

The Organic Farmer

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Photo: IN

A worker sprays a field with pesticides: Many chemicals used for crop protection and weed control affect human, animal, and environmental health. In this issue we feature the negative effects of the widely used glyphosate. Page 2,3 and 7

Dear farmer,

Recent press coverage on pollution of water sources in our country has raised alarm among many Kenyans, especially those living or using water from Athi river and all the areas it passes through on its way to the Indian ocean. However, there is little mention of the disaster that agricultural chemicals are causing to the food production systems and our health.

One such chemical is glyphosate. Most Kenyan farmers use Glyphosate-Based Herbicides (GBHs) to control weeds or eradicate weeds, especially the stubborn grasses. Research conducted in the last ten years shows that glyphosate poses one of the greatest threats to humans, animals, insects, plants and the environment and is responsible for many health problems we are facing today.

The World Health Organisation (WHO) has already categorized GBHs as a possible cause of cancer. Research conducted on rats shows that exposure to glyphosate causes abnormal tumours (unusual multiplication of cancer cells) in the rats. Glyphosate has been shown to change the way hormones work in the body (endocrine disruption) which points to its ability to cause cancer.

Last year, agrochemical company, Monsanto, was forced to pay \$289 million to Mr. Dewayne Johnson, a US citizen who developed cancer after years of using the RoundUp herbicide. A Californian court ruled that the company should have warned users of the herbicide on its side effects.

Glyphosate has very strong bonds, which attach themselves to minerals in the soil such as iron, potassium, magnesium and manganese. This effect makes them unavailable to plants. Glyphosate can also remain in the soil for a longer time than manufacturers claim.

While in the soil, glyphosate kills many beneficial soil microorganisms such as mycorrhizae, bacteria and fungi that play a very important role in the uptake of nutrients by plants from the soil.

In this issue, we explain to farmers the devastation this chemical is causing to people, animals, crops, water sources and the environment. See page 2,3 and 7.

Harvest early to avoid maize loss through rotting

Peter Kamau | Most farmers lose up to 40 per cent of their maize and beans due to weather and pest damage. One reason for this loss is that farmers leave the crops in the field (*shamba*) long after it has matured. When the rains are excessive, the maize and beans start rotting. Some maize

varieties open their husks (ears) after maturity allowing water into maize cobs. This encourages attack by pests and development of mycotoxins (a group of very poisonous fungi that include aflatoxins).

When to harvest

Ideally, maize should be harvested immediately the silk at the tip of the maize turns from pink to black. After this, the maize should be put out to dry for up to 5 days in adequate sunlight. After shelling the maize, farmers should have the moisture level tested using a moisture meter (a moisture level of 13.5 per cent or lower is appropriate).

Most of the late maturing maize varieties planted in April and May 2019 have matured and are ready for harvest in October. That means that farmers can start staking maize in readiness for harvest this month. If the maize stays longer than this period, then it will start rotting. Exposure of maize to excess moisture causes the development of moulds that includes aflatoxins.

The danger of aflatoxins

After harvest, most farmers sort maize to remove the rotten ones,

which is set aside for feeding livestock mainly cattle, sheep, goats and chickens. Rotten maize has high levels of mycotoxins that are harmful to people and animals.

Aflatoxins can cause liver cancer, kidney damage, digestive problems, reproductive disorders and suppression of the immune system in people and also in animals. In chickens, aflatoxin poisoning can cause sudden death.

Strains of aflatoxins

Mycotoxins that grow in food are called aflatoxins. Mycotoxins can grow in cereals, nuts, spices and fruits that are not dried properly. There are five strains of aflatoxins i.e B1, B2, G1, G2 and M1; aflatoxins cannot be seen with the naked eye.

Since it is difficult for farmers to see aflatoxins, it is important to ensure that all feed given to animals is mixed with toxin binders. If this not done, aflatoxins can end up in milk, meat, eggs and other products from the affected animals.

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Glyphosate: A silent killer that poses health risks to all

Research has established that glyphosate can bind itself to soils, killing beneficial bacteria, fungi and viruses that help release vital nutrients needed for healthy plant growth.

Peter Kamau | Glyphosate-based herbicides (GBHs), are widely used by farmers across the country and the world as a broad-spectrum herbicide that kills all stubborn weeds (both broad leaf and grasses in farms) before planting. GBHs are always applied as a minimum tillage method during land preparation just before ploughing or as a standalone spray when farmers want to cut the cost of ploughing. To minimize soil erosion, farmers with sloppy farms prefer spraying GBHs and planting without ploughing.

But many farmers may not know that glyphosate, which is the main active ingredient in all broad-spectrum herbicides has been found to be a silent killer that is affecting millions, if not

billions of people across the world.

Scientific studies conducted for more than 10 years now show that glyphosate-based herbicides have serious side effects on people, plants, animals, insects, aquatic life and the environment.

According to a paper delivered by Prof Don Huber of Purdue University (*Prof. Don Huber et al, Impact of Glyphosate and its Remediation*) at a recent Agroecological Conference in Nairobi, the widespread use of GBHs is causing great damage to people, animals and the entire ecosystems.

Prof Huber says that in the soil ecosystem, GBHs tend to build up as more spraying is done in farms because the chemical tends to degrade very slowly. Since it is a strong antibiotic, glyphosate makes disease-causing pathogens more resistant to treatment, leading to proliferation of soil-borne diseases where it is frequently applied. He explained that research has shown that in farms where glyphosate has been used for a long time, it can remain in the soil for up to 23 years.

Due to their chelating properties (ability to attach themselves with soil microorganisms), GBHs tend to bond with both macro and micronutrients such as nitrogen, manganese, iron and zinc. In one study carried out on glyphosate chelation of plant nutrients in the root zone (Eker et al, 2006), it was found that GBHs prevented the uptake of iron by up to 45 percent, manganese by about 20 per cent and zinc by 80 per cent. Glyphosate also kills all nitrogen fixing microbes in the soil. (See figure below left)

Inhibits transfer of nutrients

The transfer of the same nutrients to the leaves was even less with only 18 per cent of the iron being translocated, 10 per cent for manganese and only 20 percent of the zinc reaching the leaves. The results showed that glyphosate binds itself to essential nutrients in the soil making it difficult for plants to take up these essential nutrients to make food for the plants while reducing the crops' ability to fight diseases.

