

Dear Reader,
As the harvesting season approaches, we can only urge all farmers to keep their produce free of synthetic pesticides and toxins by applying the ecologically sustainable techniques that they have learnt from TOF magazine.

This issue highlights the dangers of careless pesticides use and the adverse effects they have on human health, the environment and the ecosystem.

Beekeeping is a good income earner. And, of course, bees play an important role in increasing food yields. Read about the steps you need to take to establish a good apiary.

Also, learn from one farmer, who after learning from TOF magazine about earthen water dams made of dam liners, established them on his farm. He never runs out of water despite the scarcity of rainfall in his area.

We have written about spring onions in response to inquiries on how to grow them.

In this issue, we also give you a step-by-step guide on how to start rearing catfish in your farm.

A critical factor in fighting the raging Covid19 pandemic and other common diseases is the kind of food we produce and eat. We have an article on the foods that we can eat to have a balanced diet and build a strong immunity. Enjoy the read!

From the editor



How safe are the pesticides used by farmers in food production

Many farmers are not aware that these pesticides and chemicals have been banned in their countries of origin and yet they continue using them unaware of the dangers

By Silke Bollmohr

Kenya's agriculture largely relies on artificial fertilisers and pesticides, whose use has more than doubled in the last four years. Some of the pesticides are very toxic and have been banned in the European markets.

There are 862 pesticide products registered for agricultural use and 235 have been withdrawn from the market in Europe according to a report by Route to Food (<https://routetofood.org/wp-content/uploads/2019/08/Pesticide-use-in-Kenya-COMP.pdf>). Due to lack of information and proper training, many farmers are not aware that these pesticides and chemicals have been banned in their countries of origin and yet they continue using them. Many do not

know the correct way to use sprays or how to protect themselves and the environment and are also not aware of the possible alternatives to the deadly chemicals.

Chemical effects on ecosystem

Insecticides, herbicides and fungicides are all designed to control a specific problem and protect the crop. However, most of them are not specific and affect other organisms. Many of the insecticides being used are toxic to pollinators and fish, and herbicides kill beneficial bacteria in the soil.

Many fungicides also kill fungi, which are essential for a sustainable nutrient supply in the soil and for healthy crops. Once exposed to the environment, pesticides can take many years before being degraded completely.

This persistence is harmful to the same ecosystem, which food production is highly dependent on. Pesticides can accumulate in soil and water and harm beneficial organisms and natural biodiversity over a long period.

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Catfish farming tips

Catfish farming has improved livelihoods, boosted farmers' incomes and provided an affordable source of protein. **Pg. 4**

How safe are the pesticides used in food production?

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Decimating bees

Bees, which are important pollinators, are also greatly affected. Without them, there would be no food. About two thirds of all food crops require pollination. Some crops such as pawpaws are entirely reliant on bees for pollination. The report *Route to Food* further says that 32 per cent of all pesticides in Kenya are toxic to bees. A recent study by Seibold et al., 2019 has brought to light the diminishing population of bees due to the intense use of chemicals. Pollinator experts from around the world warned of declining food production in a report by in 2019, attributing this impending situation to bees migrating to countries, where chemical use and other industrial human activities are not as rampant and harmful to the environment. (<https://www.interacademies.org/node/51495>)

Effects on fish

Fish can also be affected by pesticides. The report also indicates that about half of pesticide products used in Kenya are toxic to fish. Farmers, therefore, should not wash their spray tanks in the rivers and should observe a safe distance of about 3-20 metres (depending on the product) between the field and the river. However, since many farmers may not have adequate land to implement a buffer zone, they must exercise caution when spraying.

Effects on human beings

Many times, farmers use these chemicals oblivious of the adverse effects they can have on their bodies. Inappropriate exposure can result in symptoms such as coughing, dizziness, numb fingers, and headache. It can also have chronic effects.

Long periods of exposure to pesticides may also have chronic effects on human beings. This could include causing cancer, having effects on fertility for both men and women; on the nervous system (such as Alzheimer's disease), causing asthma and also non-communicable diseases such as diabetes. According to the *Route to Food* Report, 24 of these pesticides, which are classified as carcinogenic (meaning they could cause cancer) and have been banned in Europe, continue to retail in Kenya. Their use in Kenya is unregulated. Currently, there is a petition in Parliament to withdraw these harmful pesticides from the market, but raging arguments for and against the move continue to stall the process.

