



In the event of delayed or above normal short rains, farmers can harvest the water and even plant various food crops such as early maturing varieties to boost food security and income.

Dear farmers,

We have now come to the end of the year. Looking back, farmers will agree that this has not been a very good year for farming. Problems began in March when the expected long rains started on time but disappeared as soon as farmers had planted their maize. Most of the maize crop wilted and dried, forcing farmers to replant with great difficulties as they had to buy new inputs. The Maize Lethal Necrosis (MLN) disease resurfaced and became more widespread than in previous years. The quality of seed is partly to blame for the spread of the disease (page 3).

The failure by the National Cereals and Produce Board (NCPB) depots to buy maize from farmers has dashed the hope of recovery for farmers and given middlemen an opportunity to exploit farmers. They are now buying maize for as a little as Ksh1200 a bag from farmers desperate to get money for the next planting season and other household needs. The NCPB has been very crucial as it buys maize at Ksh 3000 a bag, enabling farmers to recover their production costs. The Ksh 2.7 billion that was recently allocated to the NCPB is grossly inadequate and may not help many farmers. This is because middlemen are stocking up maize, waiting for the board to open so they can resell at higher prices the maize bought from farmers.

In addition to the government's failure to buy maize, the production of maize as a food and cash crop is becoming unprofitable due to the high input costs involved. Maize imports from the East Africa Common market where production costs are much lower will in future make it untenable to produce maize for commercial purposes in Kenya.

As we come to the end of the year, farmers need to seriously consider the most suitable crops that they need to grow next year to reduce their reliance on maize as their only source of income. They should not only grow maize for home consumption but also other crops such as onions, sweet potatoes, arrow roots, tomatoes, vegetables and fruits. These crops take a short time to grow and fetch very good prices in the market ensuring the farmer has money all year round.

As you plan what to grow in the coming year, the TOF team wishes you a happy Christmas and a prosperous new year.

Take advantage of the changing weather

TOF - The trend in weather patterns this year has made it very difficult for farmers to plan for planting. Except for parts of Western Kenya and the North Rift, many parts of the country experienced a dry spell especially during the month of October when the short rains were expected. This is one of the effects of climate change. To succeed in farming, farmers have to be



you can recover losses that may have been incurred in the year. Crops that take a short time to grow such as millet, sorghum, beans, potatoes, vegetables are ideal for both home consumption and sale. It is advisable to avoid growing maize because of

resilient and adapt to the rapidly changing weather patterns.

Possibility of El Nino

Weather forecasts previously indicated there was a possibility of El Nino occurrence as early as July 2014, but it did not come to pass. Once again, the El Nino alert was sounded last month with forecasts showing that there was a 65 per cent chance of El Nino occurring before the end of the year. Indeed a two-day conference was held in November in Nairobi where scientists and policy makers reviewed measures that need to be taken, to prevent the extensive damage caused by the El Nino rains.

Be prepared

Farmers need to be prepared at all times to plant incase it rains. Take advantage of any rains that might come, to grow food crops so that

the threat of the Maize Lethal Necrosis (MLN) disease.

Already, the month of December has started well with some rains being experienced in most parts of the country. This is a good indication that we might have a wet season as we move to the new year.

Try small-scale irrigation

One way of succeeding in farming during uncertain weather is to plant crops on a small-scale such that in the event of crop failure, the farmer does not incur huge losses. Alternatively, farmers can do small-scale irrigation if the rains stop. In this issue, we highlight how farmers can set up simple irrigation systems in their kitchen gardens where they can grow vegetables that are usually in short supply during the dry season when the market prices are also good (Page 2).

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Cheap irrigation methods for the dry season

Using simple irrigation methods, farmers can produce food throughout the year. Relying on rains has many risks that have made crop production difficult.

Trotsky Lumiti | Many farmers have experienced crop failure due to unpredictable rains in many parts of the country this year. Rain fed agriculture is becoming so risky that farmers have to adopt affordable irrigation technologies that can help them grow crops any time of the year where they are assured of a harvest.

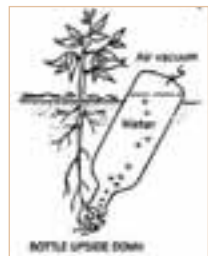
Lack of information has prevented many people in Kenya from venturing into irrigation. Many farmers find the modern irrigation systems unaffordable.

In the late 1980s foot pedal pumps (Money Maker®) were introduced in Kenya. The pumps have continued to gain popularity due to their advantages. However, the full potential for this system has not been fully exploited due to poverty and lack of information. Farmers should use simple irrigation systems in areas prone to water shortage and even in high potential areas during the dry season. Below are some of the irrigation systems farmers can use during the dry spells.

Use of water bottles

This is not a new technology in Kenya. It involves the use of plastic water bottles (used mineral water bottles) filled with water to irrigate the crops. The system reduces the workload experienced by farmers, especially women who have to travel long distances to fetch water for their crops.

