



Parliamentary committee upholds ban on GMOs

Peter Kamau | A ban on Genetically Modified products (GMOs) should not be lifted until the country develops necessary laws to ensure safety of consumers. Kenya's National Assembly Committee of Agriculture last month reinforced the ban that has been in force since 2012 despite protests by proponents of GMOs.

"There is no evidence of adequate tests to determine the safety of genetically modified products which are still finding their way

into the country due to weak border control mechanisms," said the committee chaired by Manderu North MP Mohammed Noor, in its report.

No safety tests done on GMOs

The committee notes that no GMO product has been tested for safety by the National Biosafety Authority (NBA). The current Biosafety Act passed by Parliament in 2009 has no specific provision for testing for safety," the report asserts.

The report further emphasizes that the ban should not be lifted because GMO products must pass a preliminary independent verification procedure which covers acute and sub-acute phase of testing before human consumption is allowed.

The report is a huge setback for companies and organisations pushing for the introduction of GMOs in Kenya. Proponents of GMOs claim that the GMOs would address food insecurity and malnutrition in many parts of the country and yet there is no evidence for this.

Cartagena protocol supports independent trials

According to a provision of the Cartagena Protocol of which

Kenya is a signatory, countries with an interest in GMO technologies are required to conduct independent scientific trials to ascertain the safety of any GMOs that an organisation seeks to introduce into their country's farming systems. The scientific tests should include short and long term effects of the GMO material on people, animals and the environment.

Anti GMO coalition supports ban

The Kenya Biodiversity Coalition (KBioC) supported the decision by the Kenyan Members of Parliament to ban GMOs in the country. "These men and women have shown exemplary leadership, foresight and patriotism in a matter close to the hearts of Kenyans," said Wanjiru Kamau, the KBioC spokesperson.

She added that the resources being used to promote GMOs should be allocated to support ecological organic agriculture to nurture a healthy generation, production and consumption of safe food, a healthy environment for all including future generations. She further stated that there was need to carry out independent and long term scientific safety trials conducted under local conditions before GMOs are allowed into the country.

Dear farmer,

The beginning of the year is mostly a challenging time for most farmers. They are not only burdened by many financial obligations such as paying fees for their school going children but also preparations for buying inputs and the land for planting. These tasks call for proper planning to have a successful farming year.

By now, every farmer should have decided what type of crop to plant for each season in 2017. For many farmers, maize is the most common crop. However, the practice of having only one crop every year presents some disadvantages. The main disadvantages of mono-cropping is that it continuously takes away the same nutrients from the soil. This interferes with the nutrient balance, causing a decrease in soil fertility and low crop yields.

Although we do not discourage farmers from planting maize, it is important to practise crop rotation or have different crops on the same land (intercropping). Intercropping maintains a balance of nutrients in the soil. Crops such as beans and related legumes also trap nitrogen from the air and fix it into the soil. This results to additional nutrients that crops like maize require in large quantities.

In this edition we have prepared informative articles for you. Among other articles, we have featured climate change which, is a problem majorly born of human activities. The adverse effects of climate change to human beings, crops, animals and the environment have continued to bite and can be mitigated by adopting sustainable ecological farming systems. Read more on this in pages 2 and 4.

It is common practice in January and February to see huge fires and smoke going up in many farms in rural areas as farmers burn crop residue in preparation of land for planting. This is a very destructive form of agriculture because the crop residue is a very important input on the farm which should be retained (look out for the next TOF issue for more information on conservation agriculture).

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TOF wishes you a prosperous 2017 where you can choose to embrace sustainable ecological farming strategies for improved livelihoods!

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Lessening of climate change starts with a change in human activities

Erratic rainfall, increasing air temperatures and changing weather patterns have been observed globally for the last twenty years. This has been attributed to the change in weather conditions.

Sarah Ndonge and Tino Johansson |

One term that has become synonymous with all these phenomena is "climate change". Climate change has been discussed in international high level conferences; among governments, non-governmental organizations and also among the local citizens. So, what exactly is climate change and why should those in the agricultural sector begin to pay more attention and take immediate action?

Agriculture is a vital component of societal well-being and it occupies approximately 38 percent of the land surface, and consumes 70 percent of global water resources. In Kenya agriculture, which occupies, 48.5 percent of total land area, is the backbone of the country's economy and the source of livelihood for majority of the rural population. The sector contributes about 26 percent of the country's GDP and employs about 75 percent of the population. The sector is a major source of revenue with agricultural produce exports accounting for nearly two thirds of total domestic export.

