



'ARBO' comes to KAGRC: In our March 2019 TOF issue, we informed you that following our article on breeding the Kenya Animal Genetics Resource Centre (KAGRC) had selected the top Gir bull from Makitsha farm called 'ARBO' for semen production and sale to farmers. We are happy to inform farmers that 'ARBO' has been brought to KAGRC's AI Station in Kabete, Nairobi. From January next year farmers will start buying its semen (see story below)

Farmers can now get top breed from Brazil

Peter Kamau | At the close of last year, we featured the advantages of cross-breeding in animal production (TOF No. 163, December 2018). As an example, we featured Makitsha Farm in Malindi to show farmers how the

farm has succeeded in increasing milk production in a hot and humid environment where most exotic animal breeds cannot survive.

In our editorial, we emphasized the need for the government to allow cross-breeding in order to develop highly productive animal breeds that can do well in our arid and semi-arid areas. Since then, we have been swamped with enquiries from farmers across the country who want to get in touch with Makitsha farm in order to buy the Gir cross-breed cows from the farm to cross with their animals.

Other farmers made enquiries from State Department of Livestock seeking to know if it was possible to get this breed to introduce it in their farms. However, we are happy to report here that the government has acceded to their requests.

The Kenya Animal Genetics Resource Centre (KAGRC), Kabete has taken one of the Gir bulls from Makitsha farm for semen production. This is a very important development for livestock farmers. It means that they can now be able to get

the Gir breed through Artificial Insemination (AI) services from anywhere in the country.

The KAGRC should not stop there. In order to stop the problem of inbreeding for this breed due to its popular demand, they should work closely with Makitsha farm to make sure that more top-performing cross-breed bulls from this line are brought into the country.

These can be done through Makitsha Farm or direct imports of other top, hardy breeds such as Sahiwals from Australia and New Zealand. The idea here is to try and develop highly productive breeds that require a low level of management and which can convert poor quality forage into milk and meat.

Such an initiative will not only boost the quality of dairy cows in the country, but will also enable pastoralists in Northern Kenya to have livestock breeds that produce more milk and meat for food but also empower them to contribute to the socio-economic development of the country through sales of livestock and their by products.

Dear farmer,

As we approach the end of the year, many farmers especially in maize growing areas are planning to harvest while those in medium altitude areas such as Ukambani, Kirinyaga, Nyeri, western Kenya and Nyanza region are already planting maize and beans to take advantage of the short rains that have just started.

However as these farming activities continue, we have always advised farmers to take their farming activities as a business. This means that apart from growing crops for their own consumption, the choice of crops during each season should take into account the need to make some extra income to meet their other needs.

Beginning the months of October and November, many farmers with an eye for the market set up nurseries mainly for tomatoes, cabbages, onions, *sukumawiki*, courgettes, egg plant, *dhania* (coriander), cauliflower and even indigenous vegetables. By putting up such nurseries, the farmers are planning ahead especially during the dry season when all these vegetables are in great demand.

In any business a farmer needs to plan ahead and also make small surveys to know what will be in demand in say, three months from now, who are your competitors? What are they planting? When will your competitors hit the market with their produce? Any farmer who makes such a survey will always stay ahead if they make the right choice of what to grow.

The issue of water availability is also very crucial. If growing in the dry season, the crops will require irrigation. Water harvesting is therefore very critical this time. Farmers should plan their water requirements in advance and ensure they have adequate water both for irrigation and also for domestic use. Irrigation water should be adequate to sustain crops until they are ready for the market.

In this issue we have featured kitchen gardens. Every family with some space to spare in both urban and rural areas should have a kitchen garden. Such gardens can be a source of vegetables and even fruits during the dry season. The gardens can save money spent in buying vegetables during the dry season.

In this issue

Lucerne for fodder 2



Tuta absoluta menace 3

Kitchen gardens 6

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Lucerne is nutritious fodder for dairy cows

Because of its high nutrient value, lucerne can reduce use of commercial dairy meal by 80 per cent. It is easy for animals to digest and can be planted to supplement other sources of fodder in the farm.

Lilian Maina | Lucerne, also known as alfalfa, is one of the most important fodder crops that a dairy farmer should have in the farm. The term Alfalfa is an Arabic word meaning “best fodder” because of its palatability and its high feeding value. It can replace up to 80% of commercial feeds purchased for the dairy cow. Despite the immense benefits it brings, many farmers do not know its benefits. Lucerne can be grown in many areas across the country.

Practice by farmers

The practice by many farmers is to grow more forage rich in carbohydrates such as Napier grass, Rhodes grass, fodder maize, fodder sorghum among others.

The production of carbohydrate-based pastures is done out of lack of knowledge on the feeding and nutrient requirements of farm animals. More quantities of the same type of feed leads to low milk production.

Lucerne is not the only legume that can be incorporated in the pasture profile. There are many legume species commonly used as pasture or fodder but lucerne has many advantages over other fodder crops. It has a very high protein content (15 – 25%), highly digestible (60 – 75%) and has high levels of energy (ME 8 – 11MJ/kg DM). It comprises about 50% of all protein supplements in livestock feeds. It can also be made into pellets and stored in bags.