Using water bottles reduces the loss of water



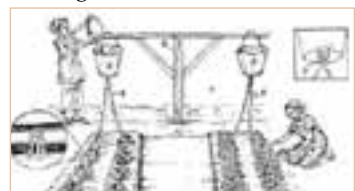
through evaporation as the water is contained in a closed bottle. The water seeps slowly into the soil where it is absorbed by the plant roots, and this helps the farmer use water more efficiently. The water in the bottle can last several days, which means the farmer will need less labour for watering the crops. To improve the soil nutrients, the water can be mixed with slurry.

One disadvantage of this system is that it may require labour if the farm is large. Here the farmer is advised to use other methods of irrigating the farm such as drip irrigation.

Bucket system

The bucket system involves the use of a 20-litre bucket mounted one metre above the field level, a filter stopper fitted at a hole at the bottom of the bucket, two connecting tubes and two 15m drip lines with outlets either spaced at 30cm or 10cm depending on the crop to be grown. Water flows from the bucket through the filters and into the lines, then drips onto the soil near the plant.

The system can be adjusted to fit smaller gardens by laying out 4 drip lines each 7.5 metres long or 6 drip lines each of 5 metres long. The drip outlets should face up to prevent residue from settling on the outlets and block-



ing the system. After installing the system, the bucket full of water at the end of the drip line is opened to facilitate free flow of water.

Spacing

This enables the water to flow quickly and that helps flush out dirt from the system. This method can be used to grow different types of crops, depending on the spacing of the outlet



An extension officer shows farmers how to use a Money Maker® pump in Likuyani, Kakamega county.

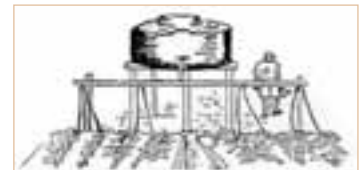
on the drip line and the crop spacing. Closely spaced crops such as onions, carrots and garlic require a drip line spaced at 10cm. Kales, cabbages and spinach have a spacing of 30cm and therefore require a drip line spaced at 30 cm. Tomatoes and eggplant require a spacing of 60cm and are better adapted to drip lines with a spacing of 30cm, but with crops grown alongside opposite outlets.

The farmer should carefully observe the soil and the plant condition and irrigate as often as needed. Since little amount of water is applied, it should be applied frequently. This system has huge benefits to the farmer and is cheap. It may cost a farmer about Ksh 1,100 to set up the system depending on the cost of the material. Moreover, a farmer can get very good returns if high value vegetables are grown. This system can operate for seven years if well maintained.

Drum system

This method comprises a drum of about 200litres placed one metre above the ground. A pipe (manifold) is connected to the drum to distribute water to ten drip lines, each 15 metres long, usually laid out in pairs on 5 beds. The pipe should be of 3/4 inch PVC material. The length of the PVC pipe depends on

the design of the garden. Water is supplied to the crops as in the bucket system. With an investment of about Ksh 7,500, a farmer can install a complete system. The system can irrigate up to five times the area the bucket system can cover.



Moisture conservation

Conserving soil moisture is important during irrigation. This helps reduce the loss of water through evaporation. One way is to use mulch. Mulch is a layer of organic material such as crop residue that is applied to the soil surface to prevent water loss through evaporation. Besides conserving the soil moisture, mulch improves the fertility and health of soil by increasing the soil organic matter. Furthermore, it reduces weed growth resulting in less plant-weed competition.

Water quality

The quality of water used for irrigation may affect both the crop yield and soil health. Salty water should not be used for irrigation as this may increase the soil salinity. Waste water should be treated first before being used for irrigation.

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Publisher icipe-African Insect Science for Food and Health, P.O. Box 30772, 00100 Nairobi, KENYA, +254 20 863 20 00; icipe@icipe.org; www.icipe.org

Editors Caroline Nyakundi, Peter Kamau

Administrator Lucy W. Macharia, 020 863 21 86

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Maize seed can transmit MLN disease

Research has shown that maize seeds may contain the viruses that cause Maize Lethal Necrosis (MLN) disease and can transfer the disease through seeds to farms.

Peter Kamau | As the Maize Lethal Necrosis Disease (MLN) spreads across the country, the government, including research institutions, are working to understand how the disease came into Kenya and how it spread rapidly to almost all maize growing areas within a short period.

Efforts to combat the disease

The government has set up a task force to carry out a survey in all maize growing areas across the country and recommend the best ways of controlling the disease. The task force is working with the Ministry of Agriculture, Livestock and Fisheries (MoALF), Kenya Plant Health Inspectorate Service (KEPHIS), the Kenya Agricultural and Livestock Research Organisation (formerly KARI), the University of Nairobi (UoN), The International Centre for Maize Improvement (CIMMYT) and the International Centre of Insect Physiology and Ecology (ICIPE) to map the extent of the disease and come up with ways to combat it.

Although pests are known to be the major carriers of viruses causing plant diseases, there is no any conclusive study that can show that they are responsible for the rapid spread of MLN. Scientists are working to find out the extent of the damage caused by the disease. Long-term solutions are awaited to protect the future of maize, a crop that more than 90 per cent of Kenya's population depends on for food.