What is Climate Change?

The United Nations Framework on Climate Change (UNFCCC) defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere, which is in addition to natural climate variability observed over comparable time periods.

This change in global or regional climate patterns is due to the rising levels of atmospheric carbon dioxide and other heat-



Insufficient rains leads to crops' stunted growth as a result of climate change

trapping (greenhouse) gases which are released when fossil fuels are used, through deforestation and human activities that lead to soil erosion. Fossil fuels are formed by natural processes that take millions of years and include fuels such as coal, oil and natural gas. Rising levels of atmospheric greenhouse gases radiate energy towards the earth's surface, heating it and cause global impacts such as rising sea levels, melting of glaciers, increasing air temperatures, more occurrences of severe droughts and floods. Research has shown that this change has accelerated and is causing threat to human health, the quality of human life, freshwater availability, decreased agricultural productivity and the peace and stability of nations due to food insecurities.

What are the visible impacts that provide evidence of the changing climate?

Climate change is a global phenomenon whose impacts vary significantly in both magnitude and rate of change across different geographic regions. The most common evidence of the changing climate is:

- Increased air temperatures that cause stress on livestock especially pigs and poultry; increase their vulnerability to vector-borne diseases; reduce their reproduction as well as appetite. Decreased appetite will lengthen the time needed for the livestock to reach their target weight. Stress can also increase the incidence of sickness, decrease rates of reproduction, and increase fighting among animals in confinement.
- Water quality and quantity have been affected in some areas due to the change in rainfall received and the rising sea levels. Climate change is likely to increase the demand for water while shrinking the supply of quality water. The potential for soils to support agriculture will be influenced by changes in soil water balance like dry soils becoming drier resulting to a higher demand for more water to carry out irrigation farming.
- Increased temperatures and longer dry spells between rain events; erratic rainfall, floods or reduced amount of rain received. In some areas, extreme weather events such as heat waves, droughts, strong winds, heavy rains and flooding are experienced.
- Increase in disease transmission due to faster growth rate of pathogens in the environment. This is due to the presence of hot conditions that favour high reproduction of vectors such as insects.
- Weeds, plant and animal pests and diseases have become more abundant. They have shifted, expanded their range and invaded new habitats as global warming increases.
- Some studies have shown that herbicides become less effective when the levels of carbon dioxide increase. In some instances, as the temperature increases, insect pest populations increase and spread into a larger geographic area.

In most areas, crop yields and agricultural productivity have been affected by all the above impacts.

Who is responsible for Climate Change? Nature or human activities?

Different studies have concluded that climate change is caused by the increase of the greenhouse gases - GHGs (heat trapping gasses as discussed above) in the atmosphere that

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

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How to make feeds for free range indigenous chickens

Poultry farming is a major economic activity among rural and even urban farmers in Kenya. However, the cost of feeds is so high that farmers find it difficult to buy commercial feeds. Making own feeds at home, reduces costs and increases profit.

William Ayako | Poultry farming has made immense contribution to the Kenya's economy. Poultry farming contributes about 2.3 % of the Agricultural Gross Domestic Product (GDP), 6.1 % of the livestock GDP and 0.7% of the GDP. Therefore many people living in the urban and rural areas of Kenya derive their livelihood from poultry farming. Keeping of local poultry has increased recently and the trend has been attributed to the demand for local chicken meat by local consumers.

However, lack of appropriate feeds for local chicken has made it difficult to improve the productivity of local poultry farming to meet the increasing demand for meat and eggs. The prices of commercially manufactured poultry feeds are beyond the reach of most small-scale farmers.

Careful preparation of poultry feeds improves productivity

The quality of commercial feeds is not guaranteed due to limited capacity and logistical challenges among the feed regulators. Lack of policy guidelines in feed industry is being addressed by the department of livestock. Hence, poultry farmers would reap more benefits once the policy becomes operational. Farmers are advised to exercise caution when buying manufactured feeds. This is because some unscrupulous feed manufacturers sell poor quality feeds such as crushed maize cobs with traces of aflatoxin and sell it as maize germ.

Another key challenge in poultry feed formulation is erratic availability of local feed ingredients among poultry farmers. Different regions in Kenya have potential for different feed resources.

A simple homemade poultry ration has been demonstrated for poultry farmers, based on



Home-made feeds ensure quality because the farmer carefully selects the ingredients to use

commonly available resources. However, the formulation is recommended for only extensively reared birds (those which are not confined in a house). Home-made feeds ensures quality because the farmer can carefully select the type of ingredients to use. Farmers should avoid the use of rotten maize when preparing poultry feeds because poultry are very sensitive to feed

contamination especially with aflatoxins.