We need to find and promote solutions to control pests naturally or using bio-pesticides instead of synthetic pesticides. This will protect our environment and the health of farmers and consumers. Successful and sustainable food production rely on healthy citizens and a clean environment.

Dr Bollmohr is the managing director of EcoTrac Consulting, Nairobi. She is an Eco toxicologist who specialises in environmental science and permaculture design and is the author of the Route to Food Report (<https://routetofood.org/wp-content/uploads/2019/08/Pesticide-use-in-Kenya-COMP.pdf>)



Farmer discovers dam-liner and turns his life around

To be successful you must work hard but to stay successful, you need to keep learning

By Caroline Mwendwa

Mr John Nguvi will tell you that he now enjoys immense benefits from his two-acre farm, thanks to his habit of voraciously reading every edition of *The Organic Farmer* (TOF) magazine. A resident of Gilgil, a semi-arid area in Nakuru County, Mr Nguvi always faced acute water shortages during the dry seasons, which had reduced the productivity of his two-acre farm to almost zero.

"I was stranded due to lack of water. But after reading the TOF magazine, I discovered earthen water reservoirs made using reeds and a dam-liner, as an easy solution for water storage," he recalls.

He secured a Ksh16,000 loan from Ebburu Fruit Farmers' group and used the money to buy a 48,000-metre dam-liner to build a 110,000-litre water reservoir. Today, water shortages are history in his homestead. With water readily available, Mr Nguvi got into serious farming by starting his tree tomato project with 1,000 seedlings, the grafting of which, he had read about in the magazine. Despite losing 300 seedlings due to the harsh weather, the venture has seen the farmer earn enough money to educate his daughter through secondary school. There is also enough to start her off in college.

The father of four says that tree tomatoes require adequate water to grow and the discovery of the earthen water reservoir harvesting technique was a major breakthrough for him.

"I would make about Ksh8,000 per week before the profits dipped."

However, Mr Nguvi still makes Ksh2,000 weekly from tree tomato sales only. Using the same reservoir, his wife maintains a kitchen garden in which she has planted spinach, kales and cabbages for home consumption. She sells any excess to neighbours and uses the proceeds from her kitchen garden to buy food and other items.

"My wife takes care of all our home needs from this kitchen garden," he says. Mr Nguvi also grows Hass avocado trees, bananas, maize and beans. "I learnt about a banana variety that does well in this area from reading the TOF magazine and bought it from Githunguri," he says. Today, the bananas literally feed his family. He sells seedlings at Ksh100 each. He practices mixed farming and has 69 avocado trees, whose fruit he sells to brokers and local consumers. Another tech-

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Nguvi's wife maintains a kitchen garden for subsistence in which she has planted spinach, kales and cabbages

Basic steps on how to start your apiary

Bee keeping is one of the ventures that can earn farmers some income while increasing their yields

By Michael Mboti

The population of bees has been declining in Kenya due to the destruction of forest areas and increased use of pesticides and other chemicals. Bees are important for pollination, and can be good income earners when well taken care of. Globally, a third of our food is dependent on bee pollination. A collection of hives is an apiary and the rearing of bees is called apiculture. Consider the following factors when starting your apiary:

Site selection

This is important so as to minimise conflict between bees, the farmer, public and animals.

- Site the beehives far from the homestead, grazing areas and noisy places, but close to watering and foraging points. Noise excites bees and motivates them to sting.
- Plant lots of appropriate vegetation close to the hives to ensure that your bees have enough food to survive with minimal artificial feeding. When bees are forced to fly more than 100 metres to look for food, they get tired and may be forced to settle for less nutritional food that is closer to their hive.
- Ensure that hives do not face the direction of the wind.
- Site the hives where it is easy to monitor them.
- Minimise chances of predation on the bees. Most farmers use wire mesh to enclose the area to keep away birds and animals that prey on bees. You can also use scarecrows. Grease the poles supporting your hive regularly to deter predators.
- Do not use synthetic fertilisers, pesticides and herbicides on your crops. Situate hives as far as possible from farms where such chemicals and pesticides are used as they can kill your bees.

