



Photo: TOF

ICIPE scientists take soil samples at a farm in Elgeyo Marakwet County: Soils in most farms in the country are depleted due to overuse of chemical fertilizers and failure to use practices such as practicing crop rotation, terracing and use of cover crops. Farmers should test their soil every two or three years, depending on the crop they want to grow *Page 2*

Take care of your soil to improve crop yields

Peter Kamau | Every farmer desires a good harvest; but very few know that soil plays a very important role in feeding the crop to grow well and produce more to improve crop yields and income for the farmer. Most soils in the country have become very poor for crop production mainly due to lack of knowledge.

The soil should be the starting point in any type of crop production. First, the farmer needs to know what is lacking in their soil before they use any form of fertilizer. Indeed, the overuse of chemical fertilizers is one of the main reasons why many soils in the country can no longer produce adequate food for many Kenyan farmers. Overuse of chemical fertilizers such as DAP, MAP, urea, and CAN are to blame for increased soil acidity in all agricultural zones in the country. Crops such as maize, beans, bananas, cassava, millet, potatoes, vegetables and fruits cannot grow well in acidic soils.

Test your soil every two or three years

After two or every three years, it is important for farmers to have their soils tested for them to know what is lacking in the soil. Farmers should also plant different crops every year in each portion of land because different crops take different nutrients from the soil. Crops such as maize and potatoes use much of nitrogen, phosphorus and potassium (NPK) from the soil and if planted every year, these nutrients will be lacking in the soil leading to poor crop yields.

Most soils also lack organic matter because farmers do not recycle crop residues after harvest or use farmyard manure to make compost which can then be worked into the soil to restore soil structure and fertility. Some farmers view crop residue as weeds or unwanted material and often burn it before land preparation and ploughing. This is very wrong. All crop residue should be worked back into the cultivated field.

Compost making is a continuous process

An acre of land requires at least 2.5 tonnes of farmyard manure or compost every year to maintain soil fertility, reduce soil acidity and restore soil structure. Since many small-scale farmers may not be able to get these amount of compost every year unless they buy it, it is important for farmers to prepare compost every time they have a small heap of farmyard manure, crop residue or other waste from kitchens, fodder waste and any other green plant material on the farm.

Compost should be worked into the soil every time it is ready to ensure that all nutrients are restored into the soil.

Dear farmer,

Kenya farmers especially those in maize growing areas will start the new year in a state of uncertainty regarding maize prices. Due to the good rains experienced during the just ended year, the harvest has been very good, surpassing the last few years' production. The glut (overproduction) is going to affect prices if the events of the past is anything to go by.

First, the government was unable to pay farmers for last year's crop but instead the National Cereals and Produce Board (NCPB) paid middlemen and well-connected individuals, who imported maize from Uganda cheaply and managed to sell it to the board, leaving hundreds of farmers unpaid. This year, the board has reduced maize prices to Ksh 2,500 from Ksh 3,200 that it paid last year. As usual, this will leave many farmers at the mercy of middlemen who purchase the maize cheaply, store it and sell when prices improve.

The other big problem is storage. Many farmers are unable to store their maize until such a time that prices are favourable, due to lack of storage facilities or lack of money during the beginning of the year when they are burdened with many bills to pay such as school fees, buying inputs and other financial obligations.

In the past we have promoted many storage technologies, such as metal silos, use of diatomite and the Purdue Improved Crop Storage (PICs) bags that farmers can use to store their maize but few farmers have adopted these technologies due to various constraints.

The government, through NCPB had started a very good initiative four years ago called the Cereal Warehousing Receipt System where farmers could store their maize in NCPB depots at a small fee and use the same receipts to get credit from banks until they were able to sell their maize when prices improved. However, the project ended as soon as it had started.

Inefficiency at NCPB has made it very difficult for the country to store its food surplus and farmers to have faith in the institution. We think the NCPB requires a major overhaul to enable it serve farmers much more effectively. Unless this is done, farmers and the country will continue to experience food shortages even when they have the capacity to produce adequate food and stored it for use in times of drought and associated food shortages. We hope the situation will improve this year.

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Improving cassava productivity in hilly areas

Farmers in Vihiga County have learnt how to maintain soil fertility by intercropping legumes with cassava and leaving legume crop residue between cassava rows.

Amina Day Ojijo | In our continuing series on how farmers can best benefit from growing cassava, we visit in Luanda, Vihiga county where farmers are faced with a challenge of growing crops on sloppy land.

In Vihiga, cassava is both a source of nutrition and income for the farmers. But the farmers are constantly worried about their soils being washed away, which reduces their yields drastically.

To keep soil healthy, farmers in Vihiga first ensure the soil is not washed away during heavy rains. Some innovative farmers pile the crop residues from the previous cassava harvest along the contour lines to reduce the rainwater runoff. Planting hedgerows of grass or small legume trees along contour lines is also effective in slowing the speed of water coming down the slope.

Planting vegetation barriers about 10 to 20 metres apart allows the water to infiltrate and the soil washed away together with nutrients to settle out above the hedgerows.