Best practices during the preparation of poultry feeds

When using low quality ingredients, it is always important to add toxin binders to prevent aflatoxin contamination. Mycotoxin binders greatly reduce aflatoxin

poisoning especially for chickens as they are highly sensitive to aflatoxin poisoning. Egg production and meat quality are adversely affected.

Farmers should understand that the formula has balanced proteins only. Energy and other nutrients can be balanced by the hen during scavenging. Therefore, the formula is not recommended for intensively managed birds. Farmers in urban areas, who have access to maize germ can use it because it is cheaper than whole maize.

Farmers can use the following simple formulations ratios to make their own poultry feeds at home:

Kienyeji chick mash with 20% crude protein

Ingredient type	Weight (kg)	Crude protein (%)	Crude protein (kg)
Whole maize meal	48.57	8.23	3.99
Soya	18.57	45	8.35
Fish meal (<i>omena</i>)	12.85	55	7.07
Maize bran	14.28	7	1
Lime (DCP)	5.7	0	0
Total	100		20.42

Kienyeji growers mash with 16% crude protein

Ingredient type	Weight (kg)	Crude protein (%)	Crude protein (kg)
Whole maize meal	62.85	8.2	5.17
soya	11.42	45	5.14
Fish meal (<i>omena</i>)	10	55	5.5
Maize bran	10	7	0.7
Lime (DCP)	5.71	0	0
Total	100		16.51

Kienyeji layers mash with 18% crude protein

Ingredient type	Weight (kg)	Crude protein (%)	Crude protein (kg)
Whole maize meal	48.57	8.23	3.99
soya	17.14	45	7.71
Fish meal (<i>omena</i>)	11.42	55	6.28
Maize bran	14.28	7	1
Lime (DCP)	8.5	0	0
Total	100		18.99

Additional tips when making your own poultry feeds

When preparing poultry feeds from home, it is always important to isolate a few birds and observe if there is any change. The changes to look out for are improved egg-laying or weight gain for birds meant for meat. For free range birds, this can be quite challenging. But, the farmer can isolate poultry by fencing off a section of the land where the birds can still scavenge as they are given the new feeds, and assessed for performance. Alternatively, farmers can send the feeds for testing at Kenya Agricultural and Livestock Research Organisation (KALRO) in Naivasha (the address is provided below) to ensure the feed is properly prepared.

For feed testing, farmers can send feed samples to KALRO, Naivasha. The results are usually ready in 24 hours and can be sent to you by email. One sample costs Ksh 1000. KALRO, Naivasha Tel. 020 23 90 930.

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The role of sustainable agriculture in food security in Africa

Sustainable Agriculture enriches scientific practices by utilizing local resources and knowledge of the culturally and climatically diverse Africa to produce enough healthy food while protecting the ecosystem.

Prof. Rhodah Birech | Globally, 1.3 billion people depend on agriculture as a major source of livelihoods through creation of employment opportunities and a direct source of food. It is therefore the driver of economic transformation, which determines food security for any government. The UN Sustainable Development Goal (SDG) number two (2) specifically aims to “end hunger, achieve food security and improved nutrition, and promote sustainable agriculture.”

In Kenya, the agriculture sector is the backbone of the economy, contributing approximately 25% of the GDP, and employing 75% of the national labour force. Over 80% of the Kenyan population live in the rural areas and derive their livelihoods, directly or indirectly from agriculture. Half of the rural labour force is engaged in small-scale agriculture and women are the majority in the sector.

Critical roles agriculture plays in various economies

Given its importance, the performance of the agriculture sector is reflected in the performance of the whole economy. The sector plays a critical role in the development of economies of many countries in Africa. Agriculture plays multiple roles such as; socio-economic development, poverty alleviation, job creation, food security and improved nutrition. Growth in the sector is, therefore, expected to have a greater impact on a larger section of the population.

Unmet commitments to sustainable agriculture by many African countries

According to the Comprehensive Africa Agriculture Development Programme (CAADP), African governments in 2003 committed themselves to achieving agricultural growth of at least 6%, an allocation of at

least 10% of the national budget to agriculture sector to achieve a GDP growth of at least 7% in each year. The aim of the commitment was to reduce by half the proportion of the population living on less than US\$1 per day and who suffer from hunger between 1990 and 2015; doubling cropland under irrigation from 3.5% to 7% as a percentage of the total land by 2015; increasing cereal yield in kilogramme per hectare from an average of 1,392 to 2,000 by 2015; doubling the adoption rate of proven technologies such as improved seed varieties, and management of water and land by 2015; increasing livestock production by at least 4% annually.