Soil microorganisms such as the nitrogen-fixing microbes, mycorrhizae, earthworms and related microorganisms play an important role in the release of nutrients for uptake by plants. Glyphosate-based herbicides kill all these important microorganisms hindering their important functions in the soil.

Increases diseases

In experimental plots where the weed killer was used, it was found that disease-causing pathogens such as fusarium root rot increased by between 200 to 500 per cent while beneficial microorganisms such as *Pseudomonas bacillus* reduced to 40 per cent and even down to 20 per cent in some trial plots (Zobiolo et al, 2010). The study showed that GBHs increased disease-causing bacteria, fungi and even viruses in the soil by suppressing the beneficial microorganisms

that control them.

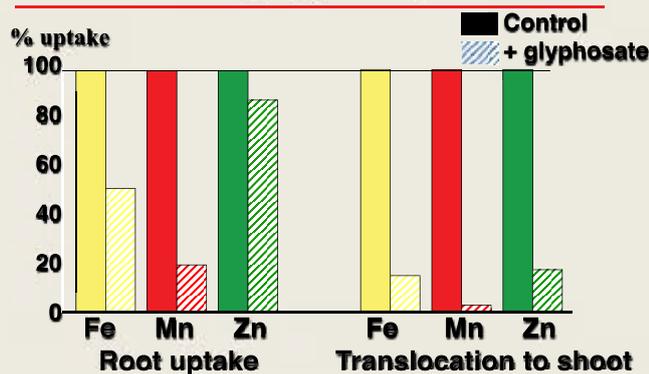
On tests done in sugarcane farms, glyphosate residue in sugarcane juice was as high as 490 parts per billion (ppb) 4 days after glyphosate application. In the same test, it was found that due to glyphosate's strong chelating (bonding) properties with other elements, very high levels of zinc (62%), iron (15-30%) and manganese (9%) were detected in the juice before sugar processing. This showed that high glyphosate residues remain in sugar even at the processing stage, which can end up in all products made from the sugar.

Increases fungal diseases in crops

Fusarium Head Scab (FHS) disease incidence in wheat grown in fields where glyphosate had been applied for two years increased by 152 per cent. The disease increased further by 295 per cent from the third to the sixth year as more glyphosate application continued in the same experimental fields (Fernandez et al, 2005, Fernandez et al, 2007).

There was no increase in the disease in control plots where glyphosate was not applied. The experiment clearly showed the role glyphosate played in proliferation of diseases and even disease resistance to chemicals used for disease control.

Effect of Residual or 'drift' Glyphosate on % Nutrient Uptake and Translocation by Plants



Source: Eker et al, 2006

What is glyphosate?

Glyphosate is one of the world's most widely used broad-spectrum herbicides. It comprises 25 per cent of all herbicides used in agriculture. The reason for its widespread use is because it is a cheap compound that kills both broad leaf and grass weeds. It is also used to dry crops such as wheat, barley and sugarcane in large-scale farms to dry them just before harvest.

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.

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Glyphosate affects human, animal and environmental health

It has been found that glyphosate kills beneficial microorganisms in the digestive tract and hormones in the endocrine system in people and animals, which alters the way they work causing diseases, deformities and even death.

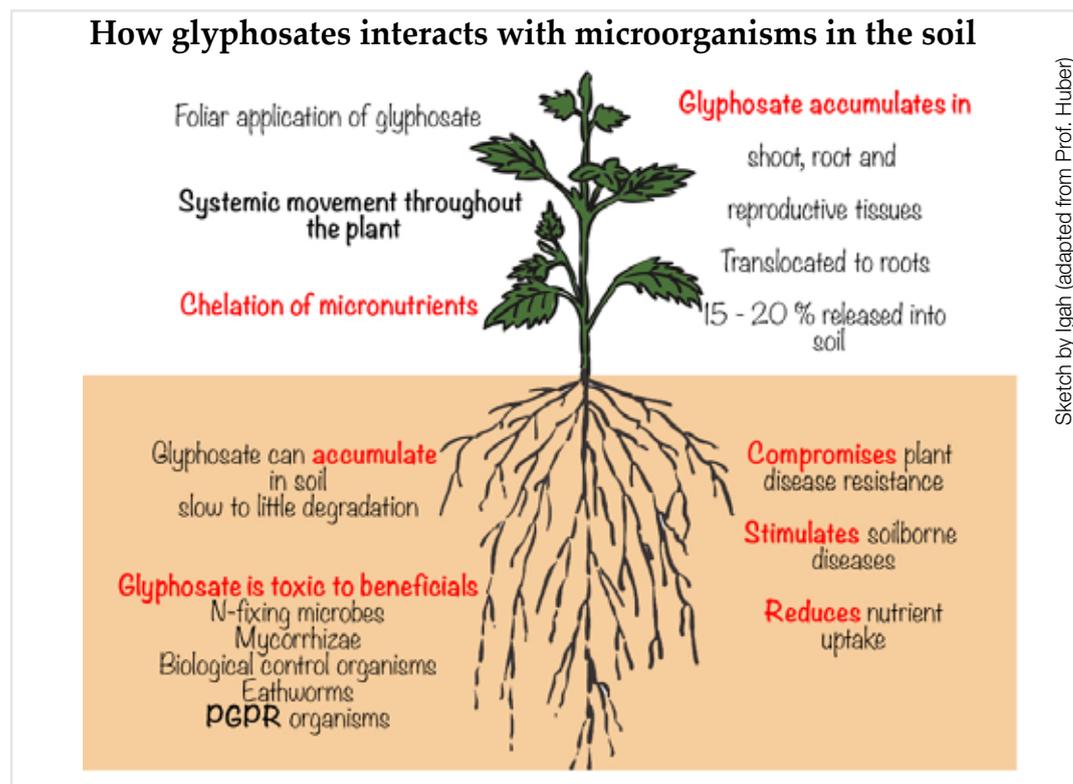
Peter Kamau Having looked at the effect of glyphosate on plants, including the crops that we grow in farms where the weed killer is widely used, it is important to mention that people rely on the same crops for food. We have already established that glyphosate on its own is a very powerful antibiotic. Since glyphosate remains in crop residue, this means that eventually, glyphosate residue ends up in our bodies.

