic groups that bear the brunt of malnutrition.

Good nutrition is very important for proper growth and development in a child's life. Good nutrition during pregnancy and the first years of a child's life is what provides the essential building blocks for development, healthy growth and a strong immune system. Scientific evidence actually demonstrates that the foundations of a person's lifelong health are largely set during this 1,000-days window. Therefore, it is critical that women and children get the right food at this

time. The right nutrition during the 1,000 days window helps a child in the following ways;

- It builds a child's brain and fuels their growth.
- It reduces disparities in health, and earning potential.
- It improves a child's school performance- readiness and educational achievements.
- Good feeding reduces a

persons risk of developing chronic diseases such as diabetes and heart diseases later in life.

- Good feeding saves more than one million lives every year.

## Feed your child a balanced diet

Adopt good eating habits and ensure that the child's food is freshly prepared using natural foods rather than tinned or canned foods. Remember after exclusively breastfeeding a child for the first six (6) months of life, complementary food is introduced at six months with continued frequency on demand. Breastfeeding should continue until the age of two.

- Increase the complementary food that was introduced at 6 months as the child gets older gradually as you increase the food consistency and variety.
- Increase the number of times that the child is fed: 2-3

*Continues on page 6*

## Plan your child daily feeding

Use child-size plates, cups, forks and spoons. As children grow in years, they are full of exploring and discovery. The best thing you can do is offer your child a variety of foods from each food group with different tastes, textures, and colours. Proper planning of the kinds of and portions of the foods to offer and when and where they are eaten is important. Be creative to provide a variety of dishes as the children's appetite changes often. A child should be eating from all the food groups, which include the following:

**Grain group** – at least 6 servings each day.

**Fruit and vegetable group** – at least 5 servings each day.

**Milk group** – at least 3 servings each day.

**Meat group/legumes** – 2 servings each day.

**Fat group** – 34 servings each day

Water-Drink at least 8 glasses of water each day.

(Refer to November 2017 article for information of the various nutritious foods for a balanced diet).

Foods to avoid include foods that may cause choking. These types of foods are;

- Slippery foods such as whole grapes; large pieces of meats, poultry, and hot dogs and hard candy or sweets.
- Small, hard foods such as nuts, seeds, popcorn, chips, raw carrots, and raisins.
- Sticky foods such as peanut butter.
- Always cut food into small pieces and watch your child while he or she is eating. Also, watch to see if your child may have some food allergies. The most common food allergies are milk, eggs, peanuts and other nuts, soybeans, wheat, and fish. Many children grow out of food allergies. If you think your child might have a food allergy, see your doctor.
- Set a good example of healthy eating for your child.
- Plan regular meals and snacks and give kids enough time to eat.
- Plan a quiet time before meals and snacks. Kids eat better when they are relaxed.
- Do not use food as a reward for your child. Remember that improving children's nutrition is the best investment that we can make for them.

# Living with bees brings honey and money to farmer

Mr Nyamu has started beekeeping in apiaries built on top of houses in his small compound from which he produces quality honey that has become his main source of income.

**Peter Murage** | Bees are friendly insects and can be integrated with human beings without any conflict as demonstrated by Mr Nyamu Kihiu popularly known by locals as *Njuki Nene* (large bee). His passion for beekeeping was ignited by his infertile land (about 0.20 acres) situated in Thunguri village in Kianga sub-location Kirinyaga West, which could not be put into any other profitable agricultural enterprise.

## Group keen on environmental health

Mr Nyamu is a founding member of Kianga Adult Self-Help Group which consists of 20 members. The group's focus is to conserve the environment through beekeeping. *TOF* magazine has provided the group with a wide range of information on beekeeping especially stingless bees which they aspire to venture into soon.

Through information from *TOF* magazine, the group was able to reach out to Peter Murage, the Biovision field Officer who has been instrumental to the group by providing practical information on beekeeping as well as bio-intensive



Mr Nyamu Kihiu processing honey after harvest

kitchen gardening. The group owns more than 100 hives housed in Mt. Kenya forest from which they harvest honey twice



Apiaries made in storied houses

a year.

## Apiaries built on the second floor

Mr Nyamu has more than 70 hives, housed in apiaries made in storied houses, surrounding his small compound and even on the ceiling of his own house.

Within his compound, visitors are received by the friendly bees that pose no threat to humans. He has planted trees all around the compound where the

bees forage, reducing any conflict with people living in the compound. His children, visitors and neighbours have had

no attacks from bees since he started the venture 8 years ago. But how does he tame the bees?