Despite these commitments, many countries haven't honoured their commitment to CAADP agreements made in 2003. Kenya in particular, hasn't implemented the commitments. Agricultural growth rate in Kenya has been below 6% and the national budget allocation to the sector has been 4.9% of the GDP. Progress towards the two tons per hectare cereal yields has not been achieved and area under irrigation still falls below 7%. Instead, more land degradation, pollution and biodiversity erosion ascribed to agriculture has continued to occur.

Rewards accrued from practising sustainable agriculture

The official approach towards increasing agricultural productivity in Kenya is presumed upon implementation of conventional agriculture, which champions the use of high external inputs: optimum fertilizer application, use of hybrid cereals, and crop protection using chemical pesticide as advocated by the Green Revolution (GR). Many Kenyan farmers have however been half hearted on full scale adoption of the GR technologies and instead opt for what works best for them. Many adopt some technologies and add whatever else they know by practice owing to the wealth of tradition. Sustainable Agriculture is an “innovation” that follows a scientifically sound principle to rejuvenate the local system and raise agricultural production under the farmers' conditions. Engrained in Sustainable Agriculture is the concept of food production by optimizing the use of local resources while integrat-



Crop rotation and intercropping improves soil fertility and health

ing locally accepted varieties/breeds, protecting the land, soil, water, plants, animals and the people. It harnesses local agricultural knowledge and respects the interdependence of natural resources for food production. Foresight would demand that enough food is produced without environmental degradation and exposing people and their future to risk.

Sustainable agriculture cares for the following:

- **Soil fertility and health** – SA cares about the health and integrity of the basic unit of production that is the land and its soil through increased soil organic matter, water holding capacity, soil structure, soil moisture and soil microbial population.
- **Agro-ecology** – SA embrace recycling of the available resources and preserves the ecosystem
- **Soil and water conservation** – sustainable agriculture conserves water using technologies such as terracing and mulching besides retaining soil water arising from a high soil organic matter content.
- **Integrated insect pest and disease management** – sustainable agriculture combines diverse locally adapted practices to manage pests and diseases.
- **Biodiversity and agro-biodiversity integration** – sustainable agriculture increases agro-biodiversity and biodiversity by embracing multiple cropping systems, use of adapted varieties including local preferences, agroforestry, multi-purpose plants and integration of crops and livestock.

Why embrace sustainable agriculture?

Sustainable agriculture increases yields and food security, improves long-term soil quality, enhances water use, reuses organic farm residues, utilizes resources better, integrates local knowledge, decreases input costs, improves the environment, increases income and diversifies diets for both human beings and animals and it leads to improved quality of the land. The system can withstand shocks imposed by extreme weather and pests' pressure. Sustainable agriculture easily adapts to climate changes, increases soil carbon that occurs from buildup of organic matter, increases the ability of soil water holding capability and averts water stress as well as holds the carbon that could be lost to the atmosphere. Sustainable Agriculture also improves adoption of localized technologies among farmers. It diversifies income sources and increases the range of food and nutrients available for the household.

Policies in support of sustainable systems should be strengthened to mainstream the following:

1. Protection of local plant and animal species
2. Strengthen seed systems for local crop varieties
3. Establish SA training and other institutional and marketing infrastructure

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The effect of the good and bad fats in a diet

The food we eat contains both good and bad fats that cause weight gain and diseases associated with lifestyle such as high blood pressure, stroke, cancer and even diabetes.

Tyson Wachira | Fat is the most concentrated source of food energy, or calories. Fat contains over twice the calories of an equal weight of carbohydrates. Each gram of fat supplies about nine calories, compared to about four calories per gram of protein or carbohydrates and seven calories per gram of alcohol. Fat accounts for 34% of the total calories in an average diet. High-fat diets have been strongly implicated as a cause of atherosclerosis (a disease of the arteries characterized by progressive thickening and hardening of the artery walls) and certain types of cancer. Fats, platelets, and other debris block arteries and could eventually close them if they are consumed in large quantities over a long period. Fats can also provide too many calories, which could lead to obesity.

