



A maize-bean intercrop: Planting maize together with legumes has been found to be effective in fall armyworm control. Farmers are advised to plant beans or any other legume 10, 20 or 30 days before maize

TOF magazine website wins BAKE award

Peter Kamau | The *TOF* magazine website has won this year's Bloggers Association of Kenya's (BAKE) award for the Best Agricultural Blog category. In a competition that is organized by the BAKE, the *TOF* magazine voted the best website out of 20 local websites that participated in the agriculture category.

More than 10,000 websites or blogs were entered into the competition, covers various issues

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TOF magazine editor in chief Ms Venter Mwongera, received the trophy during the winners' announcement Gala event held in Nairobi

including fashion, health, technology, creative writing, business, food, environment, beauty, video and photography category among others. The competition begins with a call for submission to websites or blogs to various categories for competition and ends with vetting by judges who choose the best five (5). The public then votes for the best website or blog in each category.

Rich content

During the winners' announcement Gala event that took place at Crowne Plaza hotel on May

19th 2018, one of the judges, an Associate Professor of English at United States International University, Dr. Martin Mburu applauded the rich agricultural content uploaded on the website best for Kenya's farming community adding that farmers were lucky to have such a platform which they can rely on to improve their farming practices.

Accepting the award, the *TOF* Magazine Editor-in-Chief, Ms Venter Mwongera assured the farmers that the magazine would strive to maintain quality in order to provide them with the best agricultural information responsive to their farming needs and welcomed other like-minded organisations to join hands to restore smiles on the faces of the smallholder farmers by providing timely, relevant knowledge to improve production in an environmentally friendly way.

Dear farmer,

Farmers across the country are currently weeding, controlling pests and applying fertilizers among many other farm management tasks.

Management of a crop such as maize requires a lot of hard work and dedication, to ensure that farmers get a good crop at the end of the season. Failure to observe any of the management practices will lead to reduced yields or a complete crop failure.

The heavy rains have provided the maize crop with adequate moisture. However, excess rains also come with a number of challenges such as the rapid growth of weeds, leaching of mineral nutrients especially for farmers who use chemical fertilizers and even floods which destroy the top soil and the growing crops in slopy areas. In this edition, we have prepared for you various ways of harvesting rainwater for use during the dry season (page 4).

This is the season that farmers need to work even harder because most of the crops are at a crucial stage in their growth. If your maize has not been infested by the fall armyworm, it is time to start scouting to ensure they are controlled as soon as their presence is noticed. Walk around the maize crop every day to identify any problem in order to take action before it is too late.

Despite the destruction of maize by the fall armyworm, scientists are working tirelessly to ensure that new methods are developed to deal with the stubborn worm. Farmers remain optimistic that a lasting solution will be found. *TOF* magazine will continue to publish new findings that show strategies developed to deal with the pest (see page 3 and 8). Farmers should be aware of unscrupulous businessmen and traders who sell unproven chemicals at very high prices claiming they can eradicate the pest.

Grow arrowroots for food security, diversify incomes

Many farmers do not grow arrowroots due to belief that the crop can only grow well along rivers. However, arrowroots grown in upland areas are healthier than those grown along river beds, which are in many cases polluted.

Amina Day Ojijo | Arrow roots (*Nduma* in Kikuyu, *induma* in Luhya) is a very popular tuber among Kenyan consumers. However, the demand for arrowroots (*Colocasia esculenta*) exceeds supply since very few farmers grow it. Because of its high water requirements, farmers in Africa always plant arrow roots along the rivers where there is plenty of water for the plant to grow well. As a result, many farmers believe that arrowroots can only be planted along river beds and not any where else. However, this is not the case because the plant can grow anywhere as long as it is provided with adequate water and good management.

River beds are polluted

Arrowroots farming along the river beds and wetlands is becoming unsuitable due to the increase in pollution in these farming sites. Most chemicals used in control of pests end up in rivers where they are deposited by run-off water. Arrowroots can absorb harmful chemicals and even heavy metals in the soil. Indeed, in developed countries, arrowroots are planted along river beds in heavily polluted areas to help take up harmful chemicals and heavy metals in rivers.

Many tests done on arrow roots sold in Kenya have found very high levels of dangerous chemicals such as lead and cadmium. It is very difficult for consumers to know where the arrowroots they buy comes from, which exposes them to the harmful chemicals and heavy metals taken up by the tubers.