It affects digestion

A human's digestive tract or system (the gut) is full of beneficial bacteria, fungi and viruses. In the same way that glyphosate affects beneficial microorganisms in the soil, so does it to the human body's ecosystem (microbiome). The first casualties of glyphosate residue are beneficial microorganisms (microflora) in the human digestive system (stomach), which it kills.

Interferes with hormone functions

Glyphosate also interferes with proper functioning of various hormones in the human body, which can cause many diseases. Diseases that come with disruption of the endocrine system (which produce hormones



that control many functions in the human body) include cancer, diabetes, inflammation or swelling, obesity, mental health (happiness, mood, nervous breakdown, autism, etc).

Auto-Immune diseases such as rheumatoid arthritis, type 1 diabetes, are increasing the world over. Others include, Inflammatory Bowel Diseases (IBD) such as Crohn's disease, ulcerative colitis, celiac disease, leaky gut, gluten intolerance, inflammation of the digestive system and difficile diarrhoea. The main symptoms of these diseases include abdominal cramps, bloody diarrhoea, fever, gut disbiosis, weight loss, fatigue and death.

Birth defects have been reported in Yakima Valley in the

US where glyphosate was used to eradicate invasive weeds in three rivers that pass through the region. Defects were also observed in birds (defective upper bills) and young animals (*Yakima Herald Republic*).

Diseases linked to glyphosate exposure

Brain damage and deformities in babies were also observed. These deformities were attributed to glyphosate exposure, which is caused by the disruption of endocrine hormones (Hoy, 2011). Some of the other auto-immune diseases that have been linked to increased glyphosate use include

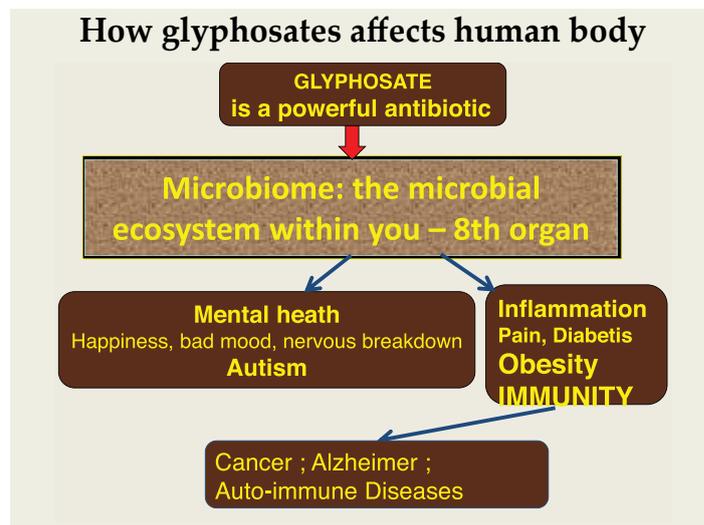
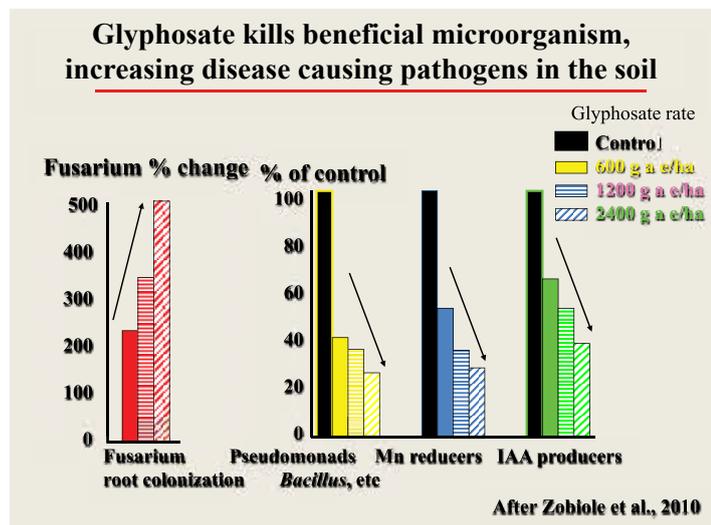
Glyphosate affects animals

Studies conducted on animals

fed on fodder exposed to various levels of glyphosate (*Botulism in Dairy Cattle*) led to animal deaths from chronic botulism (disease caused by bacterium called *Clostridium botulinum* that becomes more aggressive when exposed to glyphosate).

In another study on effects of glyphosate, 130 beef cattle were fed on flax and lentil straw dried using glyphosate (2,302 parts per billion), 29 of the animals died from the disease. In the same experiment, 300 dairy cows were fed with RoundUP Ready barley (GMO barley, which has a glyphosate molecule inserted in it to kill all weeds. On being fed on RoundUP Ready (RR)

Continued on page 7



How to manage seedlings in a seedbed or nursery

In the last issue we explained to farmers the steps they need to take when establishing a tree nursery. In this issue we explain how to manage seedlings in tree nursery to ensure they have healthy seeds both for their own planting and also for sale to other farmers.

Lilian Maina | Seed beds should facilitate the sowing of fine seeds for any tree species or fruit seeds that cannot be sown into separate tubes. However large seeds can be sown directly into tubes or containers. Containers may also be used as seed sowing beds.