Reduce soil acidity

Lucerne grows well in deep soils that are not acidic. Acidity in soils can be corrected by applying lime or even adequate compost. If the area is dry the crop can be put under irrigation. The plant is perennial with very deep roots that can go up to 6 metres under, so it can survive drought once established. Lucerne can be harvested 3 – 4 times in a year if the rains are good. There is no need of replanting because it has the ability to re-grow from the cut stems. This ability to re-grow is very important because it



eliminates the need for recurrent land preparations and sowing.

Lucerne fodder conservation: To the farmer, the most important quality of lucerne is its ability to be conserved. Other legumes have very poor storage qualities. Lucerne can be conserved as hay and fed to animals at a later date. This is important during dry periods when pastures are scarce, but even more important it allows the farmer to organize a comprehensive feeding plan for the herd. The assurance that adequate quantities will be available throughout the year makes it possible to formulate suitable rations and project the potential amount of milk that can be produced in the year.

Establishment

One impediment that has

impeded farmers is their lack of knowledge or skills on how to establish the crop. Many farmers simply purchase lucerne seeds from agrovets shops and sow them directly into improperly prepared seedbeds. Some of those who have attempted to inoculate the seeds have done it wrongly. The outcome has been very poor germination thus discouraging the farmers from establishing the crop.

Inoculation: The correct way to establish lucerne is by first properly inoculating the seeds. Appropriate inoculants are available in some agrovets. Call Mea Ltd on 0725 143 996. They will direct you where to buy the inoculant in your region.

For a good sticker make a solution of sugar or molasses in molasses and water at a ratio of 1:4. Thoroughly mix the sticker with lucerne seeds, ensuring that all the seeds are covered by a thin layer of the sticker. Then pour the inoculant on the mixture and mix thoroughly. Do not expose the inoculant to sunshine because it can kill the bacterium. Coat the resulting mixture with lime. This activity should be carried out shortly before sowing.

Sowing: Use certified seeds to sow on rows 45cm apart on a fine, moist and weed free seedbed at a rate of 3kg to 4kg per acre. The soils should be deep and well drained. Avoid any soils that are saline, waterlogged or those with damaging herbicides. To avoid scorching of the seeds with fertilizer, ensure that the seeds are planted with adequate compost or organic manure.

Sow the seeds shallowly at a depth of 5 to 15mm and cover with light soils because they may not emerge if sown deeper than 20mm and covered with deep soil. Lucerne needs sufficient moisture to germinate therefore sowing the seeds at the beginning of the rainy season or when you are sure that enough rains

will follow soon is important. Irrigate the seedbed if the soils are dry and continue this until all the seeds have germinated and strong enough to withstand low moisture levels. Ensure that there are no weeds affecting the crop.

Harvesting: Depending on rainfall and climatic conditions, the first cut should be made when the crop is around 40mm tall, has several stems and appears bushy. Cut when about 10% of the crop is flowering because if done earlier it can reduce the lifespan of the stand. Thereafter the crop can be harvested every 4 -5 weeks under irrigation or 3 months under rainfall. This can go on for 5 years when the crop should be replaced. Cut the crop at the base 50mm above the ground and allow 2 to 3 days in the field for the leaves to wilt before raking and baling. The wilted crop is ready for baling if the skin around the stem can be easily removed. Do not let the leaves to overdry because of the risk of severe losses in nutrients. Start baling very early in the morning as dew helps in reducing losses. Collect and remove the hay from the field as soon as possible and store in a barn protected from rainfall and sunshine.

Under good management, yields can be more than 8 tonnes per acre. Given that on average a cow is fed about 15kg per day on top of the grasses to satisfy its nutritional requirements, an acre is enough to feed 2 cows for one year. This is an immense saving given the high costs of commercial feeds.

Conclusion

In conclusion, the single most important forage crop that can bring sufficient increases in milk production when introduced to the dairy herd is lucerne and farmers are well advised to take this crop very seriously.

For more information on fodder production https://infonet-biovision.org/fodder_production

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Use IPM methods to control *Tuta absoluta* damage

The *Tuta absoluta* pest has caused a lot of damage to tomatoes. Since the pest has become resistant to all chemicals, ICIPE scientists have developed environmentally safe technologies to control it.

Shepard Ndlela and Samira Mohamed *| *Tuta absoluta* is a small, yet highly destructive pest that mainly affects tomatoes. The pest originated in South America but has since spread to several countries in Europe, Asia and almost all countries in Africa within a short time, causing huge losses to tomato farmers.

Chemicals not effective against pest

The pest is still a menace to tomato production in Kenya. Use of synthetic chemicals to control it has failed. In an effort to subdue the ever-increasing populations of the pest, most farmers have resorted to widespread use of unauthorized broad-spectrum synthetic insecticides that are not recommended for use on fruits and vegetables.