Hive selection:

There are three kinds of hives you can choose from – The Langstroth hive (frame hive), traditional hives, and the Kenya top-bar hives (KTBH). They all

come with unique advantages and disadvantages. Consult with a professional or experienced beekeeper to help you choose a hive. Ensure that you choose the right size. Hives that are too small will mean that the bees will be squeezed and feel uncomfortable.

Placing the hives:

- *Suspend them on stands or trees.*
- *If you use stands, ensure that they are made of strong, termite-resistant wood and are at least one metre high.*
- *Cover the stand legs with grease or put in tins of oil so that ants cannot climb into the hive.*
- *Use types of wood that will grow easily into new plants when stuck in the ground.*
- *Use suspension wires if honey badgers are a danger. Ensure that they are well greased to keep ants away and that they allow the hive to swing easily to keep animals away.*
- *Limit the number of hives and ensure that there is enough space (10-20 metres) between hives so that you can work on one hive without disturbing bees in the other hives.*
- *Make sure the hive entrances face away from footpaths.*

Attracting bees to your hive

You can use an empty hive as a bait to attract a swarm. Place some combs with honey on top of the top bars and rub the inside with bees wax or lavender leaves or lemon grass leaves. The smell of honey and these plants will attract the bees. Bees can take anywhere from one month to a year to occupy a hive.

Transferring a colony from the wild into your hive is another option. It will already have a number of combs, which can be carefully tied on to the top bars of the hive. Ensure that you include the brood combs and the queen. Ask for assistance from an experienced beekeeper.

Feeding bee colonies

When it is continuously raining and when there are no flowers blooming nearby, you can supplement a colony's feed to prevent it from starving. You can provide the colony with a syrup made from white sugar. Prepare using two parts of sugar to one part of water. Bees

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nique that he finds priceless is composting. He rears indigenous chickens and sheep on his farm. The chickens get worms from the kitchen garden, and the sheep provide manure for his farm. Mr Nguvi still has great plans for his farm.

“Ever since the push-pull technology was featured in the magazine, I have always wanted to establish it to control the Fall armyworm. I had challenges acquiring brachiaria grass, but with the help of the Icipe Centre, I can now implement the technology,” he says.

He knows too well about the benefits of growing crops and rearing animals organically. He uses cost-effective organic pest control methods against pests like aphids which are highly attracted to grafted fruits.



“My plants are free of toxins. They are healthy and yield more than when I farmed conventionally,” says the farmer, who hopes to acquire organic certification soon.

He is also growing pyrethrum to add into the pest control mixture used on his crops. To diversify his earnings, Mr Nguvi has built a small fishpond and is rearing 1,000 catfish. He was inspired into fish farming after visiting an agricultural show and learning more about catfish farming. Nguvi advises that farmers should embrace fish farming, which is a good way to diversify their income and provide nutritious food to their families.

<https://www.infonet-biovision.org/EnvironmentalHealth/Water-storage>

Mr Nguvi has built a small fishpond and is rearing 1,000 catfish.

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also require vitamins and supplements. When feeding them for long periods provide them with foods that are rich in nutrients as opposed to the sugar syrup by itself. Ensure that whatever you feed your bees on is organically produced. Put the feed inside the hive to avoid bees from other colonies consuming it, robber bee activity in the apiary, and possible interchange of bee-disease pathogens. Placement of the syrup in hives is best done towards the evening to minimise any tendency for rogue bees to rob the hives.

How to prepare sugar syrup

Measure the sugar and water portions (2:1 ratio). Heat the water in a container to a gentle boil. Pour in the sugar and stir the mixture until the sugar crystals are dissolved. Never boil the mixture as the sugars may turn brown and harden into a nutty tasting substance that is partially indigestible and toxic to bees. Let the syrup cool to room temperature before feeding it to bees.

Managing the hives

Inspect hives at least once a month to:

- *Ensure that there are no water leaks.*
- *Ensure that the queen is laying enough eggs.*
- *Decide if your colony needs a new queen.*
- *Confirm that the bees are building combs correctly (one comb on one top bar).*
- *Ensure that the brood nest has a closed brood area without too many empty cells in between.*
- *Identify productive colonies, those with docile bees and those with less tendency of swarming.*
- *Identify the presence of pests, predators and diseases in good time.*
- *Identify the honeybee colonies that may need supplementary feeding.*
- *Know when to make a division to form a new colony.*
- *Know when to harvest the honey.*

Harvesting

Harvest only when it is ready and ensure that you leave enough honey and pollen in the hive to feed the bees and their brood for the next season. Use harvesting methods that protect the bees from injuries and mutilation.