Improves water infiltration in the soil

On steeper slopes when planting cassava, avoid disturbing the soil as much as possible. Make planting holes like small trenches of about 30 centimeters long and 15 centimeters wide following the contour lines. Dig planting holes at one metre distance. You can reduce the distance if the soil is very poor and cassava roots are small. Throw a handful of compost in each hole. It contains nutrients that are essential for cassava growth.



Photo: IN

Farmers in Luanda, Vihiga have learnt the benefits of soil conservation from improved cassava production. Since the region is hilly, farmers use crop residue from groundnuts, cassava, beans and maize to prevent soil erosion along slopes. Intercropping, mulching and terracing have increased soil fertility and cassava yields for the farmers

Do not put fresh manure on top of your soil, as most of its nitrogen will evaporate into the air and other nutrients will be washed down the hill. Let the compost or the manure break down completely before applying it, so that it can slowly release its nutrients to your crop.

Use high-yielding cassava varieties that produce abundant leaves. Chop the stems of vigorous cassava plants into 15 to 20 centimetre cuttings.

Planting cassava

Place a cutting in each hole with the buds facing slightly upward and the lower part of the cutting towards the compost.

Since it will take 2 to 3 months before the cassava crop develops sufficient leaves to fully cover the soil, you need to protect the soil in various ways. "Mulching has many benefits. First of all, the cassava yield is better and it produces more roots. Secondly, it takes less labour to weed the field because the mulch covers the soil and stops the weeds from growing. And thirdly, it prevents the soil from being washed away, which helps keep the soil fertile,"

says Josephine Iravonga a farmer from Emusire village.

To reduce the direct impact of the rain, you can also keep the soil surface covered with residues of intercrops of the previous cassava crop. To quickly cover the soil surface, you can also grow a fast-growing, short-duration crop in between your cassava plants. This is called intercropping.

Intercropping with legumes nourishes cassava

Farmers either grow maize or a legume crop, such as cowpeas, peanuts or soya beans in between their cassava. Legumes absorb nitrogen from the air and store the nitrogen in their pulses and leaves.

"When intercropping, we can harvest peanuts and beans. When the leaves of bean and peanut plants are left in the field, they rot and enrich the soil. By intercropping, cassava grows better, because in those fields where we don't intercrop, the cassava is not as good. If we intercrop with maize, the leaves of maize plant are not as good.

It's best to intercrop with peanuts and beans because they give the most fertility," says Ms. Iravonga.

Use legume crop residue

By leaving the legume crop residues between the cassava plants, you will further protect the soil from rainfall impact, reduce weed growth and nourish your cassava. You can grow a legume intercrop on steep slopes, even in fields that are far from your home.

"Farmers should intercrop their cassava with legumes, such as beans or peanuts, even if their fields are far from their houses and they cannot harvest them.

Because we all know that legumes help improve the soil and protect it from erosion when the cassava has not yet developed many leaves," says Jackson Weche an agricultural extension officer.

By observing and exchanging experiences, farmers can select those technologies that suit them most.

Improving cassava productivity in sloppy areas: For further reading in cassava production <http://www.infonet-biovision.org/PlantHealth/Crops/Cassava>

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FAO, ICIPE roll out fall armyworm early warning system

The system that is being piloted in six African countries was developed last year. It will help farmers identify and monitor the spread of the invasive pest to enable them protect their maize from destruction by the pest.

Berita Mutune | The United Nations Food and Agriculture Organization (FAO) in partnership with ICIPE has established a Fall Armyworm (FAW) early warning system to help farmers and Governments identify the invasive pest in as one way of taking preventive measures to reduce its spread and prevent the destruction of maize.

The project, "Community-based Fall Armyworm Monitoring, Forecasting, Early Warning and Management System (CBFAMFEW) in Eastern Africa" is being implemented in Kenya, Ethiopia, Tanzania, Rwanda, Burundi and Uganda.

The fall armyworm (*Spodoptera*



Farmers Scouting for fall armyworm in a maize field in Sibitole Village East of Bujumbura, Burundi

frugiperda) is an invasive pest from the Americas. It was first reported in Africa in 2016 where it has infested millions of hectares of maize threatening a staple crop that more than 300 million people in Africa rely on for their food security. The most affected

are small-scale farmers who produce more than 70 per cent of maize grown in these countries.

The system empowers farmers to fight pest

The project will contribute towards increasing the resilience of farmers to respond to food security threats through strengthening Community-based FAW Monitoring and reporting system.

It also enhances capacity building, ensures the presence of a functional Early Warning System for Fall Armyworm (FAW) control as well as information sharing in the target countries. Finally, the project promotes awareness among FAW prone communities on effective reporting of the invasive pest through continuous situation monitoring and data gathering.

The project is expected to effectively prevent the build-up of the FAW in the Eastern Africa sub-region and avert production losses among farmers. Specific outputs expected out of the project include developing a sound community-based FAW monitoring and reporting system, which can be adopted by farmers, extension staff, governments, mobile operators, pheromone trap-producing companies for sustainability, prediction and making firm decisions in control of the pest.

Interventions done at village level

Farmers participating in the project also known as Community Focal Persons (CFPs) will work with extension officers and village heads.