To worsen the situation, the effect of synthetic insecticides has been short-lived as most of these products are no longer effective. Such a scenario is called "pesticide resistance" and is a much bigger challenge as it amounts to being defeated by the pest.

Integrated Pest Management (IPM)

IPM is a highly effective approach to pest management, a pillar of crop protection and production, which utilizes various pest management strategies in a compatible manner. IPM relies on the farmer's knowledge to guide decision making regarding the pest, when to start control measures and how to control it.

IPM also encourages the adoption of the most economical methods in terms of cost, ease of application, as well as safety to human, animal and environment. Farmers must know the pest and its behaviour to be able to fight it.

The International Centre of Insect Physiology and Ecology (ICIPE) together with Biovision Foundation are implementing a systems approach project in Kenya and Uganda, dubbed "Combating the invasive tomato leafminer, *Tuta absoluta* through the Implementation of eco-friendly IPM approach on Tomatoes in East Africa (*Tuta* IPM)". The purpose of this project is to implement, disseminate and promote, a sustainable and eco-friendly Integrated Pest Management

(IPM) approach for reduction of tomato losses brought about by *Tuta absoluta* infestation leading to increased yield and quality of tomatoes.

Tuta absoluta behaviour and damage



The pest usually hides under plant leaves during the day and sometimes leaves the tomato orchard or greenhouse to seek refuge in the surrounding vegetation. It is at sunset that

the female and male moths start flying around, mating, resulting in fertilized females which lay eggs on the tomato leaves, flowers, stems, and tomato fruits.

Each *Tuta absoluta* female moth can lay up to 260 eggs during its 30-40 day lifetime. If it is not controlled, one moth in the orchard, garden or greenhouse can produce up to 7800 moths assuming it survives for 30 days. The tiny *Tuta absoluta* caterpillars tunnel into leaves, eating the green part of the leaf, causing the leaves to dry out.

They also tunnel into tomatoes causing deformities and rotting due to secondary infection. The caterpillars also move from one tomato or plant to the next

by swinging using a silk web they produce, resulting in more damage to fruits and plants.

ICIPE scientists to the rescue

ICIPE continues to receive reports from farmers that insecticides which used to be effective in controlling *Tuta absoluta* no longer work. This is expected because the pest is known to develop resistance to major synthetic pesticide due to its high reproductive capacity, producing many generations per year.

Increased pesticide use

This has forced farmers to spray their crop frequently, resulting in high levels of pesticide residue in the tomatoes that reach the market. There are fears that excessive chemical pesticide residue in tomatoes being consumed by people may lead to chronic diseases such as cancer and other unknown ailments. Chemical pesticide residues also contribute to the development of neurodegenerative diseases such as Parkinson's disease, Alzheimers, etc. Thus, Scientists encourage the use of IPM strategies in controlling pests in tomatoes and other vegetables.

In the next issue we will look at various environmentally safe methods that farmer can use to control *Tuta absoluta*.

*Dr Shepard Ndlela and Dr Samira Mohamed are ICIPE scientists working in the *Tuta absoluta* control project.

For more information on natural pest control chapter https://infonet-biovision.org/natural_pest_control



A healthy tomato crop (left). The same field 3 weeks later after *Tuta absoluta* invasion (right)

Aflatoxins: The unseen poison in food that can kill

Proper drying of cereal crops such as maize, sorghum and wheat can prevent the development of moulds that contain aflatoxins - a very poisonous fungi that affects people and animals if consumed in food or feed.

Beritah Mutune* | Aflatoxin is a poisonous mould or fungal growth that develops in cereal crops, fruits, nuts and spices that are poorly stored in humid conditions. They cause cancer in humans (carcinogenic) stunted growth, digestive problems, reproductive disorders, suppression of immune system and liver cancer in both animals and people.

Aflatoxins are found in various foods including peanuts, peanut butter, bread, cakes and mainly maize, which are consumed largely in Kenya. Consumers of such foods need to be aware that aflatoxins are very toxic. They are capable of causing health problems that are difficult to treat or reverse.

Aflatoxins thrive well in areas with high moisture and temperature conditions. Chicken feed with aflatoxins can cause instant death to chickens and other birds. Aflatoxins in animal feed can be transferred to people who consume animal products such as milk, meat and eggs.

What can you do to avoid aflatoxin and lower its risks?

Aflatoxins enter the body through consumption of regularly eaten foods, especially grains and legumes, so making changes to your diet is the first step. Secondly, certain supplements can also help the body detoxify itself of aflatoxin and raise immunity against its effects.

What does aflatoxin do and where does it come from?

Aflatoxin is a type of "mycotoxin" which is produced by two different species of mould mainly *Aspergillus flavus* and *Aspergillus parasiticus*. There are natural moulds found in most areas in Kenya. Aflatoxins affect the way that cells reproduce and also target the liver, affecting the way that other substances are metabolized and eliminated, and possibly increasing food allergy reactions.

These moulds and fungus grow in food. Unfortunately,

aflatoxin makes its way into some popular "healthy" foods. Farmers are advised to be cautious once they harvest crops depending on how they are handled, processed and stored, since all of these can determine whether or not aflatoxins are able to survive and thrive.