Tools to harvest honey safely:

Smokers

Make bees feed on the honey in readiness for fire outbreak. When they are on a full stomach, bees become less active and the stinging instinct is suppressed.

Honey strainers and sieves

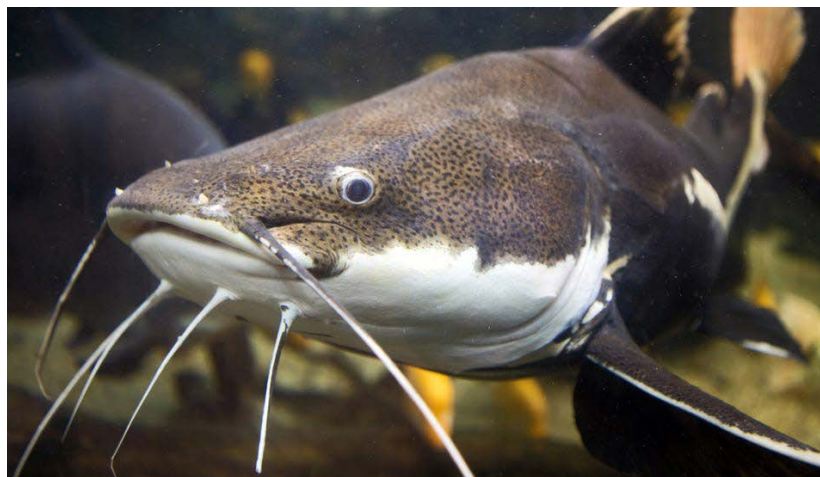
Bee brush or comb is used to brush off bees from combs during harvesting. Some farmers and handlers use a comb-like structure.

The hive tool

This is a piece of metal used to inspect the combs. Each hive can give you about 10kg of honey every year, in addition to products such as bees wax and propolis, which are used to make cough syrups, soap, and candles.

<https://www.infonet-biovision.org/AnimalHealth/Beekeeping>

Catfish farming for beginners



By Teddy Nyanapah & Elkanah Isaboke

Eating and rearing of fish is no longer the preserve of the lake region. The nutritional benefits of the delicacy, coupled with a soaring popularity now has farmers in other areas, including central Kenya, who would ordinarily never keep fish, setting up thriving ventures. Catfish farming has improved livelihoods, boosted farmers' incomes, created employment, and provided a reliable and affordable source of protein. In this edition, we tell you how to establish your pond, choose and feed fingerlings, and the different systems that you can adopt.

Fish pond establishment

- *Site selection; select a suitable place where water flows gently from the source.*
- *Site marking; after selecting the area, use pegs to mark the channel from the river, the entrance and exit and also the channel to take water back to the river.*
- *Clear all the vegetation from the identified pond area.*
- *Dig the soil out and place in a particular place as it will be used again. The upper side of the pond should be 0.5m deep and the lower side should be 1.5m deep.*
- *Constructing the dyke; This is a wall that is constructed all round the pond. A core is established by digging a trench 0.5m wider and lower than the general level of the pond bottom. It is then filled with clay and compacted or concrete used to prevent seepage. The soil is thrown on the outside and the inside of this core to make a dyke.*

Constructing inlet, outlet and spillway

- *Inlet – this is a pipe at the entrance of the pond. It's made in the dyke slightly above the level of pond water. A screen of fine mesh is placed across the inlet to prevent entrance of undesirable or strange species of fish.*
- *Outlet – this is made at the deeper end of the pond just above the bottom of the pond. A pipe is fixed and its walls cemented to ground to make the outlet firm. A screen is fitted at the mouth of the outlet to prevent the fish from swimming away.*
- *Spillway – this is the channel that directs excess water to the river. It is located at the top of the dyke on the lower side of the pond. The spillway prevents water from overflowing on the dyke. Grass is planted on the dyke and the land around it to stabilise the ground. The pond is then fenced all round to keep off predators and unauthorised persons.*

Stocking the pond

Young fishes are known as fingerlings. Stocking the pond entails introducing fingerlings to the already watered pond. Fingerlings in Kenya can be obtained from hatcheries such as Sagana, Kiganjo, Kenya Marine and Fisheries Institute- Kisumu, Bamburi Nature Park among others.