In each of the participating countries, a body known as National FAW Focal point (NFFP) were appointed to help identify the specific villages and Community Focal Persons (CFPs) in five maize growing districts or counties.

A total of ten villages were selected in each district or County, making a total 50 villages per country. Four CFPs which includes the village heads, agricultural extension workers and lead farmer were selected in each village making a total of at least 40 people per district. NFFPs are supposed to work with the FAO staff who acts as the lead person at national level in the respective countries implementing the project.

FAMEWS mobile smart phone to be used

Participants at each level, from the national to the village level have been trained on FAW identification biology and ecology, scouting and monitoring and how to enter the data collected into FAMEWS (Fall Armyworm Monitoring and Early Warning System) Mobile app (See TOF No. 160, September 2018). Each participating village has been provided with two pheromone traps and a total of 56 smart phones were given to the community focal persons per country. Farmers are expected to scout for the fall armyworm twice a week and take pheromone data once a week in their farms.

Data generated is shared

The FAMEWS application assists farmers to know the level of infestation and informs them to take appropriate action to save their crop. It is promoted through FAO-supported Farmer Field Schools (FFS) approach as well as other community-based forums.

The FAMEWS application also provides valuable information on how the insect changes over time and space to improve knowledge on the behaviour of the pest, which is new in Africa and guide farmers for the best response to control it. The data sent by CFPs is validated by the NFFP and transferred to a global web-based platform. Later, it is analyzed to give a real-time situation overview with maps of fall armyworm infestations

Organisations participating in this project include FAO, ICIPE, DLCO-EA, CABI and government ministries in respective countries.

Control Fall Army worm using natural methods. For further reading on Natural pest control http://www.infonet-biovision.org/natural_pest_control



Advantages of making dairy feeds at home

Feed costs take up to 70 per cent of production costs. Making feeds at home can save the farmer a lot of money if they can get quality raw materials and learn how to do it correctly.

Teresia Njuguna | Feeding management is crucial in dairy farming because it has a direct effect on the milk production. The quantity and quality of milk produced is largely dependent on what and how the cow is fed. A good diet guarantees good health, body growth and maintenance, reproduction and increases milk production. But feeding management can be an expensive undertaking when a farmer depends on buying dairy feeds. This is the reason why farmers should consider making their own dairy feeds from available resources at home.

Home-made dairy cow feeds can have the same quality as the commercial dairy feeds or even better, especially when the farmer is well equipped with the right feeding management information. The most important elements in a dairy cow's diet are proteins, energy and minerals. Here is a classification of locally available resources that are used to make dairy cow feeds and their nutritional value:

High energy feeds: Maize germ, wheat pollard, molasses, maize bran and wheat bran.

High Protein Feeds: Lucerne hay, cotton seed cake, soya bean meal, sesbania sesban, sunflower seed cake, fish meal, calliandra leaves, leucaena leaves, purple vetch, desmodium leaves.

Minerals: Limestone, Dicalcium Phosphate, mineral premix.



Making your own feed at home prevents purchase of poor quality feeds sold to farmers by feed dealers and middlemen. This increases production, maintaining good health for the animals

Now that we have identified resources used to prepare dairy feeds at home, here are benefits of home-made dairy feeds:

Improved Health

There are farmers who prefer free grazing for their dairy cows while this has its advantages, it can have negative implications on the health and productivity of the cows. For example, when cows feed in the grazing fields, they are likely to feed on pasture that is of less nutritional value.

This results in low milk production and health risks. The farmer then incurs huge veterinary costs that reduce profits. By making their own dairy feeds, a farmer is in a position to observe high levels of hygiene. Animals are able to feed in a clean environment and feed on food that is safe for their health.

Good quality dairy feeds

Harvest timing, handling, processing and storage affect dairy feed quality. Storage practices differ. While some

farmers are cautious with the storing process, some are not and this may lead to contamination.

There are farmers who find it easy to buy hay from large-scale sellers. It is important to note that these sellers face challenges in managing the grass. Grass is more nutritious when harvested during or before flowering. Many farmers do not have this knowledge thus harvest it when it is too late. This means that its nutritional value has reduced by the time it reaches the cow for consumption.

Commitment to home-made feeds requires the farmer to observe best practices in handling every kind of animal feed. This guarantees quality, which then increases animal health and milk production.

Cost effective

Dairy meal takes about 20% of the total cost of milk production, reducing profits for the farmer. Making homemade feeds with locally available resources can help a farmer increase productivity at a low cost, thereby increasing profits.

Reduced Wastage

On-farm by-products refer to materials or produce deemed as waste but reusable in other ways. For example after harvesting maize, the maize stalks either rot in the farm or are gathered and burnt. In a best-case scenario, the stalks should be gathered, stored, and fed to cattle as roughage.

However, due to poor storage and presentation the stalks can become waste.

Where crop residue exceed what the farmer needs to feed his cattle before the next season, he can generate extra revenue by making concentrate for sale. Overall, using on-farm crop residues improves the farmer's efficiency and economic value.

Balanced diet

Making dairy feeds keeps you aware of the exact nutrients essential for dairy cattle. Many farmers feed their cows mostly on normal grass and Napier grass. While these feeds have rich nutrients, the truth of the matter is that this is not sufficient to increase milk production. This is the reason why many farmers will complain of low milk production yet they are keen on feeding their dairy cows on grass.