"When there are many people in the compound, I usually take out some honey in cup or plate and place it on the ground. The foraging bees fly directly to the honey and start eating it, leaving the visitors alone. I also encourage people to remain calm and not to provoke the bees in any way. This way, we have coexisted with the bees peacefully and we have not had any problem," he answers.

Mr Nyamu considers each apiary as an additional acre of land. "I have a total of 14 acres of land which I depend on," he says jokingly. But, he quickly points out that he only owns 0.20 acre of land.

## Beekeeping an easy source of money

Mr Nyamu says that this is the easiest type of farming one can indulge in. Having 70 bee hives from which he harvests honey twice or thrice a year, "I sell 1 litre of refined natural honey for Ksh1,000 as it is pure honey and Ksh 400 per kilogramme of beeswax," he reveals. His honey is in high demand as it contains no preservatives and additives, which many unscrupulous honey merchants put in their honey to increase quantity for greater profit.

## Good income from beekeeping

In a year, Mr Nyamu harvests an average of 300 kilogramme of crude honey from which he gets 200 kilogrammes of refined honey and 70 Kg of beeswax. "I get stings several times while harvesting honey. But, that is the sweetness of beekeeping," he says cheerfully.

One litre of honey is sold at Ksh1,000. Mr Nyamu makes Ksh 200,000 from selling honey plus an additional Ksh 28,000 from beeswax, earning him Ksh 228,000 from beekeeping.

"All one requires are beehives, a place to keep the hives and the bees do the rest," he says.

The earnings from honey has enabled him to venture in indigenous poultry keeping, a skill he also learnt from *TOF* magazine. He now supplies 800 eggs every week to customers in Nanyuki from which he earns an extra income.

For more reading on beekeeping <http://www.infonet-biovision.org/AnimalHealth/Beekeeping>

## Feed your child well for improved health and productivity

cont'd frm pg.... 5



meals per day for infants of 6 to 8 months of age and 3 to 4 meals per day for infants of 9 to 23 months of age, with 1 or 2 additional snacks as required.

- Feed your child directly and

assist older children. This is called responsive feeding. Feed slowly and patiently, encourage them to eat but do not force them, talk to the child and maintain eye contact.

## Practise hygiene

- Practise good hygiene and proper food handling to avoid unnecessary infections.
- Use fortified complementary foods or vitamin-mineral supplements as needed especially during illness.

For every dollar invested in improving nutrition early in young children, yields a return of USD48 (Ksh 4,944) in better health and economic productivity. There is no better investment parents can make to secure the future of their children, families and nations than proper feeding.

For more reading on health [http://www.infonet-biovision.org/healthy\\_food](http://www.infonet-biovision.org/healthy_food)

# Growth activator is effective in composting and silage making

Can EM speed up the process of composting? What is the benefit of EM during silage making? From a farmer in Murang'a County

Dear Farmer,

Effective Micro-organisms (EM) is a combination of useful micro-organisms that exist freely in nature and are not manipulated in any way. EM comes in a liquid form and consists of naturally-occurring beneficial micro-organisms. EM is now produced in many countries and uses the strains of the appropriate micro-organisms that occur naturally.

EM is a combined culture of aerobic microorganisms (requiring oxygen to survive) and anaerobic (requiring no oxygen to survive) that co-exist together to the mutual advantage of both (symbiosis). EM combines with the existing microorganisms within the soil. They work together to build a healthy living soil. EM is not toxic. It is safe for humans, animals and the environment.

Current research indicates that EM cultures can suppress soil-borne pathogens, accelerate the decomposition of organic wastes, increase the availability of mineral nutrients and useful organic compounds to plants, enhance the activities of beneficial micro-organisms, e.g. mycorrhizae, nitrogen fixing bacteria, and reduce the need for chemical fertilizers and pesticides. EM helps to increase beneficial soil micro-organisms and suppression of harmful ones.

## EM consists of the following five families of micro-organisms:

**Lactic acid bacteria:** These bacteria are differentiated by their powerful sterilizing properties. They suppress harmful micro-organisms and speed up the process of composting.

**Yeasts:** These manufacture anti-microbial and useful substances for plant growth.

**Actinomycetes:** These suppress harmful fungi and bacteria in the soil and can live together with photosynthetic bacteria.