Choosing fingerlings

- Buy fingerlings from certified hatcheries. Ask your nearest county fisheries extension officer to help you identify genuine hatcheries, if in doubt.
- To prevent cannibalism, stock your pond with uniformly-sized fingerlings with an average weight of 3gm.
- The stocking density is 8 pieces/m² with an average productivity of 1.5 Kg/m². The production cycle should run for six months for optimum yields.
- Catfish can thrive in low oxygen concentration levels and do well in temperatures of 14°C to 34°C, with 28°C being the most ideal. Altitudes of 1600 metres above sea level slow down their growth due to low water temperatures. However, providing a larger pond surface area can increase growth rates.
- Because catfish are bottom feeders (feed on or near the bottom of a body of water) they do well in various parts of the country, including Kiambu, Muranga, Nyeri, Vihiga, Kakamega and Bungoma counties.

Production Systems

Aquaculture production systems can be classified as extensive, semi-intensive, intensive, and hyper-intensive. Catfish can be produced in either semi-intensive or intensive systems:

Semi-intensive production systems:

Production happens in earthen or liner ponds or cages. The units are managed by application of either manure or organic fertiliser, which encourages growth of algae that the fish feed on. Feeding is occasionally supplemented with cereals, wheat bran and other locally available commercially manufactured or locally formulated feeds. Yields using this method range between 1 to 6 Kg/m²/year, depending on the management levels. (Catfish producers in western Kenya achieve production of between 6-10 Kgs/m²/year).

Intensive production systems:

These are capital intensive and require

Recommended feeding rates for tilapia or catfish in grams per fish per day

Age in month	1-2	2-3	3-5	5-8	8 +
Weight of fish (g)	5-20	21-50	51-100	101-200	Over 200
Wheatbran(g/day)	1	1-3	3	4	5
Pelleted diet (g/day)	1	1-2	2	3	3-4

guidance from a fisheries extension officer and a business development expert to establish the unit.

Feeding

Do not use synthetic hormones and growth promoters that artificially stimulate growth and reproduction. Use natural and supplemented feeds that are not treated with chemicals.

Natural feeds occur naturally in fish ponds. They include materials such as soil and broken rocks, bacteria, plankton (small organisms that float in the sea or freshwater), worms, insects, snails, aquatic plants, and fish. Their occurrence and abundance depend on the quality of water and the fertilisation of

organisms. Supplementary feeds should be locally available and affordable. They include:

- Plants such as grasses, legumes, leaves, and seeds of leguminous shrubs.
- Aquatic plants and animals such as water hyacinth, water lettuce and duckweed and trash fish.
- Small terrestrial animals like earthworms, termites, snails.
- Broken, polished rice or bran or hulls.
- Wheat, middling, maize bran, gluten feed, gluten meal.
- Cotton seeds.
- Brewer's wastes and yeast.
- Slaughterhouse wastes such as offal, blood, rumen contents.
- Chicken and pig manure.

Supplementary feeds can be dry or wet.

Dry feeds:

Include cereals and cakes with about 10% moisture. These are easy to transport, store, and distribute to the fish.

Wet feeds:

Include blood, rumen contents, molasses, and brewery wastes, with 30% to 50% moisture. They are not easily stored and should be prepared in small quantities. They may be mixed with dry feeds to absorb the moisture or dried to increase their shelf-life.

Feeding schedule

- Feed twice a day at 10am and 4pm. Before 10am, the water is too cold and oxygen levels are low.
- Feed at the same time and place every day so that the fish will learn to come for the feed.
- Stocking density should be adjusted to age and breed of fish.
- Routinely monitor the water quality, health, and ensure that the fish exhibit natural behaviour.
- Avoid subjecting your fish to stress when slaughtering and transporting, and respect their species' specific needs.