Some fats are unhealthy

Fats should be consumed in moderation in a healthy diet. We do require some dietary fats because they provide the essential fatty acids needed in the human diet. Fats can be classified into either saturated or unsaturated. Saturated fat is high in hydrogen and is found primarily in animal products and tropical vegetable oils. Saturated fat tends to elevate the cholesterol level in the blood. Because of their molecular structure, unsaturated fats contain

less hydrogen. They can be classified as mono-unsaturated or polyunsaturated. Both types of unsaturated fat raises blood cholesterol levels. Poly-unsaturated fat is more liquid than saturated fats. This type of fat is commonly found in plant products such as sunflower seeds, corn, soybean, cotton seed oils and walnuts. It is also found in fatty-fish that is high in oil such as omena, tilapia and Nile perch. Mono-unsaturated fat contains less hydrogen than saturated fats and can be found in olive, peanut, canola and avocado oils.

Reduce fat intake

If you are watching your calorie intake, reducing the fat in each meal is the best option. By choosing low fat foods, you can get the nutrients needed with fewer calories.

Solid fats are unhealthy

Hydrogenated fats are polyunsaturated fats that are derived through food processing. An example of hydrogenated fat is margarine made of vegetable oil. Commercially prepared and processed foods made with vegetable oils or with unsaturated fats such as butter and lard can also be high in saturated fat. Soft (tub) margarines are less hydrogenated than the stick forms and therefore contain less saturated fat. Substitute both kinds of unsaturated fats for saturated fat in your diet.



Fish has more nutritional value compared to red meat

How to reduce bad fats in food

There are several useful tips that will help any person in quest to reduce fat in any diet. Below are some of the tips that may help;

- Reduce your intake of red meats, such as beef, pork, lamb and substitute with smaller portions of fish, poultry, and lean meat that are low on fat.
- Remove the outer skin from chicken, and trim the fat from meat.
- Roast, bake, boil or simmer meat, poultry or fish rather than frying them. Avoid fried foods, especially deep-fried foods, since they have high fat concentration.
- Cool meat or poultry broth until the fat becomes solid. Spoon off the fat before using the broth.
- Be cautious of processed foods and fast foods. They aren't only high in fat but may also contain coconut oil or palm oil, which have high saturations of fats.
- Reduce intake of dairy products by replacing whole milk with one percent or skimmed milk in puddings, soups and baked products.
- Drink skimmed milk or one percent milk instead of two percent milk or whole milk.
- Eating cheeses that have less than five grams of fat per ounce, such as low fat cottage cheese.
- Avoid processed hard cheeses such as brie and cheddar.
- Avoid use of margarine or fat for cooking since they are highly saturated with fat.
- Substitute plain low fat yoghurt or blender whipped low fat cottage cheese for sour cream or mayonnaise.
- Limit plant foods that are high in oil such as nuts, olives, and avocados to avoid fat dense calories.
- Read labels to choose products that are low in saturated fats and total fat content.
- Avoid commercially prepared and processed foods made with saturated fats or oils.
- Steam, boil, stir-fry, with herbs and spices instead of fatty sauces, butter, or margarine.
- Try flavored vinegars or lemon juice on salads, or use smaller servings of oil-based or low fat salad dressings.
- Use vegetable oil in place of solid shortening, margarine, and butter whenever possible.
- Limit egg yolks to one serving when making scrambled eggs. Use additional egg whites for larger servings. Limit total egg intake to two or three per week.
- Choose foods that are high in complex carbohydrates and fibre.
- In case of overweight, restrict calorie intake and exercise regularly.
- Read food labels carefully. Some items labeled low in cholesterol or containing no animal fat may still contain large amounts of fat.
- Set goals and monitor your progress towards these goals.

Remember, by closely controlling one's diet and monitoring the progress with regular checkups, cholesterol levels can greatly be reduced besides a reduction to risk of developing coronary heart disease.

Saturated	Mono-unsaturated	Poly-unsaturated
Beef	Avocados	Almonds
Butter	Canola oil	Corn oil
Cheese	Cashew nuts	Cottonseed oil
Chocolate	Olives/olive oil	Fish
Coconut oil	Peanuts/peanut oil	Margarine
Eggs		Mayonnaise
Lamb		Pecans
Milk		Sunflower oil
Palm oil		Salad dressing
Pork		Soybean oil
		Sunflower oil
		Walnuts

Improved feed formulation for pigs

Continued from Issue no. 139

Feeds for gestating sow

When planning feed formulation for gestating sows, a farmer needs to ensure a balanced diet for the sow to remain healthy and support optimal fetal development without weight gain.