A balanced diet is key. For example, a dairy cow's dairy meal should contain high protein, energy, nutrients, fibre, vitamins and water. When preparing to make dairy feeds at home, the farmer is able to prepare a well-balanced schedule. This ensures animals receive all the essential nutrients every day, and in the right proportion regardless of the season.

Home-made feed is fresh

Cleanliness and good hygiene are basic practices of productive dairy farming. A dirty cowshed can cause sickness or low productivity since it is a discomfort to the cows.

Similarly, feeds need to be clean, free of pesticides, herbicides, and mould (mycotoxins) or infestation. Inspection of ingredients, the preparation process and storage of feeds ensure good quality. Thus, there is no compromise on the quality of the feed and its storage.

Wetness brings mould causing the feed to emit toxic gases. Home-made feeds lower hygiene related problems by a huge percentage. The contamination probability is low because the farmer prepares feed with care and observes best storage practices.

So how can you make dairy cow concentrates at home?

- i) List down all the available ingredients.
- ii) Group the ingredients according to the nutrients they provide.
- iii) Identify a good mixing area.
- iv) If you are mixing manually, start mixing the portions in small quantities. For example, mix the salt plus mineral then add yeast and mix thoroughly using a shovel.
- v) Continue mixing with a shovel to ensure the ingredients are well distributed.

Advantages of making dairy feeds at home: For further reading on animal nutrition and feed rations <http://www.infonet-biovision.org/AnimalHealth/Animal-nutrition-and-feed-rations>

Home-made concentrate formulations for dairy cows

For a cow producing up to 7 kg milk comes from the normal forage diet. For every extra 15 kg milk, give 1 kg dairy meal

FORMULATION 1		FORMULATION 2	
Maize germ	77 kg	Maize + Cob	78 kg
Cotton Seed Cake	22 kg	Fishmeal	21 kg
Mineral Salts	1 kg	Mineral salts	1 kg
Total	100 kg	Total	100 kg
FORMULATION 3		FORMULATION 4	
Maize germ	54 kg	Maize + cob	72 kg
Calliandra leaves	45 kg	Cotton seed cake	27kg
Mineral salts	1 kg	Mineral salts	1kg
Total	100 kg	Total	100kg

Estimated price: Maize germ at Ksh 28/kg. Fish meal at 50/kg. Cotton seed cake at Ksh 30/kg. Maize on cob at Kshs. 10/kg. Minerals salts at Ksh 80/kg. Calliandra leaves at Kshs 10/kg

Source: Kenya Agricultural and Livestock Research Organisation (KALRO)

Insects offer future prospect for food security

Many African communities take various insects as a food source. However as protein sources diminish due to the increasing population, insects are becoming a good protein source, both for people and animals.

Mary Mutisya | Currently, the world population stands at 7 billion. By 2050, it is expected that this will hit at least 9 billion and from the look of things it might even be more. As it is now, food and nutrition challenges and more particularly protein continue to rise. There are nearly 1 billion chronically hungry people worldwide and tomorrow what we eat and how we produce it needs to be re-evaluated. For purposes of accommodating this number, current food production globally will need to almost double. The total available land for agriculture is scarce and expanding the area devoted to farming is rarely a viable or sustainable option. Most developing countries are struggling with issues such as climate change, diseases and other political related matters. This, therefore, means that there is need for people to increase distribution and widening of food options.

Insects are one of the most diverse creatures on earth. They have managed to colonise most habitats and it is estimated that they form part of the traditional diets of at least 2 billion people mostly in Africa, Asia and Latin America. Over 1900 edible species exist with majority of them being found in Africa. Although insects are considered by many as a nuisance to human beings and mere insects of crops and animals, they can provide food at low environmental cost, contribute positively to livelihoods and play a fundamental role in nature.

Contrary to popular belief, insects are not just famine foods. Many people around the world eat insects out of choice, mainly due to their palatability and their established place in local food cultures.

Because of their nutritional composition, accessibility, simple rearing techniques and quick



A rice meal with termites



Fried Termites

Insects are high in fats, proteins, vitamins, minerals and fibre. They also have a high feed conversion rate. They are readily available and easy to rear. In many countries, insects are a major source of food for many people in Africa and the rest of the world. They will therefore play an important role in food security in future due to the high population growth.

growth rates, insects can offer a cheap and efficient opportunity to counter nutritional insecurity by providing emergency food and by improving livelihoods and the quality of traditional diets among vulnerable people.

For this reason, therefore, people are coming up with massive rearing and proper and sustainable harvesting technologies. The most commonly consumed insects are beetles, caterpillars, bees, wasps and ants.

Locusts, crickets, cicadas, tree bugs and termites are also significantly consumed. For consumer acceptance and to match the busy period we are living in, people are going over and above to come up with more convenient products that people can pick and eat as they go. These

include insect enriched muffins, crackers and cookies.

Advantages of insects as food

One of the major advantages of insects as food is their nutritional composition and availability. Insects inhabit a large variety of habitats from aquatic ecosystems, farmed land to forests. They are actually said to be an inexhaustible resource obtainable from nature.