Aflatoxin symptoms and health risks

Aflatoxin poisoning usually occurs in two ways: Either one can consume large amounts at once and experience "poisoning", or slowly acquire aflatoxins over time in smaller quantities.

Some of the symptoms that aflatoxin exposure can cause include:

- Food allergies.
- Inflammation of the heart.
- Damage to the digestive organs including the liver and kidneys.
- Possibly a higher risk for liver cancer.
- Slow growth and development (stunting).

One of the biggest threats is the symptoms seen in patients with liver diseases: Vomiting, abdominal pain, water retention, pulmonary oedema, convulsions, coma, and even death. Long-term exposure to aflatoxins is a major risk factor for cancer of liver, which causes liver scarring (disfiguring), loss of nutrients, coma, haemorrhages, inflammation of the digestive tract, malabsorption, mental impairments, fatigue, and other serious problems that can lead to death.

How to avoid aflatoxin-contaminated food

The foods and crops most likely to be contaminated with aflatoxin include: Peanuts, maize, milk and cheese, nuts (especially almonds) grains, soybeans and dried spices.

Experts believe that the biggest threat of aflatoxins to human health globally is the contamination of maize, since it's such a widely-consumed staple crop in many parts of the world.

Aflatoxins in maize is a big concern for liver disease formation. Aflatoxins in peanuts are another major concern for the same reasons. Peanuts are consumed in high amounts globally, they are used in many other types of processed foods (peanut butter, cereals, packaged snacks like cookies, ice cream, etc).



Rotten maize after a harvest: Such maize should not be fed to animals as it has high aflatoxin levels which end up in milk, meat and eggs

Does cooking and processing peanuts and maize help to reduce aflatoxin?

Aflatoxin moulds are not entirely eradicated even when maize, grains, peanuts or other foods are processed or roasted, so it can even show up in foods like peanut butter and many processed products. Industrial procedures used in the processing of maize, legumes, soy and peanuts can help to reduce contamination, but the risk still cannot be completely eliminated.

Does heating processes reduce aflatoxins in grains, peanut and maize?

Heating processes performed at temperatures between 100 and 150°C for one and a half hours can help reduce the level of aflatoxin. However, this isn't exactly a great solution because high heat has the ability to alter other nutrients found in legumes, destroy vitamins and make them taste and smell bad.

What else can you do to avoid aflatoxin contamination?

Here are several tips that can help you avoid contamination:

- Don't keep grains and nuts for long periods of time. Try consuming them ideally within 1-2 months.
- Buy the mostly fresh produce as much as you can, ideally those grown close to your location and not imported ones.
- Reputable, small-scale farmers who grow organic crops are most likely to harvest them at the right time and keep them stored properly.

- Store grains, maize and nuts in places that are cool and dry to prevent mould growth. You can even freeze them to prolong freshness.
- Soak, sprout and ferment grains, beans, legumes, nuts and seeds before eating them! Lactic acid produced during fermentation reduces mould growth and aflatoxin production because of competition for nutrients between bacterial cells and mould/fungi. Lactic acid also binds aflatoxins in grains, legumes and nuts, cuts off its energy supply, also boosts availability of other beneficial proteins, vitamins and enzymes.
- There's also some evidence that eating detoxifying vegetables like carrots and celery reduces the carcinogenic effects of aflatoxins and helps cleanse the liver.

Some supplements can boost detoxification effects, cleanse the liver and improve digestion. Activated charcoal is one of them. It can help bind to aflatoxin mould and carry it out of the body more easily.

Farmers should avoid feeding their livestock with contaminated maize cobs and fodder as the aflatoxins are passed through milk and meat which are later consumed by people thus causing aflatoxin poisoning.

**Berita Mutune is a consultant at the ICIPE Technology Transfer Unit (TTU)*

For more information on food and feed poisoning in livestock <https://infonet-biovision.org/AnimalHealth/Plant-and-Other-Poisoning>

Embrace plant-based diet to attain universal health

The Eat-Lancet Commission has recommended that people eat more plant-based and cut the consumption of animal-based foods and processed sugars by 50 per cent.