How to plant seeds in nursery beds

There are different ways of sowing (planting) seeds into beds. The following are steps on how to do this:

Broadcasting: This refers to spreading seeds by hand or mechanical system on to the seedbed. This is best used with tiny seeds.

Drill sowing: Refers to the making of drills or ruts in the top soil, placing seeds in the drills and then lightly covering with the sand and forest/top soil mixture.

Direct sowing: This is often used with big seeds sown directly in the container or the field.

NOTE: When using forest soils, it should be collected two months before use. During this time water and turn the soil to allow for decomposition of manure (undecomposed manure release a lot of heat that may destroy the seedlings). The two months period is important as weeds seeds germinate and are killed by the heat produced during the composting process.

Seedling bed

This is similar to the seed sowing bed. Containers or pots can also be used. They should be perforated to allow air and water to flow freely within it for seedling development. The soil is moistened before putting it into containers or pots.

Pricking out seedling

This is the removal of seedling from the seed sowing beds and planting them in a container or the seedling bed. It is done when the seedlings develop their leaves and a tiny rosette (growth of a set of leaves at the tip of a seedling). Water the seed sowing bed before

pricking. This loosens the soil around the seedling making it easy to remove. It also ensures no damage is done to the leaves.

The seedlings should be dug out and immediately placed in a container with water. This ensures that the roots do not come into contact with direct sunlight or dry wind which may dry them out. Handle the seedlings by the cotyledon leaves and not by the tender stem. If the stem is even slightly damaged, it creates an entrance for harmful fungi. Pricking is done in the shade as the young roots are exposed to evaporation. The roots need to retain as much water as possible before hair roots develop to a stage where they can absorb water and nutrients from the soil.

Spacing: Before planting the seedlings in the seedling bed, cut a third of the long root. When planting, do not bury the stem into the soil. Plant the seedlings in a regular pattern to allow easy access during weeding and root pruning. For fast growing seedlings e.g. cypress, a spacing of 7.5cm by 5cm is ideal.

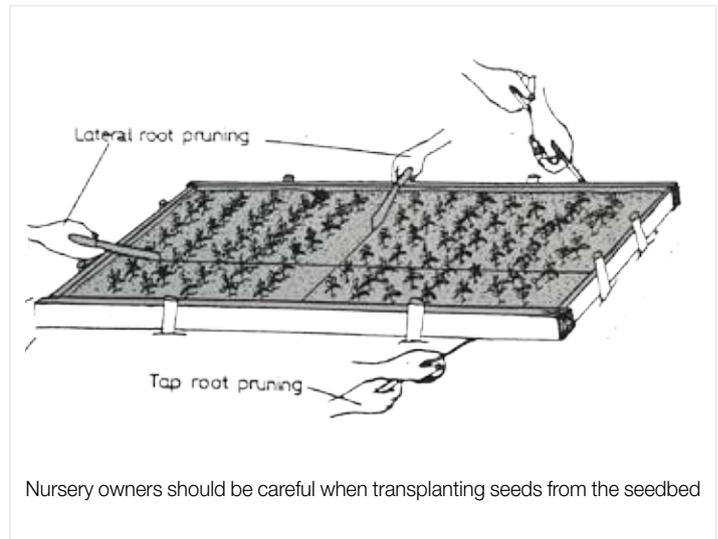
Seedlings in the beds are provided with shade for the first two weeks to slow down the rate of evaporation. After this, the amount of shade is slowly reduced by reducing the cover. After another week the shade is completely removed.

Managing seedlings

Watering: Water is needed in order to dissolve and take up the nutrients required by the seedlings. For seedlings exposed to direct sunlight, watering is done in the morning and in the evening. Seedling under shade can be watered once a day. Watering is not necessary during the rainy season.

Weeding and cultivation: Weeding is removal of any other growing vegetation except the required seedlings. Weeding removes competition for nutrients between the seedlings and other vegetation. It is done constantly. Cultivation of the top soil on the bed loosens the soil enhancing the movement of water and air circulation. Uncultivated soil turns into a hard green crust hindering movement of water and air leading to poorly growing seedlings.

Root pruning: Root pruning involves cutting of roots that grow beyond the bottom of the containers or the bed. It is done six weeks after pricking out and four weeks thereafter. The containers with seedlings are lifted and the protruding roots cut off with a

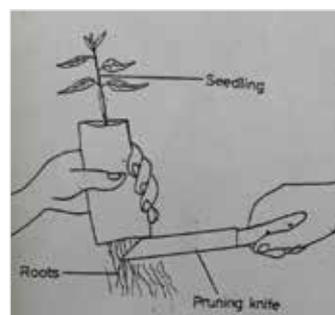


sharp knife. Moving seedlings in containers prevents roots from developing in the ground. Placing the containers on a hard or a polythene surface also prevents root penetration into the ground.

In the seed beds root pruning is done by running a sharp knife deep in the soil between rows of seedlings parallel to the seed bed. After two weeks, the same is done but this time the knife is run across the seedling bed. Cutting the roots penetrating deep into the ground requires two people holding a wire and placing it below the log at one end and pulling it from one end to the other end of the bed.

When root pruning is done as recommended, it enhances the growth of extensive fibrous root system. This hardens the seedlings for the harsh conditions in the field after transplanting. Reduce the amount of water given to the seedling four weeks before transplanting to aid in hardening the seedlings.

Pests and diseases in the nursery: Gull flies sometimes appear in the nursery. The conditions worsen in case of limited water and improves with adequate water supply to the seedlings. Young seedlings may rot at the root collar, die and fall off in a condition known as damping off.



Tree root seedling should be pruned to promote growth of fibrous roots

This is a result of excess watering. Reduce or stop watering all together until the condition stops.

Transplanting

Only healthy seedlings should be removed from the nursery to be planted in the field. These are the seedlings that are 30cm to 50cm and are growing vigorously and have been hardened. When removing seedlings from the bed, observe minimum disturbance to the soil holding onto the roots. Retain this soil as much as possible up to the planting spot.