An arrowroot planting: Arrowroots planted along polluted rivers take up chemicals and heavy metals making them unsuitable for human consumption

Arrowroots can do well in kitchen gardens

For farmers to grow a clean crop that does not pose problems to their health and that of consumers, it is recommended that they plant arrowroots in upland areas, away from polluted riverbeds and wetlands. Arrowroots can be planted in kitchen gardens. For farmers who want to grow on large-scale, the tubers can be planted under irrigation (drip irrigation is highly recommended). Below, we give farmers advice on how to plant organic arrowroots in upland areas:

Land preparation: Remove weeds in the area you want to plant arrowroots. Dig a straight trench that is 1m wide and 60 cm deep. Remove the top soil (40 cm) and the subsoil (20 cm) and put each layer of soil on either side of the trench. The trenches should be 1/2 metre apart.

- Mix the top soil with well-composted manure and then put them back into the hole. Apply water until the mixture becomes wet.
- Plant the arrowroot suckers, inserting them up to about 10cm deep in the holes (leave

a small depression of about 10 cm unfilled in each hole). Apply a thick mulch of grass and banana leaves over the hole and along the trenches. Water the plants every week if there are no rains to maintain the wetness. Ensure the trenches are always wet.

- Remove weeds regularly to reduce competition for water between them and the arrow roots. Arrowroots require constant weeding to ensure they get adequate water and nutrients.

Watering: Arrowroots require a lot of water; any arrow root crop without adequate water will produce thin tubers while

those fed with adequate water have big tubers.

Harvesting: Arrowroots are ready for harvesting when most of the leaves start turning yellow. Maturity period varies from variety to variety.

Varieties: The most common varieties grown in Kenya are the Eddoe and Dasheen varieties. The Eddoe variety has small tubers while the Dasheen variety has bigger tubers. Both varieties take eight (8) months to mature. A new hybrid variety from Rwanda is now available in Kenya which matures in six (6) months. The variety is said to consume less water and can grow in drier areas. Farmers interested in this variety can visit KALRO Research station in Thika.

Yield: The average yield for Eddoe and Dasheen varieties is about 1.68 tonnes per acre. The hybrid variety produces three (3) tonnes per acre.

Price: One tuber of arrowroots retails between Ksh 80 to Ksh 100. Demand for arrowroots is very high in the market throughout the year due to low production.

For more information contact: KALRO, Thika 0726 586 408



Harvesting arrowroots

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 or Biovision Africa Trust (BvAT).

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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

Chief Editor Venter Mwangera

Editor Peter Kamau

Administrator Lucy W. Macharia, +254 719 052 186

Editorial Advisory Board Dr. Sunday Ekesi (ICIPE), Henry Neondo (ASNS), Dr Jane Njuguna (KEFRI),



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Layout James Wathuge

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Crop diversity reduces fall armyworm damage in maize

Scientific trials show that when beans and other crops are planted 10 days to 30 days before maize, fall armyworm damage is reduced. Intercropping maize with other crops increases natural enemies which feed on the fall armyworm eggs and larvae.

Berita Mutune | As farmers continue to battle the fall armyworm invasion in Kenya and other East African countries, scientists are working to provide farmers with innovative methods on how to control the pest. One of the methods that scientists are promoting is the use of intercropping. Intercropping (planting a variety of crops together with maize) has been shown to reduce the level of damage by the invasive pest.

According to studies conducted earlier in Colombia in South America and Florida in United States the fall armyworm population was found to be significantly lower in experimental plots where maize was intercropped with other crops.

Intercrops reduce fall armyworm

In one of the experiments, one field was planted with maize and beans while another field was put under maize. After 10 to 15 days, the fall armyworm damage on the crops was examined by counting the total number of maize plants destroyed by the pest. The results showed that the number of damaged maize plants was significantly lower in the field planted with maize and beans compared to the field where maize was planted alone.

After 20 days the number of fall armyworm larvae in the maize and beans intercrop was also found to be much lower compared to the field where only maize was planted. Further trials showed that when beans are planted 30 days, 20 days or 10 days before maize is planted, the fall armyworm damage was reduced by 88 per cent. This shows that fall armyworm damage can be reduced when beans are planted earlier than maize on the same farm.

Crop diversity protects maize

In the same trials, it was demonstrated that if there are more varieties of crops and even weeds in maize field, the fall



Studies show that there is less fall armyworm damage when maize is intercropped with legumes

armyworm damage tends to be lower. Beneficial insects which feed on the armyworm eggs and larvae also tended to increase in fields with a wide range of crops and weed species that can play a role in the control of fall armyworm.