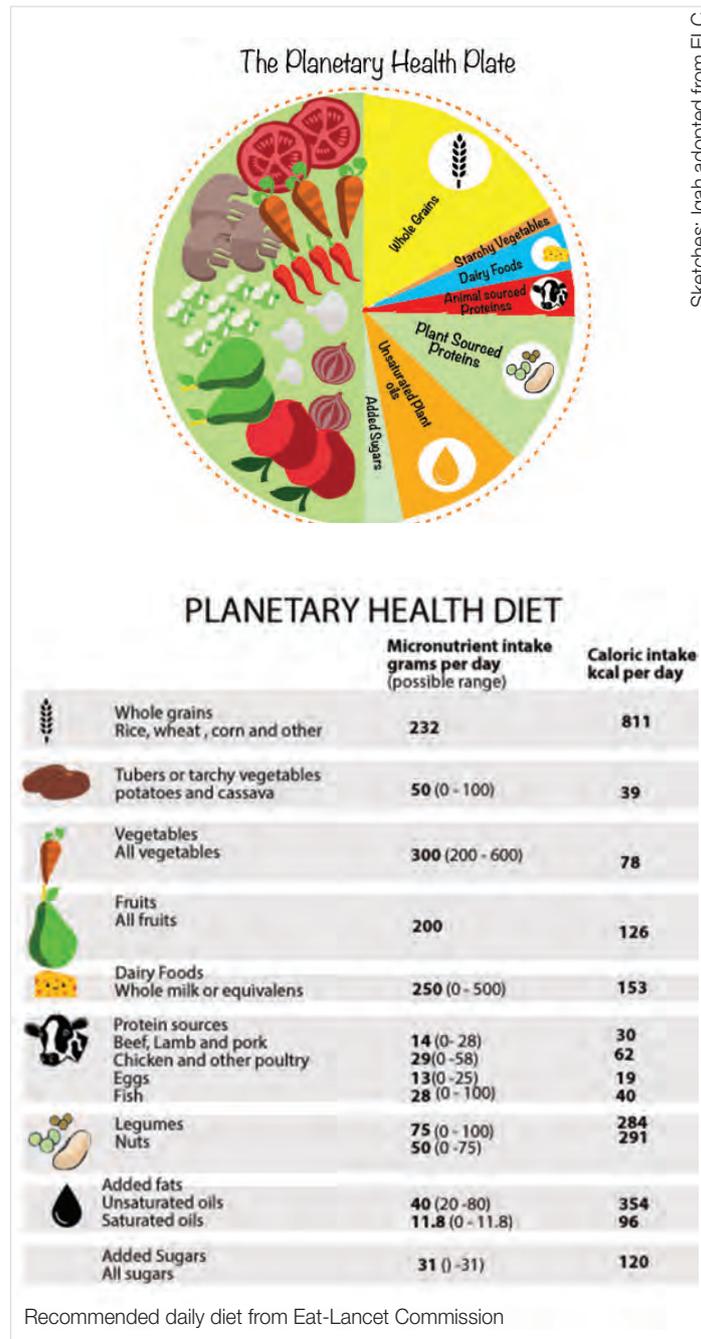
Mary Mutisya | Globally, cases of malnutrition statistics stand at 3 billion people. With the expected rise in human population by 2050, this number is expected to rise and more so with the current poor food production systems. This trend has been a key area of concern for various sectors, firstly because a poorly fed nation is a sick nation and secondly the fact that a sick nation is a poor nation.

To this end, therefore, several strategies have been developed, among them the EAT-Lancet Commission on healthy diets from a sustainable food system, a move which is timely and sheds a ray of hope in promoting improved nutrition.

Need for change in production systems

According to the commission which consists of 37 world leading scientists in various fields and from different parts of the world, it is possible to feed the expected population of 10 billion people on healthy diets and within planetary boundaries. However, for this to be attained, various transformations have to be made. Some of these are outlined below:

1. Adjustments in eating habits.
2. Improving on food



Sketches: Iqan adopted from ELC

3. Reducing food waste.

Recommended healthy eating habits

From the findings of the EAT-Lancet Commission, a strong link does exist between human diets, health, environmental sustainability and human health. As a way of solving the problem, the commission has developed a sustainable diet commonly referred to as the planetary health diet.

Reduce red meat and processed sugars

This diet is largely plant-based, has less animal-based foods, refined grains, highly processed foods and added sugars. The concept of the diet is to allow an average consumption of about 2500 calories a day and by adhering to this, the world consumption of red meat and sugars will have to reduce by at least 50% while at the same time the consumption of nuts, fruits, vegetables and legumes will have to double.

Currently, there is both overconsumption and underconsumption of various types of foods in different parts of the world, a problem which has led to an increased level of the double burden of malnutrition. For instance, in some regions, there is over consumption of meat products while in others, there is underconsumption of the same.

Through the planetary plate, this will be reduced as the diet plan takes into account variations in food types, agricultural systems, cultural traditions as well as individual dietary preferences. The intake of most nutrients and micronutrients will thus be taken care of within planetary boundaries of land use, nutrients, fresh water, biodiversity as well as climate change.

Improving food production

As the human population continues to grow with no increase in arable land sizes, efforts are being made to come up with ways of plant and animal production to boost production and ensure adequate food supply.

Among the major concerns is the use of chemicals such as fertilizers, pesticides, antibiotics and hormones. Although, all these can in one way or the other increase crop production dramatically, they can also ensure

What farmers can do to improve food systems

To manage this dilemma in a sustainable manner, the EAT-Lancet Commission has recommended that the current food systems should be adjusted in the following ways:

- Decarbonizing (reducing carbon) of agricultural production systems by eliminating the use of fossil fuels and land use change (increased tree cover in farming areas).
- Attaining zero loss of biodiversity (more conservation measures be adopted).
- Achieving net zero expansion of agricultural land into natural ecosystems

(stop encroachment into forested areas).