Transportation: Seedlings in containers are removed from the container just before planting. The ball of soil is then loosened to allow water and air circulation to the roots. If the seedlings have to be transported using a truck or even a wheelbarrow, they should be loaded and unloaded with a lot of care. They should not be loaded on top of each other or tipped while unloading. If it is not possible to plant them immediately, they should be stored under a shade to protect them from excess evaporation.

Record keeping: A farmer should keep a record of the daily activities. These include; movement of seedlings (number pricked out, number of dead seedlings, sold seedlings, etc.) application of manure (source of manure, date applied, amount applied). The record book should have information on seed source, available tools and equipment, amount of seed sown by type, germination rate and number of seedlings produced.

Source: *A Manual For Tree and Nursery Management (KEFRI)*. Lilian Maina is a Nairobi - based Journalist.

Keep food safe by maintaining hygiene across food chain

There is no food security without food safety. Access to sufficient amounts of safe and nutritious food is not only key in sustaining life but also in promoting good health. Everyone has a role to play to ensure food is safe from farm to fork.

Mary Mutisya | Every year on June 7, the world marks the World Food Safety Day. Even with this declaration, the component of food safety has continued to be among the most overlooked issues, often being overshadowed by health, education, access to water and other problems that affect people.

This should however not be the case because food safety affects everyone, every day and its implications are huge on all development issues. There is no food security without food safety. Access to sufficient amounts of safe and nutritious food is not only key in sustaining life but also in promoting good health.

Statistics by the United Nations, show that at least 600 million cases of food-borne diseases are reported annually and that 1 in every 10 people fall ill after eating contaminated food. Children under 5 years suffer the most with the reported deaths going to as high as 125,000 per year.

To achieve several UN Food and Agriculture Organisation (FAO) development goals, food safety is a key responsibility which should be shared between governments, producers and consumers. Each and every person has a role to play right from the farm to the table. The following measures should always be followed and observed to ensure that the food we eat is safe.

Ensuring food safety at farm level

At farm level, food-borne bacteria can enter the food supply chain and preventive measures need to be put in place as early as possible.

Overreliance on the use of chemical pesticides (insecticides, fungicides and other chemicals) in food production should be discouraged. The use of chemicals, which particularly contain dioxins (poisonous chemicals), should be discouraged as these have a long term and persistent residual effect once they enter the food system.

When it comes to the



Food crops should be well-handled during harvest, transportation and storage

growing of vegetables and more specifically those that are grown and consumed in the city, care should be taken to ensure that the same are not grown along raw sewage lines as this is unsafe and could be a cause of many illnesses.

Rather, organic farming and consumption of organic produce should be encouraged. Complemented by other farm practices, safe biological products (biopesticides) can be used to control pests and disease in crops.

Food safety during transportation

As food is being transported from one location to the other, it is possible for contamination to occur. For instance, when fruits and vegetables are transported in open lorries over long distances, they gather a lot of dust which could contain harmful chemicals and microorganisms. Exhaust fumes from automobiles contain heavy metals that contaminate food during transport.

Food safety during storage: All food should be well stored in a cool dry place. Cereal foods should also be dried thoroughly to stop the development of moulds which can cause mycotoxins, one of which is aflatoxins. Maize, beans, sorghum, oat, millet and many other cereals should be stored at moisture level of 13.5 % or below to avoid aflatoxin poisoning.

It is therefore advisable that farmers cover their fruits and vegetables properly during transportation. Temperature control, mixing of ready to eat food with raw food as well

as protection of food from contamination by non-food items during transportation should be avoided.

Food safety during processing important

The food processing industry is a critical sector and its role cannot be overlooked. All food that is produced by farmers cannot be consumed at a go and this has led to further processing of foods in an effort to preserve it for future use. Preservation of food should be done by skilled people as it may involve use of chemicals which can be toxic as it was the case recently when several retail supermarkets were found to treat meat with higher levels of preservation chemicals.

Food safety at household level

At household level, each and every person has the duty to maintain food safety and this can be achieved through the following five steps.

Maintaining hygiene: This can be attained by handwashing with soap at critical times (before eating, after visiting the latrines/toilets, after cleaning a child's bottom, before feeding a child, before preparing food and after handling raw meat, fish, or poultry) and sanitizing all surfaces and equipment used for food preparation. Protect kitchen areas and food from insects, pests and other animals.

Separating raw and cooked food: Separating raw meat, poultry and fish from other foods, using separate equipment and utensils such as knives and cutting boards

for handling raw foods, storing food in containers to avoid contact between raw and prepared foods.

Cooking thoroughly: Cooking food thoroughly and especially meat, poultry, eggs and fish should be encouraged. Foods like soups, stews and milk should be to boiling point (about 70°C). For meat and poultry products, ensure thorough washing such that water used is clear, not pink. Cooked food should be reheated thoroughly before it is eaten.

Keeping food at safe temperatures: Cooked food should not be left at room temperature for more than 2 hours, refrigeration should be done promptly for all cooked and perishable food (preferably below 5°C). Cooked food should be kept piping hot (more than 60°C) prior to serving and food should not be stored for too long even in the refrigerator.

Use of safe water and raw materials: Use safe water, safe water storage, select fresh and wholesome foods, choose foods processed for safety, such as pasteurized milk. Wash fruits and vegetables with clean and safe water, especially if they are to be eaten raw. All foods should not be eaten beyond the expiry date.

**Mary Mutisya is a Masters degree in Nutrition student at Jomo Kenyatta University of Agriculture and Technology (JKUAT).*

For more information on food hygiene during food processing <https://www.infonet-biovision.org/EnvironmentalHealth/Premises-food-value-addition#simple-table-of-contents-6>

Beetroot is food for people and fodder for animals

Mangold Beetroot is highly nutritious for both animals and people. Its drought resistance properties make it a suitable crop for growing in the dry season.