Nutritionally, insects are high in fats, protein, vitamin, fibre and mineral content. Their nutritional composition varies from one insect species to the other. Within the same insect species, the nutritional composition can also vary as this is mostly determined by the metamorphic stage of the insect, the habitat in which it lives as well as its diet. As tiny as

insects may appear, some of their nutritional facts are incredible. For example, the composition of unsaturated omega-3 and 6 fatty acids in mealworms is comparable with that in fish (and higher than in cattle and pigs), and the protein, vitamin and mineral content of mealworms is like that in fish and meat.

Environmental safety

Although most insects are harvested from the wild, currently their rearing in more organized and quality-controlled environment. Commonly reared insects include mealworms, crickets and grasshoppers. One of the main benefits of rearing insects for food is that they have a high feed conversion efficiency, can be reared on organic side-streams and can help reduce environmental contamination.

Insects have also been reported to emit fewer greenhouse gases and less ammonia than cattle or pigs, and their land and water requirements are significantly less compared to that of common livestock such as cattle, goats and sheep. Compared to mammals and birds, insects also pose less risk of transmitting zoonotic infections to humans, livestock and wildlife.

Insects provide livelihood opportunities

Insect gathering and rearing as minilivestock at the household level or industrial scale can offer important livelihood opportunities for people in both developing and developed countries. In developing countries, some of the poorest members of society, such as women and landless dwellers in urban and rural areas, can easily become involved in the gathering, cultivation, processing and sale of insects.

Such communities can directly improve their own diets and provide cash income through sale of excess production as street foods. Insects can be directly and easily collected from nature or farmed with minimal technical or capital expenditure (i.e. for basic harvesting/rearing equipment).

Rearing insects may also require minimal land or market introduction efforts, as insects already form part of some local food cultures.

Grow and add value to bananas to increase income

Bananas is a very important fruit crop in Kenya.

Knowledge in its production and cultural practices will go a long way in increasing its yield and quality of produce. Farmers also need to do value addition to lower post-harvest losses and take advantage of the better prices of value added produce to increase their income.

Joan Mukiri Bananas do well under warm, humid conditions. Its growth and development is optimum at temperatures between 22 and 31°C. Plant development is slows down below 16 °C, stops at 10 °C, plants may die below -2 °C and get scorched at above 37°C. Generally, bananas require a minimum of 2000 – 2500 mm of rainfall annually or 25 mm per week.

They are best planted on a flat area (slope 0–1 %), well-drained deep soils with high organic matter content and a pH between 5.5 and 7.0. Low pH increases susceptibility of bananas to panama disease.

Poor soils such as light sandy soils can be improved by mulching to improve water retention and adding organic matter to nutritionally deficient soil. Bananas cannot withstand water-logging since it causes rotting of its roots, which can be solved by planting in raised beds.



Plant tissue culture Bananas

Tissue culture plantlets are the recommended planting material since they are disease-free, uniform and take a shorter time to mature unlike suckers. Tissue culture plantlets can be purchased from Jomo Kenyatta University of Agriculture and Technology (JKUAT) or at Kenya Agricultural and Livestock Research Organization (KARLO) among other production centres.

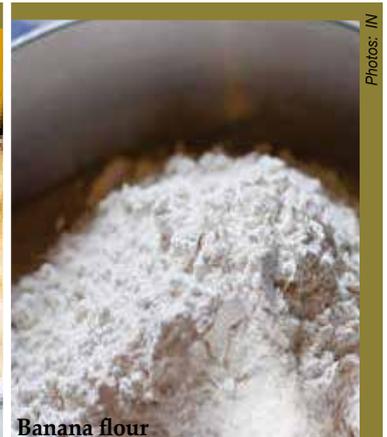
How to do value addition to



Banana Muffins



Chips and crisps



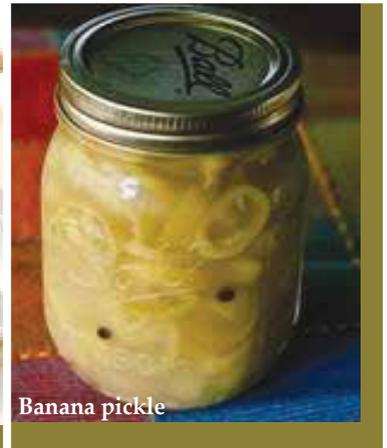
Banana flour



Ripe banana juice



Banana jam



Banana pickle

bananas after harvest

Bananas are very perishable meaning that they have a very short shelf life after harvest. Farmers are often faced by the challenge of high post-harvest losses. They are very prone to spoilage and wastage. To overcome this, the post-harvest shelf life can be extended through value addition. Value addition entails development of innovative products of consumer interest from the harvested produce. Processing of bananas also enables farmers to get better prices for their produce. The various products that can be produced from banana include:

Chips and crisps

These are made from plantain bananas. After harvesting the banana bunches, the fingers are peeled and treated with 0.1% potassium metabisulphite. They are then sliced into small, thin pieces of about 1.2 mm and deep-fried in cooking oil.