**Photosynthetic bacteria:** These bacteria play the leading role in the activity of EM. They produce useful substances from the secretions of roots, organic matter and/or harmful gases (e.g. hydrogen sulphide) by using sunlight and the heat of



*EM increases beneficial soil micro-organisms and suppresses harmful ones. The fungi in EM brings about fermentation*

soil as sources of energy. They contribute to a better use of sunlight or, in other words, better photosynthesis (the process by which plants make food). The metabolites developed by these micro-organisms are directly absorbed into plants. In addition, these bacteria increase the number of other bacteria and act as nitrogen binders.

The fungi in EM bring about fermentation that helps break down the organic substances quickly. This suppresses smell and prevents damage that could be caused by harmful insects such as houseflies.

## Aerobic composting

During this process, oxygen is required for the composting process. Turning the contraption often and adding water keeps the materials moist. Adding EM to a compost pile helps increase the air flow into the pile, increasing the aerobic microbe populations in the pile. This means you can get more air transfer in a pile with less turning. It will give a complete breakdown of organic matter in your compost and also give a higher quality compost. This means that a higher growth index will be experienced resulting to better growth rate from plants as a result.

## Use of EM in silage making

In this process, no oxygen is required. The silage making occurs in an airtight pile. The benefits over aerobic composting system is that it doesn't generate heat. So it retains all the energy that would usually be

lost in the process of composting. This makes it effective and more digestible to the soil. The anaerobic system requires that the silage material is compacted down to remove air, covered with a plastic sheet and secured. No turning is required.

## EM produces better silage

The cover prevents the loss of moisture and also leaching through excess rain or water seepage. The silage material usually has high energy and nutrient levels than a conventional aerobic composting because the heat generated is much lower, and no leaching occurs because of the cover. This process is similar to making silage where we get a process more towards fermentation than decomposition. A good example as to why this process is important is that the silage making process produces fodder that is more digestible to cows and other animals that eat it. The EM-based silage making process makes the material more digestible for animals.

## Semi-anaerobic composting

This is a quick fermentation method. Organic materials in form of carbon (leaves, grass, wood chips, sawdust, crop residue e.t.c) are collected and piled. If adding fresh manure (cow, horse, chicken, pig, rabbit, e.t.c), mix at a ratio of 1 carbon: 20 parts manures. As the materials are piled, add water with a solution of EM1, molasses, and water (1:1:100). The moisture content of the pile should be about 30-35%

moisture.

Once this is achieved, cover the pile with a tarp or polyethylene sheeting and weigh down (press down) with rocks, tree logs or anything heavy. Fermentation will take in about two weeks. The longer you let it sit, the better. After the fermentation cycle is complete, the materials are ready to be incorporated into the soil. You will likely see white mold on the pile. This is a beneficial mold and is a sign of success in composting. Depending on what was used (food scraps, e.t.c.) you will not want to mulch with this material as it will attract animals. If it is made only with plant material, you can mix it with compost or bark mulch to use as a mulch.

## EM effect on soils, crops, weeds and diseases.

Results show that in most cases EM gives positive results. EM is not a substitute for other management practices. EM technology is an added dimension for optimizing our best soil and crop management practices such as crop rotations, use of composts, crop residue recycling, and biological control of pests.

## Improves soil fertility

If used properly EM enhances soil fertility and promotes growth, flowering, fruit development and ripening in crops. It can increase crop yields and improve crop quality as well as accelerating the breakdown of organic matter from crop residues. The population of beneficial micro-organisms in the soil is also increased helping to control soil diseases through competitive exclusion (suppression of harmful fungi and bacteria).

Farmers should know that EM is not a pesticide and contains no chemicals. EM is a microbial inoculant (any substance that helps to produce or increase immunity) that works as a bio-control measure in suppressing and/or controlling pests through the introduction of beneficial microorganisms to soils and plants. Pests and pathogens are suppressed or controlled through natural processes by enhancing the competitive and antagonistic activities of the microorganisms in the EM inoculant. Farmers can call TOF magazine for additional information. *Answers Elkanah Isaboke*

For more reading on EM <http://www.infonet-biovision.org/PlantHealth/Composting>

## TOF Radio answers your questions

TOFRadio is broadcast on KBC on Thursday at 8:45pm and Mbaitu FM on Friday at 8.30pm. Tune in and listen to farmer experiences and expert advice on agribusiness and eco-friendly farming methods. On this page, we respond to some of the issues raised by farmers in their correspondence to the radio program. Send your questions and comments via SMS 0715 916 136.