- Improving on efficient use of water resources.

For all this to be achieved, the commission also has recommended the following transformations mainly in the food systems:

- Encourage people to choose healthy diets by improving the availability and accessibility of healthy foods.
- Diversify crop production into nutrient-rich crops and the support of agricultural policies to enact this in the way of incentives, programs and research funding.

- Sustainably increase of agricultural activities using best practices to generate sustainable, high quality and nutritious crops.

- Effective governance of land and ocean use as a way of protecting the environment (reduce pollution in both land and sea).

- Food waste should be reduced by half in low and high-income countries.

Involvement of everyone, from communities all the way to government level is also a key factor which the commission pushes for everything to be attained and implemented smoothly.

Kitchen gardens are a good source of vegetables and fruits

At a time everyone is concerned about the safety of the food they eat, every family should have a kitchen garden where they can grow their chemical-free vegetables and fruits to maintain family healthy.

Lilian Maina | Kitchen or vegetable gardens are a very important part of organic farming be it in the rural or urban setting. Buying vegetables and fruits can be expensive especially in urban areas. As we approach the dry season, kitchen gardens become even more important to every family. Kitchen gardens provide a fresh supply of vegetables every day. A small piece of land in your backyard the size of 10m by 10m is enough to establish a vegetable garden to feed your family throughout the year.

To establish an ideal vegetable garden, you have to take into consideration the following factors:

Water availability: Vegetables need a lot of water to flourish. Choose a place where watering your plants will not be hard i.e. near a water source or maybe a tap. Ensure the water is clean and not contaminated.

The soil: Choose a place with good soil. It may be best if the land slopes slightly so that water from heavy rainfall falls off and does not drown the vegetables. If



Vegetables planted in circular garden such as the Mandala garden

the land is flat, ensure it has good drainage. You may dig furrows to take care of excess rain water. Make raised beds if the planting area has stagnant water. Check the pH value of the soil and adjust it accordingly. If the soil is acidic add lime or even more compost to improve it.

Fencing: When starting a garden, fence it off before planting to keep animals away. You can use wire mesh, chicken wire or barbed wire.

Provide shade: If you live in a hot and dry place, you may have to establish your garden under benevolent trees e.g. acacia as this tree improves the soil as well as providing shade to your vegetables. Avoid planting your vegetables under trees that take a lot of water and nutrients from the top soil.

Practise crop rotation and intercropping

You can keep on improving soil fertility using manure in the beds. Crop rotation and intercropping is also easier when your garden is laid out in beds. Walking along the borders of the beds when transplanting, weeding or watering the plants to avoid stepping on the planting bed. This beds should be narrow and long i.e. 5m long and 1m wide (or in a circle such as those of a mandala garden).

This ensures that you can reach the middle of the bed from the border/path on either side. If the land is sloppy, lay your bed along the contour. If the land is flat, lay the beds in the East-West direction. This way the sun reaches all the plants but it does not shine so much on the soil to make it dry.

Plant only healthy seedlings

When transplanting your seedlings, always use healthy seedlings that are disease free. Affected seedlings introduce disease to your garden which may turn out to be costly to manage. Avoid working in your garden when the leaves are wet.

Brushing up wet leaves has been found to spread disease from one plant to another.

After transplanting, mulch your garden with organic material. This prevents loss of moisture by preventing the sun from directly hitting the soil. When the mulching materials rot, they enhance soil fertility in your garden.

Keep the garden clean

Ensure the garden is cleared of plant debris from trees and other crops. This helps in managing pests and diseases such as fungi and disease-causing microorganisms that flourish in the debris. This may be dropped leaves, husks and dead plants left behind after a harvest.

Remove diseased plants immediately. If you find a plant that has been attacked by fungi or any other disease, remove and burn it as it may spread the disease to the healthy plants. Burn the plant and avoid putting it in the compost pit. Disinfect your farming tools to avoid transporting diseases from one bed to the next.

Use disease resistant plants and destroy volunteer plants. Volunteer plants are those that grow on their own at the same place as last year's plants. They are weak and have a high potential for disease and pests.

**Lilian Maina is a Nairobi - based Journalist.*

For more information on kitchen gardens https://infonet-biovision.org/cultural_practices



Vegetables planted in straight lines: A kitchen garden can be planted with a variety of vegetables and fruits or even flowers

Farmers can use Zai pits to grow food in dry spells

I would like to grow vegetables such as *Sukumawiki*, spinach, cabbages and indigenous vegetables using Zai pits. Kindly explain to me how to make Zai pits and let me know if I can use this method to grow the above vegetables.

Zai is a term used by farmers in Burkina Faso in West Africa to describe small planting pits or depressions in a farm which are dug and filled with farm yard manure or compost. The Zai pits harvest water and retain moisture longer for crop production. The pits basically help to keep moisture close to the root zone of the crop.