The maize crop in most areas has been affected by the MLN disease.

Infected commercial seeds may be a source of disease

As research continues, it is important to look at other possible causes of the fast spread of this disease. For example, there are two interesting studies, which can perhaps shed some light on one of the likely causes of transmission of the MLN disease in the country.

The studies - *Effects of Seed Quality on the Proportion of Seed Transmission for Sugarcane Mosaic Virus in Maize* (by Li, X.F Wang and G.H Zhou), and *Seed Transmission of Maize Chlorotic Mottle Virus* (by Jensen S.G and David S. Wysong, and others) show that the quality of seed can contribute to the spread of MLN. This disease is caused by a combination of both Maize Chlorotic Mottle Virus (MCMV) and Sugarcane Mosaic Virus (SCMV).

According to the study on transmission of MCMV through seeds, four seed samples of maize containing 11,000 seeds supplied by two seed companies had 17 infected seeds. One sample with 3,000 seeds had one infected seed. However, three seed samples with 8000 seeds were found to have 16 infected seeds. The remaining 21 seed samples with 31,000 seeds from other seed companies were free of the virus.

Percentage of diseases determined

To find out the potential of the diseased seed in each seed sample to pass on the disease wherever they were planted, a simple calculation was done to determine the percentage of diseased seeds that were likely to pass on the disease. In the seed

samples free of the viruses the seed transmission rate was 0.0%, while among the seed samples with MCMV, the least was in the first seed sample i.e. 1 out of 3,000 seeds indicating a seed transmission rate of 0.03% (i.e. 1 divided by 3,000 and multiplied by 100) and the highest was in the second seed lot at 0.33% (i.e. 10 infected seeds divided by 3,000 and multiplied by 100).

Estimated number of diseased seeds in one acre

One acre of maize has approximately 42,000 seeds. Therefore, to get the number of seeds per acre that are likely to be infected and have the potential to pass on the disease, we have to go by what Jensen and his group found out. In the case of the first seed sample case scenario, 13 seeds per acre are likely to be infected (i.e. 0.03 multiplied by 42000 and divided by 100). In the second lot case scenario with 0.33% transmission, 139 seeds per acre are likely to be infected (i.e. 0.33 multiplied by 42000 seeds and divided by 100).

Farmers need to know that the likelihood of MCMV spreading among seed shows that seed contamination depends on how the seed farms are maintained and certified.

Seed with 10% rate of MLN infection certified

Several technical staff in a number of seed companies in Kitale and Nairobi interviewed by TOF indicated that seed farms with up to 10 per cent infestation levels were being certified by the Kenya Plant Health Inspectorate Service (KEPHIS) to sell the maize as seed. This essentially means that in nominal seed crop yield of

1.7 tonnes per hectare, 170kg of seeds are at the risk of carrying some seeds with the virus. At a 1000 seed weight of 240gm, this 170kg of seeds are likely to have 0.7 million seeds and at a maximum seed transmission rate of 0.33% nearly 2310 seeds from among seeds produced in one hectare are likely to be infected and have the ability to spread the disease where such seed is planted. It is important to note that the seed transmission rates of 0 – 0.33% discussed above are for MCMV one of the two viruses responsible for MLN disease.

Seed transmission of SCMV virus

The second study that focused on transmission of SCMV virus showed that for every 42,000 seeds per acre, approximately 966 to 1,638 seeds could be infected and can transmit the disease where the seed is planted. This means that nearly 27,300 seeds from one hectare are likely to be infected and pass the disease if used as seed. The distribution and marketing of these seeds needs to be carefully monitored and controlled to prevent fast spread of the disease in the farms.

Insects pests spread the viruses

The number of infected seeds per acre could look small compared to the large number of seeds sown in an acre. However, in a scenario where these spreads in the whole farm if there are pests like thrips and aphids, which act as carriers; this can cause major damage to the entire maize field in areas where such seed is planted.

In this regard, the level of disease infestation in the seed farms has to be revisited and it is therefore, recommended that more stringent measures put in place by Kenya Plant Health Inspectorate Service (KEPHIS) to ensure only clean maize seed is certified and sold to farmers. As the regulatory authority mandated to control the quality of seed in the country, KEPHIS should ensure that all maize seed it certifies is of the highest quality and does not contribute to spread of all diseases including MLN. KEPHIS should ensure that there is a high level of management in seed farms so that certified seed is not con-

Orange-fleshed sweet potatoes are nutritious

Potato farming is getting popular in most parts of the country. In Western Kenya, many farmers are finding the crop a good alternative to sugarcane.

Josphat Mulindo | More than half (54%) of the Kenyan population suffer from hunger and malnutrition. Lack of Vitamin A in the diet leads to low immunity and blindness especially in children. It is estimated that 70% of children suffer from vitamin A deficiency and many go blind.

To ease this problem, the Kenya Agricultural and Livestock Research Organization (KALRO, formerly KARI) with support from partners has developed orange-fleshed sweet potatoes that are rich in vitamin A. The varieties developed and available for production are Kenspot 3, Kenspot 4, Kenspot 5, Vitaa and Kabode.