Lilian Maina | Beetroot (*Beta Vulgaris*), from the chenopodiaceae family is grown for its leaves and highly nutritious edible roots. Beetroot serves as food for people and fodder for animals. When consumed by people, it is a source of dietary fibre, has anti-cancer nutrients as it contains phytonutrients and is a rich source of vitamin A and C. The chemicals in the root can also be extracted to make food colour.

Climate requirements

Beetroot does well in cool climate though it can also be grown in warm areas. The ideal temperature for its growth ranges from 15°C to 25°C. Very hot temperatures may lead to poor root colour hence a crop of low quality. It prefers loose, fertile soils with a pH value of 6 to 6.8. For best results beetroot should be grown in an open field with access to the direct sunlight. In Kenya it is mostly grown in Nakuru, Kiambu and Tharaka Nithi counties.

Varieties

The commonly grown varieties include; the garden beet (used as a vegetable), sugar beet (major



Beetroot leaves are nutritious vegetables for people

source of sugar), Swiss chard (preferred for its edible leaves), Mangold, Detroit (has small sized, round shaped root dark red in colour and is resistant to bolt). Other varieties include, Burpee's golden, Crimson globe, Chioggia pink and Cylindra. The most suitable variety for fodder in Kenya is the Mangold variety.

Land preparations and planting

Plough the land and ensure that the soil is of a fine texture. Plant the seeds in rows. The row spacing should be 25cm to 30cm apart. Make the seed-bed firm and keep it moist. Plant your seeds at a depth of 1.5cm to 2cm. Beetroot seeds take about 1 to 2 weeks to germinate. Thin the seedlings out soon after germination at a height

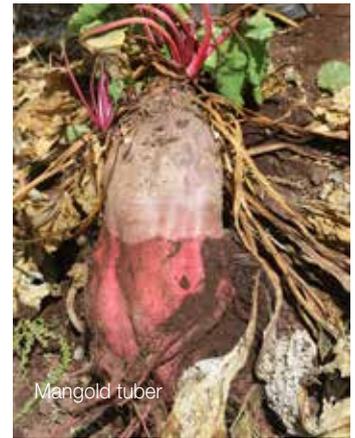
of 7-12 cm. Plant the seedlings 5cm-10cm apart in rows.

Spread planting across the year

Stagger the crop planting a portion every month so as to spread the crop throughout the year. Avoid planting during the rainy season as this exposes the seedlings to diseases. The farmer can apply rock phosphate or any other organic fertilizer along the rows before planting. Farmers are advised to avoid the use of farm yard manure on beetroot.

Do not give excess water

Keep the seeds and the seedlings well-watered throughout the dry season. Avoid over watering as it favours faster development of the leaves at the expense of



Mangold tuber

the roots. Lack of enough water leads to woody roots. Mulching is encouraged as it helps in retaining soil moisture during the dry season and discourages weeds growth. Always keep the field weed free.

Beetroot is ready for harvest in 9 to 10 weeks. An acre of land yields between 2.5 to 4.5 tonnes of beetroot. When harvesting, lift the crop carefully to prevent damage to the top root or the beet. Watering the soil before harvesting makes it easier to pull out the beetroot. Twist the leaves to stop them from bleeding which affects the colour and flavour of the beet. Store the non-damaged beetroots in a cool dry area free from moist. When stored properly, beetroot can stay up to 6 months and still retain its nutritional value.

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

Beetroot sustains my cows during the dry season

Mary Wairimu Mungai 88, is a dairy farmer in Passenga village in Rurii area in Nyandarua County. Since 1970s, her family has practiced dairy farming. One of their main sources of fodder has been Mangold fodder beetroot. Although she has reduced the number of dairy cows due to her advancing age, Ms Wairimu still relies on beetroot to feed her 4 dairy cows especially during the dry season.

"One reason why I prefer Mangold beetroot is that it is highly nutritious. It is also not affected by frost as it retains a lot of water, which is very crucial during the dry season when animals need water most. If well stored, it can stay for up to 6 months without spoilage. The only precaution is for the farmer to ensure that it is not bruised at the time of harvesting and storage," she says.

Fodder for dry season

Lack of pasture is a big problem in many parts of the country, beginning January to April. But for Ms Wairimu, this has not been a problem because she has always planted beetroot in time for use during the dry spell. All the beetroot is harvested and stored in her barn by December. As soon as the grass pastures diminish, she starts feeding the beetroot until the next rains when the pastures regenerate in March or April.

Besides storing most of the beetroot for her animals, Ms Wairimu leaves some of the beetroots on the farm, whose leaves she uses as vegetables from which she makes various dishes for food. "They are useful since there is a shortage of vegetables during the dry season. The beetroot vegetables sustain us until the rains come. It is a very useful vegetable crop during the dry season," she adds.

For animals each cow is fed about 4kg of beetroot fodder divided into 2 kg in the morning and another 2 kg in the afternoon during milking time. To supplement the beetroot, some concentrate is also fed to the animals.

Farmers can buy seeds

Due to the increasing demand for beetroot fodder accompanied by shortage of seeds in agrovet shops, Ms Wairimu has discovered a way to get extra income from selling Mangold beetroot seeds. In her seedbed she allows some of the fodder beetroot to set seed, which she harvests and dries in her store under controlled light. Once the seeds are dry, they are threshed and winnowed and packed in sachets for sale to other farmers. Farmers interested in buying seeds from her can call 0723 098 or 0711 894 552. *Peter Kamau*



Ms. Wairimu harvests Mangold beetroot in her farm

How to identify animals suffering from FMD

What are the first observable conditions for Foot and Mouth disease in cattle?

Foot and Mouth Disease (FMD) is a highly infectious disease that spreads fast affecting cattle, pigs, sheep, goats and even wild animals. The main cause of the disease is a virus of which there are 7 types, each producing the same symptoms. An animal can develop resistance to one strain of the virus but still get infected by other viruses from the seven strains; that is why the disease is very difficult to prevent.