Producers commonly feed a gestation diet of about 4-6 Kg/day to sows under most environmental conditions. This quantity of feed per day is only a target and the actual amount fed should be varied according to individual animals and situations. Reducing daily feed allowance to less than 1.35Kg may cause an inadequate intake of vitamins and minerals with typical gestation diets. Use of scoop method to weigh the contents of the scoop with proper records guides a farmer to almost an accurate feed method. The following are some factors to consider when formulating feeds for gestating sows.

- **The size of sow**-Larger, heavier animals have higher maintenance requirements than smaller, lighter animals. Energy requirements increase about 200 kcal ME for each 9Kg increase in body weight.
- **Housing and feeding method**-When breeding stock are housed and fed in groups, they require about 15% more feed than individually fed animals because timid sows will not consume



A well fed sow feeding her piglets

their full share.

- **Environmental temperature**-Sows housed at temperatures below their lower critical

temperature require more feed to maintain body temperature than sows housed in a warm environment.

Condition scores of the sows

Score	Condition	Body Shape
1	Emaciated	Hips, backbone prominent to eye
2	Thin	Hips, backbone easily felt without applying palm pressure
3	Ideal	Hips, backbone felt only with firm palm pressure
4	Fat	Hips, backbone cannot be felt
5	Over fat	Hips, backbone heavily covered

- **Body condition**- Thin animals have less fat and insulation and require more feed than animals in good body condition to maintain body temperature when housed in low environmental temperatures. The consequences of undesirable body condition for sows include increased culling rate, increased numbers of gilts in the sow herd and decreased pigs/sows per year. Sows body condition that have more fat or thin bodies and an extreme in either of the body has various challenges.

Over fat sows are more likely to experience:

- Increased embryonic mortality.
- More crushed pigs.
- Decreased feed intake during lactation.
- Lower milk production, and
- Increased susceptibility to heat stress.

Thin sows may exhibit:

- Failure to return to estrus.
- Lower conception rates.
- Smaller subsequent litter sizes.
- Downer sow syndrome (bone breakage and spinal injuries due to excessive mobilisation of minerals from bones).

Michael Wanyoike, the Managing Director at Bell Farm Kenya Ltd. His contacts are 0722981400

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trap the heat radiating from earth toward space within the earth causing the temperatures to increase (global warming).

How do human beings contribute to climate change?

- The activities during the industrial revolution in the 19th Century, that involved the burning of coal and other fossil fuels, raised the atmospheric carbon dioxide from 280 parts per million to 400 parts per million in the last 150 years.
- Methane, a heat-trapping gas, is also emitted during the process of oil drilling, coal mining and from leaking gas pipelines. It is also released by livestock fermentation and manure, from rice or paddy fields that are flooded during the sowing and matur-

ing periods. When soil is covered with water it lacks oxygen, providing conditions for, methane-producing bacteria to decompose organic matter in the soil to form methane. The motor vehicles and equipment used everywhere are run on petrol and diesel which are fossil fuels that produce fumes that get released to the atmosphere.

- Deforestation is a major contributing factor to climate change. Forests play an important role in the carbon cycle of the earth. They absorb the carbon dioxide that is released into the atmosphere. When trees are cut down or burnt the carbon dioxide absorption ceases and the carbon stored in the trees is also released as carbon dioxide. It is estimated that more than 1.5 billion tons of carbon dioxide are released to the atmosphere due to deforesta-

tion, mainly through cutting and burning of forests, every year. Clearing of land for agriculture, industry, and other human activities has increased concentrations of greenhouse gases.

- The thermal power plants that produce electricity for domestic and industrial use are run on fossil fuels that emit large quantities of greenhouse gasses into the atmosphere.

What measures can farmers take to deal with the changing climate?

Climate change is already happening and causing diverse negative impacts to the agricultural sector in Kenya and globally. Developing and strengthening the resilience of farmers especially the small scale farmers to adapt to the changing climate is inevitable. Climate change adaptation

needs to involve changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change. Adaptation practices must focus on issues such as water resources; crop and animal pests and diseases and alternative energy sources. Some of the adaptation strategies that farmers can adopt include:

- Planting drought-resistant crop varieties that can thrive even with uncertain, erratic or low rainfall levels.
- Roof rain water harvesting to capture and store water during the rainy season for later domestic and farm use during the drier seasons.
- To promote the efficient use of water resources, farmers can adopt drip irrigation which conserves water while ensuring that the plant gets sufficient water.