The new varieties of orange-fleshed sweet potatoes are highly productive when compared to local varieties, sometimes by up to 50% and are early maturing, meaning they can be grown twice in a year. The following guidelines help farmers to grow sweet potatoes:

Land preparation: Land should be prepared before the beginning of the rains. Open up the land to a depth of 30 – 45 cm



by ploughing or digging. The soil should be made to a fine consistent tilth to ensure straight uniform tubers. Raise ridges or mounds (if the area is swampy) to a height of about 30 cm.

Planting: Vines are used for planting orange-fleshed sweet potatoes. Use a vine cutting, about 30 cm from the top rather than the middle or lower part of the stem. The vines should be inserted at an angle in the soil and NOT vertically. About 2/3 of the vine should be buried in the soil at an angle. Spacing should be 100 cm between the ridges and 30 cm from plant to plant.

Weed control: Weeding should be done twice in the first two months when the sweet potatoes are slow in growth. The first weeding should be at 2-3 weeks of age, while the second at 5 weeks. After the second month, plant growth is vigorous

enough to cover the surface and suppress weeds.

Fertilizer application: Farmyard manure should be thoroughly mixed with the soil during land preparation. If the tubers get

into direct contact with manure, they become susceptible to black scab disease.

Harvesting: After 3–4 months, orange-fleshed sweet potatoes are ready for harvesting. Prior pruning, 14 days to harvesting day, is recommended to ensure that the amount of water/milky fluid in the tuber is reduced (curing) for long storage after harvesting. Harvest when the soil is moist or wet to avoid bruising the roots. Yellowing and drying of the lower leaves shows that the crop is ready. Harvesting too early results in low yields. Late harvesting results in the tuber becoming fibrous and coloured and can be attacked by pests or prone to rotting. Use oxen plough to avoid bruising or injury to the root tubers.

Pests and disease control: The sweet potatoes are prone to the sweet potato weevil (pest) and sweet potato virus (disease). These can be controlled through crop rotation, selection of clean planting material, proper field hygiene and early planting and early harvesting.

Post-harvest handling of the crop: Dip the tubers in water and wash them thoroughly but carefully to avoid bruising the skin. Sorting should be done according to colour, size and shape. The tubers should be dried under a shade. They can be boiled and eaten with milk or tea for breakfast or used as carbohydrates in the main meal (lunch or supper).

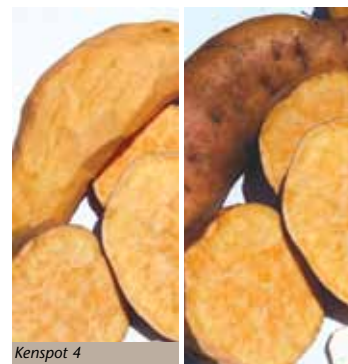
Value addition: Various value added products are produced from orange-fleshed sweet potatoes. Usually the potatoes are peeled, chipped and then shade-dried or dried by use of solar driers where available. The dried chips can be stored for as long as possible under dry conditions. They are milled into flour that is used in various recipes especially bread, chapati, mandazi, crackles, cakes and porridge. ■



Kabode



Kenspot 3



Kenspot 4



Kenspot 5

Returns for Orange-Fleshed Sweet potatoes per acre in one season

Activity	Cost (in KSh)
Land preparation	
• Ploughing	4,000
• Harrowing	3,000
• Ridging	3,000
Farm-yard manure: 20 tonnes × 700/-	14,000
Vines [seed]: 13 bags × 1,000/-	13,000
Planting: 10 Man days × 430/-	4,300
Weeding: [10+10] Man days × 430/-	8,600
Harvesting: 15 Man-days × 430/-	6,450
Gunny bags: 120 × 40/-	4,800
Transport	9,000
Total Variable Costs [TVC]	70,150
Returns:	
Vines: 40 bags × 750/-	30,000
Tubers: 80 bags × 1,350/-	108,000
Total Revenue [TR]: 40,000 + 108,000	138,000
Gross Margin: 138,000 – 70,150	67,850

Push-pull farmers now form cooperatives

By adopting Push-Pull technology and other sustainable agricultural practices, farmers in the Central region have increased crop and milk yields. They have formed cooperatives to market their produce.

Peter Kamau | For Samuel Kinuthia, a member of Nyamumi Self Help Group, farming had been a loss-making venture. He could only harvest two debes of maize from a ¼-acre plot he rented in Kangoo village, Gatundu North sub-county in Kiambu County. But in the year 2008, things changed for the better for Kinuthia and 16 members of his group when KARI, through funding from the Biovision Foundation introduced the Push-Pull project in Gatundu North, Gatanga, Kandara, Kahuro, Kigumo, Kiharu and Kirinyaga central.

The farmers in the project region received practical tips on how the Push-pull technology works. In this method of pest control, desmodium is planted between rows of maize - the stem borer which damages maize, does not like desmodium smell and moves to the Napier grass which is planted around the maize field and has attractive smell. When the eggs hatch and the larvae try to feed on the Napier grass stems, they are entrapped by a sticky glue-like substance, produced by the Napier, and they die. This way they fail to reach the maize.