Points to note:

- Small fish need more food than larger ones.
- Where there is plenty of natural food or where low stocking densities are used, less supplementary feeds are required.
- The better the quality of feed the less the quantity needed for feed.
- More food is required in warm water than in cooler water.
- Producers should adjust the feeding throughout the production cycle for better results.
- Feed Conversion Rate which determines the quality and weight of the fish, will be affected by overfeeding, poor feeds, poor pond fertilisation for semi-intensive production, and poor fish health.

Fish harvesting

Different species of fish reach marketing weight in different ages. For better price and profit collect the fish in proper time. When the fish reach marketing weights, you can use a net to harvest or totally discharge the water from the pond. If you are thinking about starting this business it is important to get training about fish farming and visit established fish farms to learn more.

<https://www.infonet-biovision.org/AnimalHealth/Fish>

To improve your diet, eat the 'rainbow'

Eating colourful selections of foods is important for your health

By M. Nowicki

Whether you grow all your food, or buy some at the market, it is important that you maintain your health by optimising your nutrient intake. This can be achieved by eating a diverse diet – preferably a colourful one. An individual consumes a “diverse diet”, by eating food from a variety of food groups. Dietary diversity increases the number of nutrients consumed such as Vitamins A, and C, and iron, which are essential for maintaining health and well-being.

The food categories include:

Grains, white roots and tubers, and plantains; Pulses (beans, peas and lentils); Nuts and seeds; Dairy; Meat, poultry, and fish; Eggs; Fruits; Vegetables.

Throughout the day, you should try to eat food from a variety of these food groups, with an emphasis on fruits and vegetables. A simple rule of thumb is to increase the number of colours you eat in a day.

The chart below gives an example of what two people might eat in a single day. As you can see, Person A eats many more colours than Person B. On this day, person A will consume a greater array of nutrients.

The easiest way to introduce more colour into your diet is by adding an assortment of fruits and vegetables. The bright colours of fruits and vegetables are caused by natural chemicals that help protect plants from germs, bugs, the sun, and other threats.

Fruits and vegetables fall into five different colour categories: Red (for example, guava), orange or yellow (jackfruit, mango), green (sukuma wiki, managu, terere, mrenda, mchicha, saga), purple or blue (e.g. purple cabbage), and white or brown e.g pears or white ugali. These colours indicate the presence of diverse specific nutrients.

Figure 1 highlights the types of nutrients, often found in fruits and vegetables that have these colours. Moreover,

What to eat	Colour & nutrients	Benefits
Red apples, red cabbage, tomatoes, raspberries, watermelons and grape fruit	Red What is inside: Lycopene, Anthocyanins	Heart, urinary tract health and reduced inflammation
Carrots, bananas, sweet potatoes, lemons, pumpkins, yellow squash	Orange /Yellow What is inside: Betacarotene, Vitamin A & C, potassium	Bone, skin and hair health, improved night vision
Spinach, kales, asparagus, broccoli, avocado, kiwi	Green What is inside: Calcium, Lutein	Healthy bones and teeth, eye health and contains cancer fighting compounds
Egg plant, purple cabbage, purple potatoes, blue berries, black berries, plums	Purple What is inside: Resveratrol, Anthocyanins	Reduced inflammation, lowered blood pressure, eye and heart health
Cauliflower, white onions, white beans, garlic and mushrooms	White What is inside: Potassium	Blood pressure regulation, kidney stones prevention, heart health, improved fluid and electrolyte balance
Depending on your age and activity you should eat about 21/2 to 61/2 cups of various fruits and vegetables each day		

Figure 1: Aldridge, S. M. (n.d.). Eating the Rainbow. Retrieved from <https://hemaware.org/mind-body/eating-rainbow>



Person A	Person B
Breakfast: Porridge (brown), guava (red)	Breakfast: Porridge (brown), milk (white)
Lunch: Potatoes (purple), carrots, (orange), chapati (brown), pear (white)	Lunch: Ugali (white), chicken (brown), sukuma wiki (green)
Dinner: Ugali (white), goat meat (brown), managu (green)	Dinner: Ugali (white), goat meat (brown), Sukuma wiki (green)
Colors = 6	Colors = 3

it highlights the potential health benefits that these nutrients can have over time. Eating a specific colour of fruits or vegetables is not a cure for all illnesses.

The nutrients associated with each colour are connected to small potential health benefits. Moreover, eating a single serving of fruits or vegetables will not have long lasting effects.