Four strains of FMD common in Kenya

In Kenya there are four strains against which the animals are vaccinated. The disease-causing viruses can survive in contaminated fodder and the surrounding environment for up to one month depending on temperature and pH conditions (these conditions only accelerate the disease but are not the main cause). It can also spread through the air under favourable weather conditions, mainly travelling considerable distances by this

route.

The animals can pick up the virus either by direct contact or with an infected animal, contaminated fodder or when they come into contact with some parts of an infected carcass. Infected meat and meat products can also spread the disease. FMD can also be spread by people, vehicles and any object that is contaminated by the virus.

Symptoms

The following are the symptoms of FMD:

- Fever
- Blisters in the mouth and feet
- Drop in milk production
- Weight loss
- Loss of appetite
- Quivering lips
- Blisters may also appear on teats
- Lameness

Treatment

There is no treatment for FMD. Affected animals often recover on their own. However, because of loss of production and the infectious nature of the disease,

infected animals are often culled (killed and disposed). FMD is one of the most difficult animal infections to control. Since the disease can break out in any part of the world, export restrictions are always imposed on any country with an outbreak. FMD outbreaks are also controlled by quarantines and movement restrictions, disinfection of affected areas, equipment and vehicles.

Infected carcasses must be disposed of safely by burning, or any other techniques that stops the spread of the disease. Rodents (rats and mice) and other vectors are often killed to stop them from spreading the disease. Milk from infected animals can be sterilized by heating to 100°C for more than 20 minutes. Animal manure and slurry can be sterilized by heating up to 67°C for three minutes.

Prevention

Vaccination can be used to reduce the spread of the disease or to protect specific animals. Vaccinations can be carried out in areas where FMD is common to protect animals from specific strains of the virus common in those regions. In Kenya animals

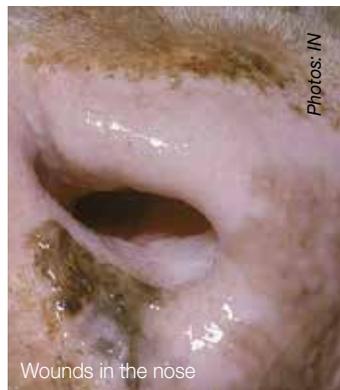
are vaccinated against the four strains of the FMD virus found in East Africa.

Foot and Mouth Disease is mainly transmitted through infected people, birds, vehicles, fodder or anything that comes into contact with the virus in areas with the virus or regions with infected animals. This is one reason why livestock farmers (especially dairy farmers) are advised to put in place biosecurity measures such as putting up foot baths with disinfectants at the gate or entry into the animal farms.

NOTE: Whenever you notice any disease symptoms in your animals, it is always advisable to consult a veterinarian for diagnosis and treatment. Do not try to treat the animal yourself.
Elkanah Isaboke

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

For more information on Foot and Mouth Disease <https://www.infonet-biovision.org/AnimalHealth/Specific-Management-Diseases#simple-table-of-contents-6>



Wounds in the nose



Wounds on the tongue



Wounds on the tongue



Wounds on the lower lip

Continued from page 3 ►►

barley (518ppb), 1 to 2 cows died every week. This shows that even very small traces of glyphosate in fodder can be devastating to livestock.

In many temperate and even in tropical regions, glyphosate is often sprayed on wheat, barley and sugarcane to dry them so that they can be harvested). Glyphosate levels are very high in crops dried using the weed killer.

Chicken deaths

In the same study, 5,000 flock of chickens were exposed to RoundUP Ready maize and soybean meal (1,500ppb). Out of

the 5,000, 25 to 30 chickens died every day. In all the experiments, animal and chicken deaths stopped when they were given feed that was not exposed to glyphosate (Dr. Ted Dunmeier, Dr. Monikar Krueger, Department of Veterinary Medicine University of Leipzig, Germany).

Resistant bacteria in chickens

From another study, *Toxicity to and Impact of Glyphosate on Poultry Intestinal Microflora*, it was established that chickens fed on feed exposed to low levels of glyphosate had developed resistant strains of *salmonella*, *clostridium*, *E. coli* and *Enterobacter cloacae* (clair et al, 2012, Shehata et al, 2012; Krueger et

al, 2012).

Effect of glyphosate on environment

Widespread use of glyphosate especially in developed countries has been identified as one of key causes of the lower mineral availability in plants in the affected areas which affects key pollinators such as bees.

Glyphosate also affects digestion in bees by killing beneficial microorganisms in the bee stomach called lactobacillus and bifidobacterium making them vulnerable to diseases caused by viruses, bacteria and stress.

Pollinators affected

Glyphosate has also been found

to affect bees through direct toxicity, endocrine disruption, neurotoxicity, which affects bee reproduction and disorientation (Faulk, 2009; Amos 2011). This effect on bees has been linked to what is called the Bee Colony Collapse Disorder (BCCD) that has reduced bee populations in many developed countries where glyphosate is widely used in large-scale farms.

Widespread use of glyphosate has also affected fish and other aquatic life including the development of super weeds that are resistant to all herbicides, including glyphosate itself.

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

Managing tsetse flies to protect your livestock

This is an excerpt from Kilimo Hai radio programme done in partnership with ICIPE's Tsetse fly Project. It was aired on KBC and mainly focused on answering farmers' questions on tsetse fly infestation.

Musdalafa Lyaga | Many small-scale farmers in Kenya rely on livestock as their bank. When they need money, they sell animal products such as calves, milk, meat, hides and skins. The farmers also produce milk and meat for home consumption which contributes to food security for many livestock keepers.