Desmodium improves soil fertility

Being a legume, the desmodium improves soil fertility while providing high protein fodder for livestock. Combined with Napier grass, desmodium enables dairy cows from households practising Push-Pull technology to increase their milk



Farmers in Kagunduini, Murang'a South assess stalk borer damage in a demonstration plot.

yields considerably.

Within one year of practicing the Push-Pull technology, farmers started noticing a change in crop yields. Kinuthia says that in the first year, stem borer infestation in his maize crop decreased while the maize yield increased from 2 debes to 2 bags in the same area. In the second year, he harvested 3 bags of maize. There was also enough fodder for his 2 dairy cows, which increased their milk production.

Hundreds of farmers have learnt the technology from farmer field school groups which were targeted in the project, and have witnessed increased crop yields, soil fertility and income.

Introduced to organic production

Farmers were also introduced to other sustainable agricultural practices such as use of organic top dressers (plant extracts), organic manures, compost and liquid manures to reduce use of chemical fertilizers. They also learnt biogas production to reduce reliance on wood fuel for cooking.

The project coordinator, Mr. Samuel Njihia says the adoption of Push-Pull technology was successful with pest infestation reducing from a high of 60 per cent to as low as 10 per cent in most of the farms. The project also recorded an increase in maize yield from an average of 4 to 12 bags an acre.

"Of course it was not easy to persuade farmers who have used chemical fertilizers in

crop production for many years to use of compost and other organic inputs instead. Eventually many have realized the benefits of organic manures and its contribution to soil fertility and improved crop yields," he says.

To increase farmers' income from the various farm products, farmers in the entire project area were introduced to value addition. Instead of selling raw milk, they learnt how to make yoghurt, which they would sell to hotels, schools, hospitals, open-air markets, farmer field days and funerals.

More money for farmers

Kinuthia says the project is slowly transforming farmers' livelihoods across the entire region in a big way. "Before the project started, we would sell a big bunch of bananas to middlemen for only Ksh 200. Now we sell our bananas as a group directly to consumers where a kilogramme fetches as much as Ksh 15. We have learnt that we can even sell banana fingers at Ksh 5 apiece. I can now ripen bananas and make such products as banana wine, jam or even crisps, which I sell at a much higher price. We also make banana flour mixed with cassava or millet which has become very popular in local hotels. This translates to more money for our members," he says.

Most of the marketing cooperatives in Central region collapsed in the 1980s and 90s due to corruption and mismanagement, but the concept is now gaining acceptance among

farmers participating in the KARI-Biovision Push-Pull project. They have realized the benefits of marketing their various farm products together.

Cooperatives formed

Mr Njihia says the main challenge at the moment is to help transform farmers from subsistence farming to agribusiness in order to improve household incomes and standards of living. In this regard, the project is mobilising farmers groups to form marketing cooperatives as one way of helping them produce, process and transport various farm products to markets where they can fetch good prices.

The project intends to register cooperatives in each project area and ensure that each cooperative has at least 500 members. This is expected to increase the range of products that farmers produce and help in their marketing.

"The county governments in the regions are working on a policy that will ensure every farmer belongs to a cooperative to market their produce," adds Njihia. He says this will promote the growth of cooperatives, which will contribute to increased earnings for the farmers. The KARI/Biovision Project is working closely with the county governments to educate farmers on the benefits of cooperatives and has identified bananas, fruits, macadamia nuts maize and dairy farming as priority enterprises that farmers will be encouraged to grow for the market.



You can use charcoal to improve soil fertility

Farmers know charcoal as fuel For cooking. However charcoal can also be used to improve soils and increase crop yields.

Elkana Ondiek | Have you ever wondered why crops grow very well when planted in an area where charcoal has been burnt?

When charcoal is produced, it can be used for two purposes: It can be used to cook or to improve the soil when it is used to improve the soil, it is called biochar. Adding biochar to soil can increase the crop yields and the ability of the soil to retain moisture, thus reducing the need for synthetic fertilizers and demands on water. This increases productivity whenever plants are planted in an area where charcoal had been burnt previously.

What is biochar?

The definition of biochar is more about how it is created and used rather than what it is composed of. Both charcoal and biochar are produced through an energy conversion process called pyrolysis, which is the heating of biomass in the complete or near absence of oxygen. Biochar or charcoal is a solid material obtained from the carbonization of wood or any plant material. It is 80 per cent carbon.

What makes biochar different from charcoal is that the biochar product is created for use as a soil conditioner. Biochar can be produced from a variety of plant



In this garden, biochar was sprinkled on the soil to absorb sunshine to warm-up the soil to keep away snails from the garden.

material, but it is generally considered as biochar only if it used to improve the soil.