A Zai pit is 0.7ft to 1ft wide, 0.5ft to 0.7ft deep and 2ft to 2.6ft long. After digging the pit, a farmer applies 3 to 4 handfuls of soil or well decomposed Farm Yard Manure (FYM) or compost. After planting vegetables or any other crop, dry plant material or crop residue is spread all over the pit as mulch that helps prevent evaporation of moisture that the crop utilizes to grow. The pits improve water management and protection of the soil from erosion.

Benefits of Zai pits

Zai pits create a micro-environment where crops can be grown in dry areas with little rain to improve crop yields. By using Zai pits, farmers address the problem of land degradation, fertility and soil moisture. They also help break hard pans that prevent plant roots from penetrating the soil.

Zai pits can be used in many



Both Zai and *Tumbukiza* are good methods of conserving water for crop production

areas when there is limited rainfall or dry areas that receive between 300mm to 800mm of rainfall. They play an important role in harnessing water when it rains and keeps the moisture in the root zone.

Important due to climate change

Zai pits are becoming very

important especially when many parts of the country are getting less rainfall and prolonged dry spells. Farmers in many parts of the country face a lot of problems when the rains fail. With the use of Zai pits and other irrigation methods, they can grow crops both for home consumption and sale.

Tumbukiza Method

Apart from Zai pits, farmers can also use the *Tumbukiza* method, which is best suited for low to medium altitude agricultural zones. Small-scale farmers in Kenya use this method to increase productivity in dry areas. It is best for growing maize, Napier grass or Sorghum. There are two types of tumbukiza pits:

Round pits

These are dug 2ft deep, 2ft wide and 2ft apart.

Rectangular pits

The rectangular pits are 2ft-3ft wide, 2ft deep and 3ft apart.

When planting, mix the top soil with manure and fill the pits. Leave at least 6 inches unfilled at the top of the pit. In each pit, plant 9 maize seeds or 5 to 10 cuttings of Napier grass. The crops in the pits are sustained by water from run off as it collects in the hole during rainy seasons.

During the dry season, watering the pits with one bucket per pit is enough to sustain the crops. Weeds that grow in the pits are easily pulled off by hand. Compost and crop residue are thrown into the pits occasionally. After four to six harvests, manure is added into the pits.

Answer by Elkanah Isaboke

**Isaboke writes on agricultural issues- He holds a diploma in Organic Agriculture.*

For more information on Zai pit <https://infonet-biovision.org/PlantHealth/Conservation-tillage-systems>

Continued from page 5 ➡

a higher quality of produce, they are also toxic, and some can cause problems if they are consumed by humans in large amounts.

Use of chemicals a major challenge

Their effects on biodiversity are dire and cannot be overlooked. Coming up with a way to balance a reliable, high-quality food supply with the need to protect the consumer from unnecessary exposure to chemicals is a major challenge which is facing the food industry.

Natural method can control grasshoppers

Is there a proven organic method of controlling grasshoppers to stop damaging crops?

Grasshoppers are one of the most destructive pests. Grasshoppers can feed to approximately one half of their body weight per day. They cause damage to crops by chewing on the leaves and stems in growing plants. If not controlled they can destroy an entire crop in a short period of time.

Control method: There are many natural methods that can be used to control grasshoppers; for small gardens such as vegetable gardens, a farmer can cover the crop with netting to keep most pests including grasshoppers



away. In open gardens, farmers can use plant extracts where a number of plants such as chilli, Sodom's apple, African marigold, garlic etc are chopped and put in an airtight bucket of water for 14 days, sieved using a piece of cloth into a knapsack and sprayed using a natural sticker as bar soap at least 3 times a week.

Farmers can also use neem extract (Nimbecidine®) which is available in most agrovet shops. They can then spray weekly with a sticker to keep all pests including grasshoppers away from their crops. *Peter Kamau*

TOF Radio answers your questions

TOFRadio is broadcast on KBC on Thursday at 7:30pm 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 422 460, email: admin@theorganicfarmer.org

Climate-smart Push-Pull technology boosts farmers yields

Musdalafa Lyaga | "When we planted maize as a single crop, it suffered from striga attack. The whole crop was lost as a result of this striga. But we have learnt about a new technique called Push-Pull technology. This technology involves intercropping maize with a repellent plant, such as desmodium, and planting an attractive trap plant, such as Napier grass or brachiaria, as a border crop around this intercrop. Stemborers are repelled away from the maize crop by the unattractive smell from the desmodium and pushed to the trap crop, leaving the maize crop protected. Desmodium also produces chemicals in its root which inhibits the growth of striga seeds after germination." Says Agnes Ambubi, a farmer from Vihiga County, Western Kenya.

Across Africa, farmers grow cereals to feed their families and make money from selling surplus produce. As an important food crop in Kenya, maize is eaten and enjoyed in many ways i.e. boiled, roasted, fried, or milled into flour.