Poor man's pest

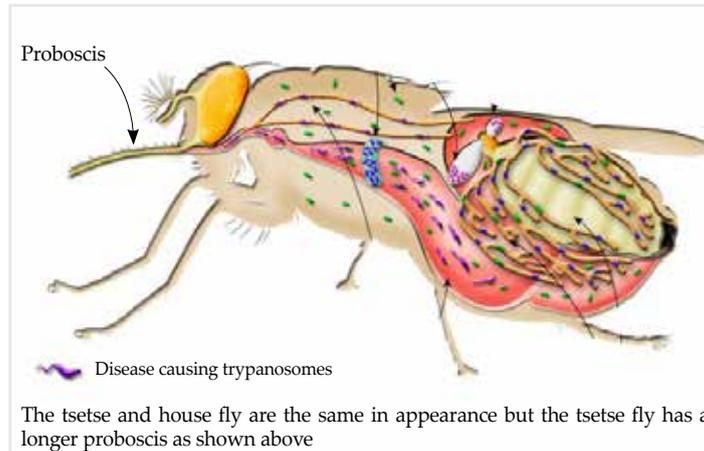
However, there is a destructive pest that is a major headache to livestock farmers. This destructive insect that closely resembles the common housefly is called the tsetse fly. The tsetse fly causes a serious illness known as sleeping sickness in people and trypanosomiasis in livestock. Tsetse flies survive on human and animal blood.

This troublesome pest affects mostly the small-scale farmers who keep livestock near national parks where wild tsetse flies from wild animals move to livestock. The tsetse flies also disturb livestock when they bite since they cause pain as they pierce the animal skin to suck blood.

Dr. Daniel Masiga, a Principal Scientist and Head of Animal Health Theme at ICIPE, says that the areas mostly affected by tsetse fly are the Kenyan coastal region, Lake Victoria and its environs, Lake Bogoria and its surroundings, parts of central Kenya, especially Meru and Mwea, Narok, Kajiado, Isiolo, Samburu, Moyale, Wajir and Mandera.

Tsetse flies cause huge losses

According to Ms. Joan Nduku, the County Executive Committee member in charge of Agriculture, Livestock and Fisheries Kwale County, farmers whose livestock have been affected by trypanosomiasis have to contend with low or total loss in milk production, high cost of



treatment, livestock affected also fetch very low prices or may even lack market. Some animals also die from the disease.

Concerned farmers called or sent SMS to ask TOF Radio questions after the broadcasts on the tsetse menace. This article samples a few of the questions addressed during the last programme whose title was *Understanding tsetse fly*.

Symptoms of trypanosomiasis

Mrs. Felistus Kibibi from Kwale County asks, "What are the symptoms of trypanosomiasis and is it fatal?"

When you observe symptoms such as absorption in in-calf cows, oxen losing the ability to pull the plough due to weakness, drastic weight loss, high fever, trembling skin and straight fur, an animal is likely to be infected. In addition, an infected animal will get exhausted quickly and normally will be left behind by the rest of the herd. Affected livestock will also have tears frequently. The best action to take when you observe these symptoms is to immediately consult the nearest veterinary personnel. Timely treatment can save your prized animal.

How to identify and prevent tsetse fly

"How can I differentiate between the common house fly and tsetse fly?" Asks Mr. Eliud Okello from Siaya County.

It is difficult for farmers to tell

the difference between the house flies and the tsetse flies.

You must be very keen to tell the two apart. For example, if you look at the mouth of a tsetse fly, you will notice that it is serrated and looks like a straw. This enables it to pierce into tough animal skin and suck the blood.

When the tsetse is not on flight but has spread its wings, you will notice markings on the wings that looks like a machete.

Mr Joseph Serian from Narok County asks, "How can I prevent tsetse flies from attacking my cows?"

Ms. Olabimpe Olaide, an ICIPE scholar responds.

"Our study established that zebras produce certain scents that repel tsetse flies. We also found that a blend of three of these odours enhances the effectiveness of existing tsetse management tools, including the ICIPE's tsetse fly repellent collar technology and NGU traps," notes Olabimpe Olaide.

Traps and repellents fight tsetse fly

The NGU trap is built on visual (shape and colour) and smell-based cues like cow urine that attract tsetse flies. The highly successful tsetse repellent collar technology exploits chemical signals obtained from the waterbuck, an animal that has also been found to repel tsetse flies. A blend of these chemicals has been packaged in innovative dispensers which, when worn as

collars around the neck of cattle, makes them unattractive to tsetse flies.

Contacts and further information

Should farmers have any questions on various Ecological Sustainable Agriculture technologies and innovations, please do not hesitate to call or send us a text on the cell phone number: 0715 422 460. You can also email on: feedback@biovisionafrica.org and we will discuss your question on air.

You can download the whole series radio program on tsetse infestation on;

https://www.youtube.com/channel/UCWaoyhgaT9BwyDUu_8DEN1g

Additional information from icipe website;

<http://www.icipe.org/news/zebras-offer-leads-control-tsetse-flies>

*Musdalafa Lyaga is TOF Radio Manager and Producer.

Radio Taifa frequencies for our TOFRadio programmes

TOWN	FM FREQUENCIES	MW (MEDIUM WAVE FREQUENCIES)
Nairobi	92.9 MHz	
Mombasa	100.8 MHz	
Kisumu	104.5 MHz	
Kakamega	104.5 MHz	
Bungoma	104.5 MHz	
Eldoret	88.6 MHz	
Nakuru	104.1 MHz	
Meru	90.4 MHz	
Nyeri	87.6 MHz	
Kisii	103.3 MHz	
Malindi	90.1 MHz	
Kapenguria	93.3 MHz	
Kitale 9	3.3 MHz	
Voi/Kibwezi	96.9 MHz	
Namanga	89.9 MHz	
Lodwar	88.6 MHz	
Lokichoggio	89.3 MHz	
Garsen	93.1 MHz	
Kajiado	92.9 MHz	
Kitui	92.9 MHz	
Lamu	96.3 MHz	
Maralal		1107 KHZ
Wajir		1152 KHZ
Marsabit		675 KHZ
Garissa		567 KHZ