How to make biochar

To use this technology, you do not have to cut down trees. Indeed farmers living in major towns where charcoal is sold can simply collect the charcoal dust which is discarded by charcoal traders and spread it on their kitchen gardens or portion of land where they want to improve soil fertility. In developed countries, there are plants for producing biochar for use on large scale but we do not have such a plant in Kenya. As a farmer, you can burn your own charcoal or buy it, grind it and spread in your kitchen garden.

This technology is good for use on small-scale, or on smaller parcels of land where farmers can use any unwanted wood.

Benefits of Biochar?

1. Soil pH amendment

For soils that require liming, biochar may provide similar benefits of improving soil pH balance. However, the quantity of biochar that needs to be applied relative to liming may be high. Also, the substitution of biochar for lime can provide the carbon needed to increase soil pH compared to standard liming. For plants that require high potash and elevated pH, biochar can therefore be used as a soil amendment to improve crop yields.

2. Water retention

Some research has shown that biochar applied on crops may enhance soil moisture retention. This may lessen the effects of drought on crop productivity in drought-prone areas.

Biochar is a desirable soil material in many farms due to

its ability to attract and retain water. As a result, plant nutrients such as phosphorus and nitrogen are retained in the soil for use by plants'. Therefore, the plants are healthier and fertilizer loss into the surface or groundwater is reduced.

3. Disease Control

Research has found that biochar improves the ability of crops to resist some fungal diseases such as *Botrytis cinerea* (gray mold) and *Leveillula taurica* (powdery mildew) on pepper and tomato. Plants also become resistant to the broad mite pest (*Polyphagotarsonemus latus banks*).

4. Climate Change Mitigation

Biochar helps reduce emission of green house gases like carbon dioxide respiration, nitrous oxide and methane contribute to global warming.

5. Soil Pollution Control

Pollutants such as metals and pesticides seep into soil and contaminate food supplies, reducing the amount of land suitable for agricultural production. Biochar is beneficial to crop production as it helps improve degraded and nutrient-poor soils.

The various impacts of biochar depend on the properties of the biochar, as well as the amount applied.

Farmers can therefore use this simple, yet powerful technology to increase agricultural productivity while reducing the effects climate change. It's one of the cheapest technologies that can be widely used by farmers.

Tips on how to use the biochar stove

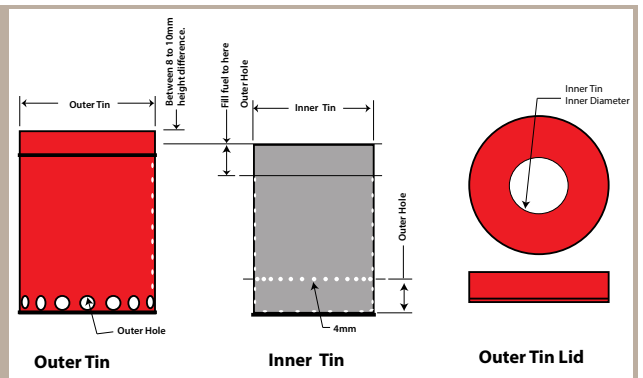
1. Fill the inner tin with fuel (wood pellets, dry twigs, etc.) up to the line you have drawn below the top lip.
2. Place a fire starter (like wax, a few teaspoons of rubbing alcohol, etc.) on top of the fuel.
3. Place the inner tin inside the outer tin. Make sure the two sit concentrically.
4. Light the fire starter. After the fire is going, place the lid on the stove.

If made correctly, the flame should turn blue and there should be little smoke. This means a clean, complete burning of the fuel is taking place. The stove should leave behind char when the flame goes out.

(If you want to be sure the two tins are sitting concentrically, try drilling a hole through each at the center of the bottom. Then, put a small bolt through both holes, and lock them together with a lock washer and nut!)

Facts

- Farmers should not cut trees to make biochar. They can cut twigs, unwanted tree branches and prunings. Any other wood material such as grasses, organic material such as crop residue can also be used to make biochar.
- Charcoal and biochar are produced in the same way in a process called pyrolysis (pyro means fire and lysis means decomposition). Charcoal and biochar are produced when wood is heated under reduced oxygen supply and at low temperature. What remains is pure carbon (charcoal or biochar).
- When applied to the soil biochar prevents the loss of phosphorus by surface water. It also reduces the leaching of nitrogen into ground water.



Stingless bees require special hives

Do stingless bees have special hives?

Yes. Stingless occupy special hives especially when domesticated. The idea is to create an environment as near as possible to their preferred nests in the forest, to make them comfortable and encourage them to remain in the hive. In the forest, some species of stingless bees build their nests in tree cavities while some build theirs in underground nests. When designing hives, beekeepers have to build nests that imitate their natural nests to attract and reduce chances of the bees abandoning the hives. Farmers who want to rear stingless bees should consult bee experts who can advise them on the most suitable type of stingless bees for their areas and the type of hive suitable for their region. Contact ICIPE Commercial Insects Programme on Tel. 0714 948 689.

The best way to store honey

Can I store my honey in a metallic container?

Honey requires special storage to reduce chances of deterioration. Honey by its very nature is hygroscopic, which means that it attracts moisture. If the storage



A pot hive for *Meliponula Lendliana* stingless bees.