On frying, one gets crisp, yellow coloured chips which are seasoned with salt and are packed in polythene bags. The storage life of these crisps is 30-35 days which be extended to 4 months if nitrogen gas is added in the packaging. Additionally, one can add flavours such as pepper

and tomato flavor depending on the consumer preference.

Banana flour

Banana flour is made from mature green bananas. The green bananas are blanched (brief boiling), peeled, treated with 0.1% potassium metabisulphite and sliced. The slices are dried and powdered in a grinder or mixer to yield flour. The flour can be used as a nutritious adjuvant in preparations of bread, cakes, biscuits and baby food formulations. Additionally, it can be blended with other cereals to make chapatis. The flour can be stored for a year.

Ripe banana powder

This is prepared from ripe bananas. The bananas are peeled, pulped, homogenized and dried to a moisture content of 2-4%. The product is widely used in confectionary industry, making milkshakes and ice cream preparations. It can be stored for over 6 months.

Ripe banana juice

Banana juice is produced as a healthy drink from ripe bananas. Bananas are peeled, pulped, homogenized, deaerated (airspace removed) and flash pasteurized to form a puree. The puree is then treated with pectolytic enzyme to

obtain a clear fluid after filtration. The fluid is decanted and diluted with water, pasteurized and packed in sterile bottles. The puree can also be diluted and used in preparation of carbonated beverages and banana nectar.

Banana jam

Banana jam is prepared by cooking the banana fruit pulp with sugar along with pectin and citric acid. This is product, which has good commercial value and good market.

Banana wine

Banana wine is made by fermenting the enzyme-treated clear banana juice with wine yeast. The fermentation process is done for about 3 weeks followed by filtration, clarification, and bottling. The alcohol content of banana varies from 6-12%.

Banana pickle

Pickling is preservation of food in common salt with or without oil and spices. Pickles are made by peeling bananas and cutting them into cubes and fried in oil. The fried cubes were mixed with onion, mustard, garlic, turmeric and ginger paste and fried together till they turn brown.

For further reading on processing and value addition http://www.infonet-biovision.org/processing_and_value_addition

How to make quality feed for your dairy cows

Kindly let me know the raw materials and feed requirements for dairy cows starting from calf, heifers and mature dairy cows like you did for chickens.

Dear farmer,

In this last part of the ongoing series that answer the above question, we show farmers how they can make feed for their heifers and dairy cows at home (*Also see page 4 for other simple methods of formulating feed for your dairy cows*).

To make feed for your heifers and dairy cows, farmers have to know the percentage of Digestible Crude Protein (DCP) in each of the ingredients they want to use. For example, the following are some of the ingredients including the percentage

of DCP commonly used by manufacturers of feed and even experienced farmers who make their own feed at home:

Whole maize – 8.23%

Soya- 45%

Fishmeal (*omena*)-55%

Maize bran-7%

Sunflower- 35%

Maize bran-7%

Pollard-7%

A dairy cow or heifer that is about to be served requires dairy meal with a DCP of between 14.5% to 16.5%. If a farmer wants to prepare their own dairy meal, they will have to work out the percentage of DCP in each ingredient they have to ensure that the total crude protein is at least between 14.5% to 16.5%. The following example should guide the farmer to work out what they require to make their own dairy meal:

Working out crude protein percentage

To work out the percentage of Digestible Crude Protein (DCP) in some of the ingredients we want to make dairy meal for dairy cows, we need to use the following procedure as shown below:

Whole maize = $34\text{kg} \times 8.23 \div 100 = 2.7\%$

Maize bran = $12\text{kg} \times 7 \div 100 = 0.8\%$

Sunflower = $14\text{kg} \times 35 \div 100 = 4.9\%$

Pollard = $35\text{kg} \times 7 \div 100 = 2.45\%$

Fishmeal (*omena*) = $9\text{kg} \times 55 \div 100 = 4.95\%$

To find out if the above ingredients have adequate DCP for dairy meal we simply add up each of the percentages e.g. $2.7\% + 0.8\% + 4.9\% + 2.45\% + 4.95\% = 15.6\%$.

To find out if the percentage of DCP in a 100kg bag of dairy meal is correct for your dairy cow, you have to work out the percentage in the following way:

$$15.6 \times 100 \div 100 = 15.6\%$$

So they dairy meal has the right crude protein DCP that is adequate for a dairy cow but it is not complete. So we need to include other supplements which a dairy cow requires for proper growth and daily body maintenance as given below:

Lime: This is source of calcium which the dairy cow needs for milk production and bone development and maintenance. A 100kg bag of dairy meal requires 8kg of lime. To these, the farmers can add dairy premix (a source of minerals) mineral salt and some sources of microbes such as molaPlus Super® to activate rumen for improved digestion (buy these from any agrovet shop near you).