### A mango factory changes the fortunes of farmers in Makueni



Photo: Charles Kimani

The installed plant will solve the multiple challenges faced by mango farmers in the region. The plant's main objective is to improve the livelihoods of local farmers by boosting production and facilitating trade through value addition

**Charles Kimani** | As Kenya adopted the new constitution in 2010, agriculture was one of the functions that was devolved. Devolving agriculture to the county aimed at enhancing service delivery to the grassroots farmers and improve food security in the country. The beauty of devolving agriculture is that devolved governments are better-placed to promote agriculture at the local level.

Makueni County Government is one of the counties that have embarked on improving the livelihoods of farmers by rolling out projects such as water pans, greenhouses, factories to make farming easier for the farmers to market their products. The county's main agriculture activities include mango, maize and livestock production.

#### Mango farming

Mango is a popular fruit in Kenyan market and other parts of the world. In Kenya, the fruit is grown on large-scale in the lower Eastern parts of the country such as Machakos and Makueni, Elgeyo Marakwet county and the Coastal region. The fruit is mostly produced by small-scale farmers for both export and domestic consumption. The produce from Makueni is mostly consumed in the local market.

There are about 32 mango varieties grown in Kenya. The common varieties grown in Makueni are tommy and apple. The apple variety is preferred because it is the most preferred variety by the consumers and is sold at a higher price compared to the other varieties. The county has experienced massive planting of new mango trees with 46 per cent of households selling mangoes. The setting of the factory will ultimately see more farmers taking up mango farming.

#### The challenges faced by mango Farmers

Makueni County produces a bumper harvest of mangoes. Most farmers harvest the fruit at the same time creating a surplus in the market. Due to oversupply of the fruit in season, most farmers end up selling their produce at low prices (Ksh 3 - Ksh 5 at the farmgate and Ksh 20 in the market).

In setting up the mango processing plant, the county seeks to address the multiple challenges of low prices and post-harvest losses. The fruit fly is another problem that affects the mango fruit. The pest leads to huge losses thus reducing production.

#### Establishing a fruit processing plant

The Makueni fruit processing

plant is the county flagship project. The installed plant will solve the multiple challenges faced by mango farmers in the region. The plant's main objective is to improve the livelihoods of local farmers by boosting production and facilitating trade through value addition.

The plant has a capacity to handle 20,000 metric tonnes of mangoes, 20,000 metric tonnes of citrus, 1,500 metric tonnes of avocado and 5,000 metric tonnes of bananas all valued at 20 billion.

Initially, the plant will produce mango puree (pulped fruit). But, as production stabilizes the plant will produce mango juice, bottled water and process other fruits such as avocado, passion fruits and citrus. The plant was expected to commence full production in November 2017.

#### Management

Once the factory is fully operational, the county government of Makueni will hand over plant ownership and management to the local community through local cooperatives. Currently farmers are forming groups that will give them bargaining power and enable them to access more markets and better prices for their mangoes.

#### Improving quality and quantity

As mentioned, one of the major

**Beehives for sale:** We make beehives for sale. Interested farmers can make orders on any quantity they require. The following are prices for various hives: Langstroth Ksh 4,500, Kenya Top Bar Hive Ksh 3,800, Stingless bee hives cost Ksh 400 and Ksh 1,500 depending on size. Interested farmers can call Stephen on 0734 371 557.

**Jersey Heifer wanted:** I would like to buy a healthy Jersey Heifer preferably incalf for 5-6 months. Call 0722 357 918.

**Fleckvieh bull for sale:** I am selling a 1½ year old Fleckvieh bull. Call 0726 434 521.



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problems faced by mango farmers is the fruit fly (*Bactrocera frauenfeldi*). The fly attacks mango fruits leading to poor quality, yielding and great loss. To alleviate and control the fly, the government of Makueni is training farmers on biological ways of controlling the pest using fruit fly traps, a project partly funded by Biovision Foundation through ICIPE.

#### Future plans

In the 2015-2016 financial year, the county government distributed over 4,000 fruit fly traps and continues to train farmers on how to use them. The fruit fly trap is in line with the county plan of producing chemical-free fruits that fetch high prices both locally and internationally. To increase the number of mango trees, the county government gives farmers a free mango seedling for every single seedling they plant.

#### Improving livelihoods

The plant targets to engage 12,000 farmers who will supply the required fruits through their respective cooperative societies. The plant's products will be sold in the local and export market.