Maintain hygiene and keep your cows off mastitis

I'm a farmer and I would like to know the best way to keep my dairy cows from contracting mastitis. Kindly explain

Mastitis can be a challenge to dairy farmers who do not observe high hygiene standards for their dairy cattle. Dairy cows require clean housing, feeds prepared in clean environments and feeding troughs, water drinking points, all require regular washing. Unless dairy cows are kept in clean environment, mastitis will always remain a persistent problem in farms.

Mastitis is a swelling of a dairy cow's udder caused by several strains of bacteria mainly from the *Streptococci* and the *Staphylococci* families. In many rural farms and even peri-urban areas. It is common to find dairy cows housed in dirty sheds where the animals are forced to lie on their own droppings mixed with urine. The soggy mess is a fertile breeding ground for bacteria that enter the teats through the teats ducts



A strip cup used in detecting mastitis

(canals or milk passages) when the animals lie down to rest.

Mastitis can cause great

d) Conservation agriculture which promotes minimal soil disturbance, permanent soil cover and crop rotations through planting of cover crops, mulching and crop rotations.

e) Biological control of pests which includes the use of parasitoids (natural enemies), small wasps released into a farm where they feed on the larvae of common crop pests.

The acceleration of environmental degradation and climate change has direct impact on agricultural productivity and food security globally. The agricultural sector especially the small-scale farmers, throughout the developing world, can be part of the solution contributing to the mitigation and adaptation to climate change. This can be done through establishing ecologically friendly agricultural systems that provide a buffer to the extreme weather events



The picture above shows a thoroughly cleaned udder ready for milking

losses to farmers sometimes up to 40 per cent of milk loss. Farmers who want to prevent mastitis in their cows, therefore, need to maintain high hygienic standards in milking and resting sheds, including all equipments used in the dairy unit.

Types of mastitis infection

There are three clinical forms of mastitis as explained below:

- **Sub-clinical mastitis:** This form of mastitis is caused by a bacterium called *Streptococcus agalactiae*. The bacteria cannot be easily detected because the farmer cannot see any symptoms in the affected animal. It is only a laboratory test that confirm the existence of the bacteria. Therefore, it is difficult for farmers to detect sub-clinical mastitis in their cows, and

such as farm forestry to increase the shade trees to shield from the maximum temperatures and reduce evapo-transpiration, roof rain water harvesting to supply fresh water during the dry spells and embrace organic farming that avoids the use of chemical fertilizers. The farmer associations can also lobby governments to ratify 10% budget allocations of their national budgets to support ecological organic agriculture as a mitigation strategy where all the activities implemented through organic farming are a mitigation to climate change. Various governments too can implement policies that promote better use of the ecosystems.

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very often, much of the milk on sale in the local markets may contain this bacterium.

- **Mild clinical mastitis:** This is the most common and easily detectable because the farmer can notice changes in the cow's udder. The affected part of the udder is usually hard to the touch. There are also changes in the quality of the milk from infected animal. The milk from such an animal has a distinct or abnormal colour usually pinkish or yellowish. The milk from the infected cow is usually watery with flakes or clots. Farmers can easily detect these signs when using a strip cup (a special cup that is used for visual analysis of milk – the cup can be bought from most agro-veterinary shops).

- **Acute or severe mastitis:** The milk from a cow with acute or severe mastitis is usually yellow in colour with blood clots. The milk from a cow with this type of mastitis can also appear yellowish green with a foul smell especially if the infection is caused by *Corynebacterium pyones*, a bacteria that forms pus in the affected udder. The teats may also show signs of injury. The infected cow may also produce less milk that is watery or grey in colour.

Treatment for mastitis

If a farmer notices any signs of mastitis, the best way to handle the situation is to consult a qualified veterinarian to treat the animal. Organic standards allow treatment of animals using chemical drugs. But, the farmer must not sell the milk until the treatment withdrawal period is over. This is to ensure that the drugs used to treat the animal do not end up in the milk meant for human consumption.



The picture above shows how to treat an infected cow teat

How to prevent mastitis

Dairy farmers can prevent mastitis by taking the following measures:

Thoroughly wash your hands before and after milking each cow (this prevents transfer of bacteria from one cow to others while milking). Hot water mixed with a disinfectant should be used always when milking.

A separate clean cloth for washing the udder should always be used to wash the udder of each cow before milking.

The first jet of milk from the cow should be directed to a container with a disinfectant (do not let any milk from the infected animal to spill on the floor). This may spread the mastitis-causing bacteria. Wash milk containers and other dairy equipment thoroughly and continuously.