A beekeeper in Kakamega shows his traditional stingless bee hives alongside modern stingless bee hives (right) donated by ICIPE.

container allows in air, the honey will ferment and degrade in quality and cannot last long. Honey should therefore be stored in airtight containers where it can maintain a longer shelf life.

Most of the companies in Kenya use plastic containers for storage. Food grade plastic is allowed by the Kenya Bureau of Standards (Kebs) for honey

storage. But the best storage container is glass which has an airtight stainless steel cap that keeps the honey fresh for long periods of time. Much of the honey for the export market is packed in glass containers but the price is relatively higher than that of honey stored in plastic containers because the packaging is more expensive.

How to control red spider mites in your farm

How can I control mites using organic methods?

Spider mites suck the sap from almost any type of plant - vegetables, fruits, fruit trees, houseplants and ornamental plants. The pests are especially prevalent in dry, dusty conditions. Avoid pesticides, which may kill the beneficial insects that prey

on mites, effectively keeping the pests under control. Instead, rely on less risky, natural methods.

1. Use hot chilli Spray for pest control

Hot pepper spray helps control mites and other common pests. To make the spray, combine 1 teaspoonful of chilli or 1 teaspoon warm water, along with a



few drops of bar soap lather. Let the mixture to stay overnight, then spray the solution on the tops and bottoms of the leaves. Shake frequently to blend the ingredients. Wear rubber gloves and keep the mixture away from your face. Add minced onion and garlic to make a stronger spray. Strain the mixture through a fine sieve before pouring it in the spray bottle.

2. Soap Spray

Soap spray helps control mites and many pest insects. Use 2 tablespoons of a gentle soap, such as bar soap, because modern dish detergents may

damage leaves. Add 1 to 2 tablespoons cooking oil, which chokes pests and also helps the solution stick to the leaves.

Mix this with 1 litre of water and spray plants thoroughly, then repeat every 3 to 4 days. Never spray plants if you notice beneficial insects, such as honeybees or ladybird beetles on the plant because the spray kills all insects on contact (preferably spray early in the morning or late in the afternoon when most of the beneficial insects have gone back to their nests). Spray directly on the leaves in cloudy weather.

Bar soap lather is a good sticker

What is the role of bar soap during the process of making plant extracts?

The use of bar soap is to help the plant extract stick to the plant after the application and also spread the extract to all parts of the plant. It is used as a stick in the same way synthetic stickers are used to help the chemicals stick to the plant. When application of plant extract is done when it is wet, it is possible to lose much of the solution since the rains or excess moisture may wash it away, making it less effective. Adding liquid cooking oil enhances the ability of bar soap lather to spread as it increases surface tension of the sticker.



continued from page 3

Maize Lethal Necrosis...



taminated.

Already KEPHIS has taken measures to reduce the possibility of seed to transmit the disease. In a meeting with seed companies and other stakeholders held at KEPHIS headquarters on October 9 2014, the regulatory authority agreed that any seed with more than 1 percent infection will not be certified for sale to farmers. All imported

seed would not be certified if it has any traces of both MCMV and SCMV pathogens.

Maize seed companies and contracted producers need to a high level of crop management to reduce the risk of spreading the disease. This may have implications on the seed cost but it will go a long way in reducing the potential losses incurred by farmers. ■

TOFRadio answers your questions

TOFRadio is broadcast on KASS FM, Mbaitu FM and Milele FM at 8:30pm on Tuesday, and KBC on Thursday at 8:15pm. 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.

How to set up a zero grazing unit

Dairy farming is taking root in Kenya. Many farmers are now opting to keep high yielding animals. At the same time, land is becoming scarce and farms are becoming smaller even in areas where farmers have been known to own large sizes of land. As such, farmers are opting for zero grazing so as to keep more animals.

Musdalafa Lyaga | A good zero grazing unit protects dairy cows from the harsh weather like rain, wind and too much heat from the sun. Cow sheds must therefore be comfortable for the cows. The major components of a zero grazing unit are cubicles, feed troughs, water troughs, calf pens, milking parlour, feed store and walking area.