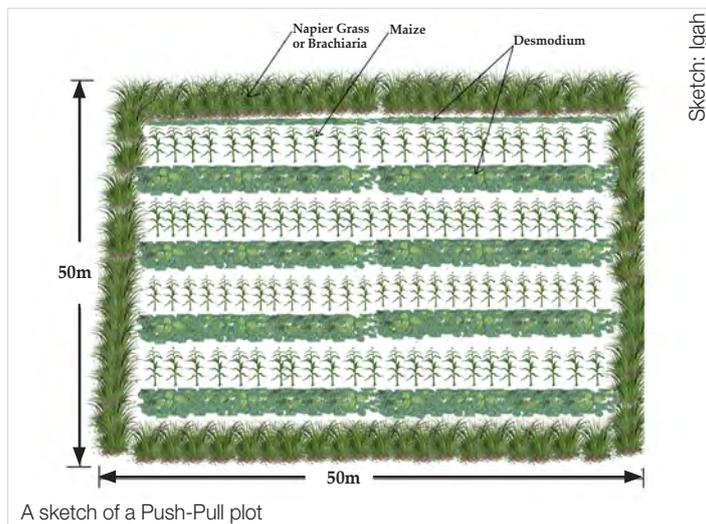
Maize is considered ideal for fodder because it grows quickly, produces high yields and is rich in nutrients. However, growth of maize continues to be hampered by poor soils, the parasitic striga weeds and pests such as stemborer and the devastating fall armyworm.

It controls stemborer and Fall armyworms

Stemborers and fall armyworms can damage and cause complete yield loss if not controlled. Fall armyworm is a caterpillar that feeds on the leaves of different types of crops thus affecting their growth. On the other hand, stemborer caterpillars drill holes into stems of maize disrupting the flow of nutrient from the roots to the leafy parts of the crop.

Efforts to control the Fall armyworms through the use of pesticides has failed because this caterpillar has developed resistance to most of the chemical pesticides in the market. In addition, when farmers spray chemical pesticides, beneficial insects are killed.

There are many insects, which are farmers' friends, such as ants, wasps and ladybird beetles, which can help control the population of the armyworms in the maize fields.



A sketch of a Push-Pull plot

With the rapidly growing population, farmers no longer leave the land fallow, they grow crops on the same land year after year. This increases the pest population.

Push-Pull controls striga

As land becomes less productive, farmers struggle to produce the food they need. For centuries, Kenyan farmers have grown multiple crops in the same field to reduce the risk of hunger, and to produce food and fodder.

"The problems of soil fertility, striga, stemborers and fall armyworms can all be managed together by intercropping maize with desmodium legume and planting Napier round the intercrop as a border crop," says Ms Ambubi.

"We harvest desmodium when it matures and feed it to the livestock. We sell the surplus to make an extra income because it has a ready market. Legumes also add nitrogen to the soil and improve soil fertility. In addition, a good ground cover of legumes conserves soil humidity while controlling soil erosion. Desmodium legume also suppresses striga emergence and development," she adds.

How to set up a Push-Pull plot

Now that we know how push-pull works to increase our maize yields, and we have decided to start using this system, how exactly do we set up a Push-Pull plot?

When establishing a Push-Pull plot for the first time, make sure you have certified maize and

desmodium seeds.

You will also need Napier or brachiaria grass, either as root splits or canes, that you will plant later. Your Napier grass should not be diseased. If the leaves are yellowish and very narrow, don't use it, it could be affected by the Napier stunt disease.

Make sure to also have pegs and ropes for measuring the plot as well as your usual farming tools such as a machete, a hoe or jembe. It is important to have adequate farmyard manure. Organic matter helps to manage striga and improve soil fertility at the same time.

Land preparation: The first step in setting up a Push-Pull plot is land preparation. First clear your land by ploughing just before the rains start. Then harrow the land until no large soil lumps remain. Desmodium seeds are very small and do best in fine tilth and clean soil.

When your land is cleared, use pegs and a rope to measure your Push-Pull plot which should be at least 30m by 30m or more (See sketch above). First, dig holes alongside the three outer lines, in which you will plant your Napier grass or brachiaria grass. Make sure the spacing between the holes is 75 cm.

Use compost or manure for planting

When planting, apply two handfuls of manure in each planting hole. Plant Napier cuttings with three nodes, covering two nodes with the soil and all canes facing the same direction. Place the cuttings in a slanting position.

When using root splits, simply place them upright in the hole and cover the lower part. After this stage, you can now plant the desmodium.

Between the rows keep a spacing of 75 cm. For a 30m x 30m plot, mix 300g of desmodium seeds with fine sand in a ratio of 1 part desmodium to 3 parts sand.

Then drill narrow rows using a stick and sow the mixture.

Desmodium should be planted in between the maize and should be in the first and last row.

After that, plant the maize between the desmodium rows.

While planting the maize, maintain a spacing of 30 cm between the holes.

Push-Pull restores soil fertility

By using the Push-Pull method, you will attract many farmer friendly insects in your field, restore your soil fertility and manage pests in your farm. With the increased yields, your family will have more food to eat and you will make more money by selling healthy maize in the market.

**Musdalafa Lyaga is TOF Radio Manager and Producer.*

Radio Taifa frequencies for our TOFRadio programmes

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