Change the cows' bedding and clean the floor with water daily to keep the cow udders clean. (As an additional protection measure, spray disinfectant powders such as Staldren® (this is available from agro-veterinary shops or at Farmers's Choice Ltd (0722 331 706, 0722 205 698) or disinfectant sprays to keep bacterial growth on the animal sheds at a minimum.

Do not treat the infected animal yourself – allow qualified veterinarians to treat the animals.

Answer by Elkanah Isaboke ■

TOF Rad answers your questions

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

Mandala garden guarantees vegetables supply throughout the year

Joyce Wambui | With ever shrinking arable lands, food production is increasingly becoming a major challenge for farmers, thus a concern to food security. Land subdivision, desertification, rapid population explosion, land ownership system where the elders delay in partitioning and handing it over to the younger generation to freely practice farming. Over the years, farmers have continued to report poor yields and low income.

It is for the above reasons that small-scale farmers need to apply crop production technologies that can highly yield despite the size of the land. This can lead to increased household income, better nutrition with a guarantee to food security and improved livelihoods.

Provides vegetables throughout the year

Mandala gardening is one such farming technology. It does not only have aesthetic value but also saves on labour and space. Mandala garden is a home garden that can provide the family with fresh supply of vegetables and fruits throughout the year. It helps the farmers to meet their daily food requirements with the surplus being sold to the market for an additional generation.

It is a circular double dug beds of 1.5m long with a central



A farmer attending to his mandala garden

pit of about 1m in diameter and one metre in depth.

Choose type of crop well

When planning a mandala garden, it is important to know the following; the types of crops that grow well in that region, appropriate planting dates to ensure the best yields, preparation of the garden and the sources of water. Different crops mature at different periods. Hence, ensure the choice chosen will allow crop rotation within the year. It is

important to consult the local agricultural extension worker who will guide in each step for best results.

Constructing a Mandala garden

- **Site:** It is best near the homestead or a water source. The water source should be on the upper side.
- **Layout the beds:** Make at least 3 circular beds of 1.3 m to 1.5 m width beginning from the central pit. Leave spaces of between 0.3 m to 0.5 m as a path between every two beds.
- **Spread a thick cover of well decomposed manure on the bed.** One *debe* per cubic metre is sufficient.
- **Starting from one end of the bed,** measure out a narrow strip of 60 cm wide.
- **Dig the strip,** mixing the compost manure with the top soil.
- **Remove the top soil just dug and take it to the end of the bed.** Put it outside the bed on the far end. Make sure that all the top soil is removed. You will know this when the jembe hits a harder layer at the bottom or when the soil changes colour from dark

brown to reddish brown depending on the soil type.

- Then dig this hard-compact subsoil deeply. When the whole strip is completed, level out the loose subsoil. Apply another layer of manure or chopped green vegetation on the leveled subsoil.
- Measure another strip of 60 cm; dig the top soil again mixing it well with the compost already applied on the surface.
- Again, remove all the top soil. But, this time spread it on the top of the subsoil of the previous strip.
- Remove all the top layer of the soil to allow a second digging of the bottom compact subsoil. Therefore, this technique is called double digging.
- The finished bed is then raked (spread soil evenly) and mulched in preparation for planting.

Working mechanism of Mandala garden

There are many sources of water for use in mandala garden. The water can be sourced from roof tops, runoff water or waste water from kitchen (use waste water without any detergent). The pathway prepared during garden preparation leads water to the central pit. Then, this water permeates slowly into the surrounding beds from the pit where plant gets water for growth.

It is always advisable to practise crop rotation as a way of restoring soil fertility and pest and disease control. When weeding or harvesting any crop grown in mandala garden; always do so while standing on the paths to avoid compacting the soil.

Common crops to grow in a mandala garden

The common food crops that can grow well in a mandala garden include; green leafy vegetables, yellow or orange-coloured fruits, legumes, and most of the crops that propagate through roots and tubers.

A call for your financial support in the production of The Organic Farmer (TOF) Magazine

Dear TOF stakeholder,

For over 10 years, TOF magazine has continuously provided you with impactful information on sustainable ecological agriculture, where majority of farmers' lives have been changed for better. Biovision Foundation in Zurich, Switzerland, generously sponsors the continuous production and publication of TOF magazine which comes your way at no cost.

The demand for the publication grows each day and an increase in quantity of printing, pushes up the production (printing, packaging and posting) cost.

It is for the above reason that TOF magazine seeks your financial contribution, starting July 2017, to continue availing this resourceful material to you and all her partners.

Looking forward to your cooperation.

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