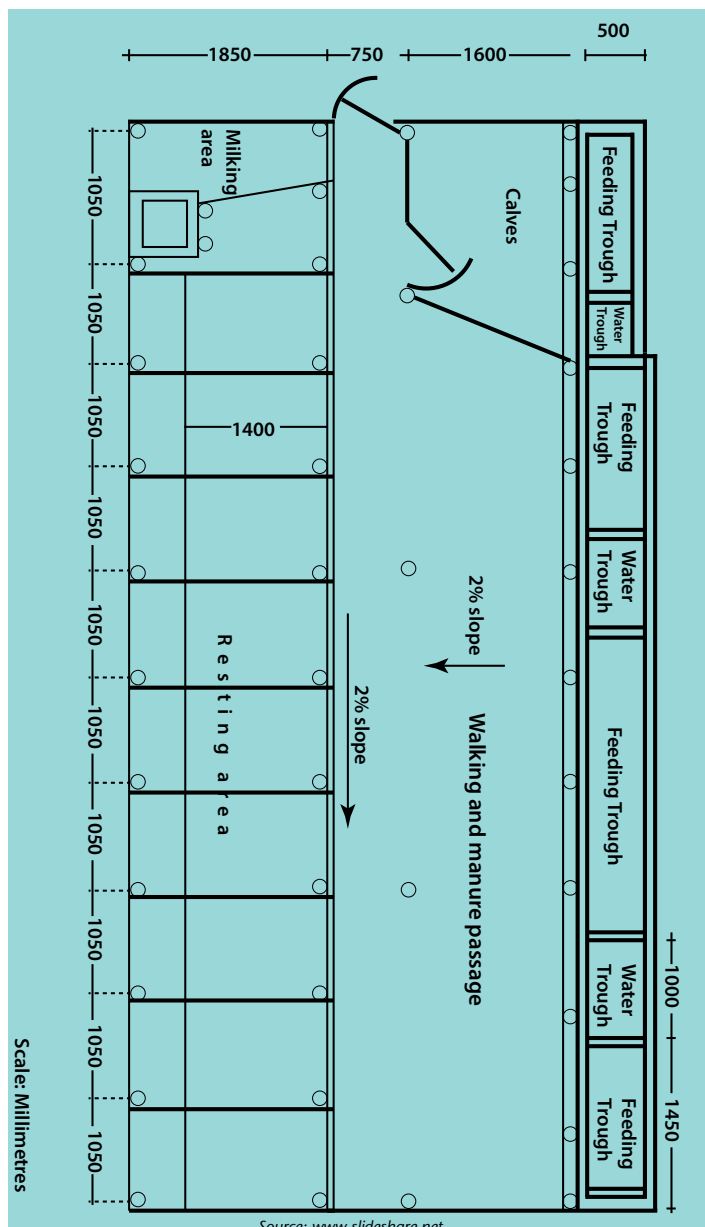
Floor: One of the mistakes many farmers make is it to make the floor of the zero grazing shed very hard that it affects the hooves of cows. In many areas where zero grazing is practiced, cows suffer from lameness and leg injuries caused by the hard material used to construct the floor of cow cubicles. Soft material such as saw dust, wheat or grass straw can be spread to make it easier for the animal to move or lie on the surface of the unit without injuring them.

Cowdung: A cow can produce up to 1.5 tonnes of cowdung per year. While this is good manure for the soil, it can also cause health problems to the cows and also a source of bad smell in the farm and neighbours if not handled well. The floor should also have a gentle slope so that cowdung and urine washes off and drains easily.

Walking space: Cows need space to walk and exercise. Excessive lying down and confinement in zero grazing units can cause lameness. Provide enough space, even if it is outside the zero grazing unit for cows to move and get sunlight. Cubicles in a dairy unit should form the resting area (sitting room) for the cow, thus it should not prevent the animal from moving around.



A zero grazing unit should always be kept clean and comfortable for the animals by adding straw and replacing it regularly.



 farmers forum
0717 551 129 / 0738 390 715

Beehives for sale: We make beehives for sale. Interested farmers can make orders on any quantity they require. The following are prices for various hives: Langstroth Ksh 4,500, Kenya Top Bar Hive Ksh 3800, Stingless bee hives between Ksh 400 and Ksh 1500 depending on size. Interested farmers can call Stephen on 0734 371 557.

Grafted avocado seedlings: We have grafted avocado seedlings, selling at Ksh 70 per seedling. We can supply any quantity. Call 0716 795 253, Nairobi and Muranga.

Silage tubes for sale: We have silage tubes for sale. We also conduct training for farmers groups. Call Star Rays Education Centre Tel. 0721 245 443.

KARI kienyeji chicks for sale: Healthy and vibrant Kienyeji chicks for sale. 3-day old, 1 week old and 3 week. Place your order on 0787 312 623 or email: antonville@outlook.com.

Zimbabwe grass: We have Zimbabwe grass for sale at Ksh 800 per bag. Call. 0733 372 163.

Stevia seeds wanted: I am looking for stevia cuttings and seeds for planting. Call 0722 732 851.

White briquettes: Ideal for broilers. Call 0723 895 754.

Tree tomato seedlings: Ruthamer red giant. Price negotiable. Transport provided. Call 0722 577 678, Mukurweini, Nyeri.

Tree tomato seedlings wanted: I would like to buy good tree tomato seedlings. Call Kimani 0722 408 539.

Improved kienyeji chickens eggs: We are selling improved Kienyeji chicken eggs at Ksh 750 per tray. Call 0704 561 092, 0705 714 449.

Kuroiler chicks: We have one month-old Kuroiler chicks for sale. We sell each chick for Ksh 250. Call 0724 742 656.

Potatoes for sale: We have 1 acre of high quality KARI certified *sangi* potatoes to be harvested at the end of October. Call 0724 696 730, Njoro.

Foliar fertilizer: Organic foliar fertilizer (KEPHIS certified). Call 0726 754 014 (8am to 5pm, week days).