These benefits are achieved in small, sometimes imperceptible ways, over time. Maintaining your health requires

a consistent effort over time to eat a diverse diet and to maintain physical activity. That said, small changes—such as adding colorful fruits or vegetables to your diet can substantially improve your nutritional intake. Over time, these small changes can improve your overall health. To improve your dietary intake, eat the rainbow.

<https://www.infonet-biovision.org/Human-Health/Introduction-Nutrition-0>

Why farmers should consider Fresian cows

By Clifford Akumu

Fresian cows are a great choice to raise commercially, especially in the Kenyan highlands

Dairy farming is still arguably one of the most lucrative enterprises in the country, if it is properly done. Kenya has over a million small-scale dairy farmers keeping more than 70 per cent of the 3.5 million dairy cattle and producing about 4.2 billion litres of milk a year. The dairy industry earns farmers Ksh100 billion annually from milk sales, and employs 350,000 people at farm level and over 400,000 people in related activities in the informal sector.

Use of cow manure to boost crop production is also gaining popularity. There is also the production of biogas for energy generation to light up the home and cook. In Kenya, there are 10 dairy cattle breeds, with five of these used for only milk. The other five breeds are for dual or triple purposes, used for milk, drought resistance (adapt well to dry areas) and beef.

Despite the benefits from dairy farming, few smallholders know how to choose breeds for greater profits. Let us take the Fresian, for example. How can farmers benefit from keeping it? The Fresian/Holstein breed was originally developed in the northern part of the Netherlands in the province of Friesland and Northern Germany.

According to the National Farmers Information Service developed by the National Agriculture and Livestock Extension Programme (NALEP) to enable farmers to get extension information, Fresians have the following characteristics:

- *Body colour is black and white.*
- *Milk production is high.*
- *Body size is large (500-550kg).*
- *Feed requirement is very high.*
- *Meat production is also high.*
- *The milk has low butter/fat content.*
- *Average live-weight is 600kg.*
- *They are very sensitive to management.*
- *They are important for both dairy and beef production (they are dual purpose)*

Although it can produce 40-60 litres of milk a day, its production will depend on the level of feeding and other management practices. However, Fresians also have some challenges:

- *They require high volumes of feed (90-110kg fresh forage day).*
- *They are susceptible to diseases, and milk fever.*



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Small-scale dairy farmers keeping more than 70 per cent of the 3.5 million dairy cattle

- *They are susceptible to high temperatures.*
- *They require large amounts of water (a minimum of 60 litres a day or more for heavy yielders).*

Fresian cows are a great choice to raise commercially, especially in the Kenyan highlands and cooler parts such as central areas of the Rift Valley, including Nakuru, Laikipia, Naivasha and Kitale. Farmers can obtain this breed from Manera Farm (Delamere Estates), the University of Nairobi, Kabete, Kalro-Naivasha, Kisima farm in Njoro, Agricultural Development Corporation (ADC), Katuke Complex, Kitale and Gichecha farm in Ruiru. To reap the most out of this breed, farmers need to uphold good agronomic practices.

Kenya is not self-sufficient in milk production due to rising consumption fuelled by growing incomes and urbanisation. It imports about 120 million litres from the East African Community (EAC) member states and 2 million litres from non-EAC members annually.

Low productivity has been attributed to poor management, especially inadequate feeding, poor health management and poor breeding management that lead to long calving intervals. Mr Isaac Kamau, a dairy feed consultant says that quality feeds are crucial in milk production.

A major concern for farmers should be on fodder treatment right from planting, harvesting, conserving and storage.

"When cows are fed with bad feeds, the milk produced will be contaminated; hence, leading to diseases such as cancer," he adds. Besides good feeding programmes, dairy cows need proper housing, which protects them from extreme heat and direct sunshine. Below are several methods of keeping the dairy animals:

- **Zero grazing:** *Animals are housed and farmers bring all the feed and water to them. Zero grazing results in higher milk yields per cow (15-30 litres).*
- **Semi zero-grazing:** *the animals are confined but released to graze for a few hours per day.*
- **Open range:** *Animals graze in open fields throughout the day and are given water and minerals in the grazing field.*

100b

Amount the dairy industry earns farmers from milk sales annually

10

Dairy cattle breeds in Kenya, with five of these used for milk production



Location	Frequency
Nairobi	102.7
Kakamega	91.5
Bungoma	
Busia	
Malindi	106.3
Location	Frequency
Webuye	95.9
Garissa	88.7

Location	Frequency
Taita	107.4
Narok	102.3
Nyeri	105.7
Machakos	93.8
Makueni	
Kitui	
Meru	105.1
Marsabit	88.3

Location	Frequency
Nakuru	104.5
Gilgil	
Kisii	91.3
Kisumu	105.3
Mombasa	105.1
Kericho	90.5
Eldoret	91.1

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How can I grow spring onions?