Answers by Elkanah Isaboke

Control fall armyworm using natural methods

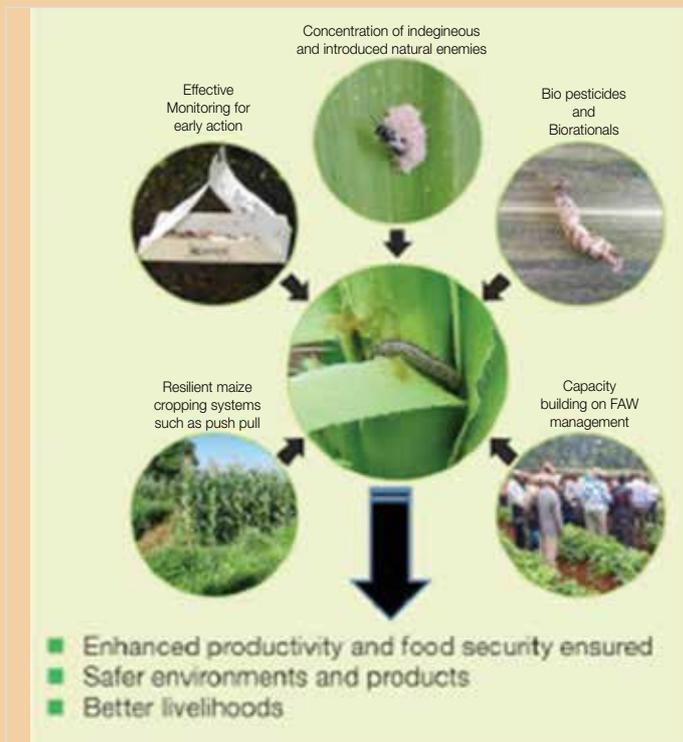
Berita Mutune! Farmers across the country have in the last two years experienced the damage to their maize crops brought by the fall armyworm (a new invasive pest). As the government rushed to buy and recommend expensive chemical pesticides; most farmers were shocked to discover that the pest did not respond to the expensive chemicals they were using to control the pest.

However, as we advised then, it is a waste of money to use expensive chemicals for the control of fall armyworm. Farmers can keep away the pest by using simple organic plant extracts through proper timing.

Organic plant extract

Here is a simple method to prepare plant extracts to control the pest:

- Get 4 kg of different plants that can kill both pests and provide nutrients to your maize crop. Such plants are chillies, garlic, stinging nettles, tithonia, neem, and African marigold, sodom's apple, pyrethrum or lantana camara.
- Mix molasses and EM1 (the two can be bought at your local agrovet shops).
- Add 5 litres of water. Dissolve a bar soap into the solution that produces lather (foam). Chop the plants into small pieces and put them into a bucket.
- Fill the bucket with water to the brim and close it completely to stop the air from escaping. Cover the mixture for 14 days.
- After 14 days, use a piece of cloth to filter the solution if you want to use a



Integrated Pest Management have proved effective in FAW control

knapsack sprayer (this stops particles from blocking the nozzles).

- Dilute the mixture at a ratio of 1 litre of the solution to 100 litres of water.

How to spray

Since organic plant extracts do not work the same way as chemical pesticides, ensure you spray your crop two (2) weeks after

germination and then two (2) or three (3) times every week to protect your crop effectively.

- Do not wait until you see the damage from the pest to start spraying.
- By spraying regularly, your crop will be protected from all pests including the fall armyworm.

Field scouting important

Just like people, armyworms can also get sick from diseases. In the field, you may find armyworms killed by fungus. The armyworms become rigid and turn white or light green as the fungus matures and the worms die. As the beneficial insects may not kill all the fall armyworms, check your field twice per week. Use your hands to destroy any armyworms or their egg masses. Do this at least until the plants are 6 weeks old, as that is when they are most vulnerable.

"I saw the importance because when I hand-picked the fall armyworms in the field near my house I got a harvest, while the other fields that I did not bother with did not give any harvest. In our group, we teach one another about this and people agree to do it because they have experienced loss of crops from fall armyworms," says Mr. John Fundi a farmer in Taita.

Why the plant extracts work

Some farmers also use locally available plants that do not cost them anything. Some prepare a local concoction to spray a half hectare of their maize field. Some start by collecting a handful of wild marigold, a handful of young tephrosia shoots and some aloe vera leaves and also pick a handful of ripe chillies. Others decide to put aloe vera because it is very strong, add wild marigold because its smell repels the moth and hot pepper adds bitterness, which gives extra strength to the mix.

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

Nyeri dairy farmers benefit from training and value addition

Charles Kimani | Farming in Kenya has undergone a revolution, gone are the days when farmers used to practise dairy farming the traditional way. Today the demand for milk in the country is rising, but for farmers to profit from dairy farming, they have to be exceptionally good to reap maximum benefits from their enterprises.

Here are a few tips to make your dairy farming profitable:

Feeding is key

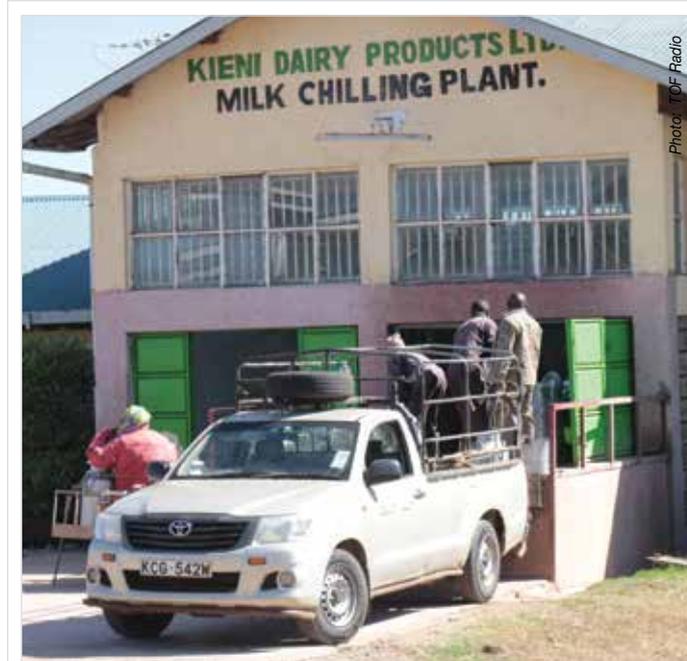
Dairy animals require suitable, safe and quality feeds. The quantity and quality of milk that a dairy cow produces is directly proportional to the quantity and quality of feeding. Dairy feed should be rich in proteins, carbohydrates, vitamins and minerals. Clean water should be provided to the animals all the time (*adlib*). On average, a dairy cow should be fed 12-18kg of fodder (Dry Matter or DM) - this depends also on the body weight of the cow and moisture content of the feeds given to the animal.

Animals need a balanced diet

Feeds such as Napier grass, Boma Rhode grass, lucerne, desmodium and purple vetch are excellent and provide 80% of the animal needs. To achieve maximum production, a balance diet should be provided, the feeds should be supplemented with dairy meal to boost milk production. You can feed your cow lupin and other sources of cheaper protein which is efficient and cost effective.

For more information on lupin, listen to our radio broadcasts on feeding your livestock with Lupin (*See link below*). Note that dairy meal should be served after milking, so that the cow remains standing until the teat canal closes. This prevents infections such as mastitis.

Lack of water will reduce dry matter intake and production. It's important to note that cows are more sensitive to water than human beings. Inadequate water causes an instant drop in milk production. The farmer should never forget to check the quanti-



Farmers deliver their milk to Kieni Milk Cooling Plant: by working together to form Cooperatives Societies, Kieni farmers have attracted funding and support from donors, including the IFDC 2SCALE project and the Nyeri County government, which has improved their livelihoods

ty and quality of water they give their animals.

Animal health

Health is essential for everyone. Dairy animals should be well-maintained to remain healthy and disease-free. Therefore, dairy farmers should take the responsibility to put in place an effective health care programme that is more preventative than curative.

Milk hygiene

Cleanliness is key when it comes to milk production. The equipment used in milking and storage should be suitable, well-maintained and clean. Ensure milk is delivered within the shortest time possible to a cooling point to reduce bacteria counts. Normally it should take less than one hour to make sure your milk is safe otherwise it might be rejected up on failing quality tests.

Animal welfare

Just like human beings, animals require a safe and comfortable environment. A good and clean shed is essential. The dairy ani-

mals should be free from hunger, fear, harsh conditions or any discomfort.

Strength in numbers

It is estimated that dairy farming provides 4% to the country's GDP. Small-scale farmers supply 70% of milk produced in Kenya with an estimated production of 6.4 billion litres/year. As mentioned, dairy farming is a lucrative business when done the right way. For Kenyan farmers working together through cooperatives and other formal groups provides advantages as we found out by visiting Kieni Dairy Products Limited (KDPL).

KDPL is an apex body that is owned by small-scale farmers (SHFs) who are dairy farmers from Kieni West, affiliated to seven dairy farmers' co-operative societies namely Endarasha, Mweiga, Watuka, Gataragwa, Nairutia, Lamuria and Thuruthuru. The current membership of KDPL is 5,600 farmers located in Kieni West.

The unity has enabled the local farmers to attract the support of various stakeholders such as the Nyeri County Government

and the 2SCALE project. 2SCALE is a project that seeks to improve rural livelihoods and food security in Africa by accelerating inclusive business in agri-food industries through public-private partnerships.

Mr. David Njenga, the Dairy Industry Team leader at International Fertilizer Development Centre (IFDC), which is implementing 2SCALE project in Kenya adds "we partnered with Kieni Dairy Products Limited (KDPL) in the value addition of milk into a low-cost yoghurt targeting the local market and the results are impressive. We helped in branding the yoghurt, developed a marketing and distribution strategy that has done well.

They have helped in branding the yoghurt, developed a marketing and distribution plan that has done a lot in increasing milk production and processing. KDPL has a new brand of yoghurt - Peak Dairies®. This has not only increased farmers' income, but also generated jobs for the youth and women involved in yoghurt production, marketing and distribution.

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/Kitwezi	96.9 MHz	
Namanga	89.9 MHz	
Lodwar	88.6 MHz	
Lokichoggio	89.3 MHz	
Garsen	93.1 MHz	
Kajjado	92.9 MHz	
Kitui	92.9 MHz	
Lamu	96.3 MHz	
Maralal		1107 KHZ
Wajir		1152 KHZ
Marsabit		675 KHZ
Garissa		567 KHZ