Elikanah Ondieki Isaboke

Low prices and stiff competition in the markets have forced many farmers to abandon traditional crops in favour of high-value ones. One such crop is the spring onion. Also called scallions or green and bunching onions (*Allium fistulosum*), they are popular with consumers and are easy to grow, which makes them a viable opportunity for farmers.

Like any other crop, good agronomic practices are essential for proper establishment and growth. They can be sowed directly into the main field or in a nursery bed. They thrive in well-drained, aerated and fertile soil with a pH of 6.5 to 6.8. They grow in a range of altitudes up to 1900 metres above sea level. Warm temperatures (15 to 30 degrees Celsius) favour their development. To establish a spring onion farm, one needs seeds a hoe, a planting cane and string, a garden fork and a metal rake.

Land preparation

Plough your land to a fine tilth early and during the dry season. This allows the soil to aerate and exposes any soil-borne pathogens to the sun.

Direct planting:

Mix soil with well-decomposed manure then make shallow furrows (drills) 25cm to 30cm apart depending on the quality and fertility status of the soil. Use a planting cane and a string to ensure that your drills are straight. Plant the seeds at a depth of 2.5cm and cover slightly. Your field should be well-drained, be-

cause too much water makes the seeds rot. However, after sprouting, spring onions require a lot of water. Therefore, if your area has little rainfall, you will have to irrigate them. Avoid over-watering.

After germination (10days), monitor your crops for pests and diseases and weed to reduce competition for nutrients. Thin (removing the onions that are growing too close together so that only one plant is left to grow) after one to one-and-a-half months, leaving 8cm gaps between the plants. Transplant the thinned plants elsewhere.

Planting via nursery:

- Prepare raised beds 1m wide and put in well-decomposed manure at a rate of 13kg to 17kg or one full medium bucket per square metre.
- Plant seeds in furrows 12cm to 15cm apart and plant 2cm to 2.5cm deep.
- Mulch using dry grass or banana leaves to protect the seeds from splashing out when watering the bed.
- After germination, remove the mulch and use it to make a shade above the tender plants 80cm to 1m above the ground.
- Two weeks to transplanting, after 3 to 4 weeks, remove the shade so that the seedlings become strong and adapt to the main field conditions. Reduce the watering to harden them.
- Transplant the seedlings at about 4 to 6 weeks after sowing them in the nursery or when they have a pencil thick base and a height of about 15cm.
- Water your nursery bed before transplanting to reduce damage to the roots. Transplanting should be done early in the morning or late in the evening, and not during the day when the sun is hot to avoid wilting.

- Mix well-decomposed manure with the soil in the main shamba. Plant your seedlings in furrows 25 to 30 cm apart and cover them firmly. If possible, mulch them to reduce water loss and prevent weeds. Spring onions mature fast and you should ensure that your soil is rich enough to support their fast growth. Yields of over 17 tonnes/ha are achievable.

Common pests include thrips and caterpillars. Diseases include anthracnose, downy mildew, onion rust and purple blotch.

Prevention of pests and diseases

Prevent pests and diseases using the following agronomical practices:

1. Use certified seeds as substandard seeds are prone to poor germination, disease attacks and low yields. Certified seeds are good since some are resistant to the pests and diseases, and also have good yield capabilities.
2. Avoid planting spring onions where crops such as garlic, bulb onions, chives or leeks were planted before.
3. Keep your field free of weeds, and scout for pests and diseases.
4. Regularly scout for pests and diseases before their levels increase.

Control

Use extracts such as neem, pyrethrum and tithonia to control pests.

Harvesting

Harvesting begins two to three months after sowing depending on the variety. Mature spring onions will stand tall and appear green and succulent. Harvest the entire bulb to boost market potential.

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