The experiments showed that natural enemies of the fall armyworm also increase within farms with a wide range of crops, which can play a big role in fall armyworm control.

Technology transfer

Scientists at ICIPE have studied fall armyworm control methods used in other countries for example in South America and the US, where the pest originated with a view to introduce the same fall armyworm control measures in Kenya and other African countries.

Farmers can also employ other ways that help reduce the fall armyworm damage in their maize crops if they can practise the following control methods which are harmless to people,

animals and the environment:

Early warning and monitoring: Farmers can remain alert in order to take action immediately the first signs of the pest are noticed. They can do this by walking around their maize field daily. If they notice any moths, then they should start spraying their maize crop immediately. The following are some of the safe pesticides they can use:

Bacillus thuringiensis: This is a biopesticide obtained from a fungus found in the soil and in several insects, which is very effective in the control of many pests including the fall armyworm. *Bacillus thuringiensis* (Bt) is harmless to non-target insects such as bees.

Metarhizium anisopliae: *Metarhizium anisopliae* is a fungus that infects insects when they come into contact with it. Once the fungus attaches itself to the insect pest, they germinate and begin to grow. Eventually the fungus manages to enter into the pest's body, growing inside

until the insect dies. Insects that come into contact with infected insect also die.

Nimbecidine®: Nimbecidine is a neem-based biopesticide that kills pests on contact. It also makes the insect unable to feed. Neem-based biopesticides reduce the reproduction and longevity (lifespan) of the insect pest while interfering with the development of the larvae. The biopesticide is less toxic to other insects such as bees and even parasitic insects such as wasps.

Push-pull method: The Push-Pull technology is a simple method that was developed to control the stem borer and Striga weed in maize farms. The method uses a trap crop such as Napier or brachiaria and desmodium (silverleaf or greenleaf) as intercrops in maize to control the stem borer and striga that damage maize (See page 8).

For more information on: Natural pest control http://www.infonet-biovision.org/natural_pest_control

Free fall armyworm information service launched

The Ministry of Agriculture and Irrigation (MAI) in collaboration with Precision Agriculture for Development (PAD), is launching a free SMS information service for farmers that provides important recommendations on the control of the Fall Armyworm (FAW) in the country. The free SMS information service will first enable farmers to get up-to-date information on the devastating pest, including how to identify it, determine level of infestation, and various control methods,

before expanding to recommendations about other pests and other agricultural topics.

According to Mr Emmanuel Bakirdjian, the Kenya Country Director of PAD, who is running the SMS information platform on behalf of the MAI, the mobile service is currently available to all Safaricom customers for free. It will also be available to Airtel customers for free. All a farmer needs to do to get information on FAW is to send an SMS message with the word "SHAMBA" for those who need

information in Kiswahili and "FARM" for those who need information in English to 40130. Sending and receiving SMS messages is free.

After receiving a first set of messages, farmers can access more information about FAW by sending the word "ORODHA" (for Kiswahili) or "MENU" (for English) to 40130. The farmers can learn more about how to detect FAW, how to manage it, its origin and chemical solutions. **Peter Kamau**

Learn various methods of harvesting water during rainy season

A lot of water is lost during the rainy season. Farmers can harvest the water and use it for domestic and even irrigation in dry season using various water-harvesting methods.

Venter Mwongera | Water is a rare commodity that can be harvested and preserved when in surplus for use in the dry seasons. During the rainy seasons, much water is lost through floods which damages roads, sweeping away homes, livestock, trees, bringing down walls and buildings, eroding away the fertile top soil among other damages caused by excess and unharvested rainwater.

Below are different cost-effective ways that farmers can use to harvest the rainwater for use during the dry seasons:

Gutter system

Farmers can construct a gutter around the roofs of their iron-roofed houses to collect much of the rain-water and direct it to a tank or a reservoir. The gutters could be made from materials like plastics, metal sheets, palm leaves, banana leaf

sheaths among other materials.

Build an earthwork

These are simple ways of ensuring rainwater is directed to the plants rather than flowing on the roads and not put into good use. To build an earthwork, use a shovel to shape the soil to collect rainwater from the sidewalks, steep hills among other surfaces and direct the rainwater into a reservoir or to the roots of the crops in the farm. Trenches can be dug, and low earth walls can as well direct the flow of the water to a central reservoir point.

Contour ridges

These are ridges constructed along the contour lines, spaced between 5 and 20 m apart. The height of each ridge varies according to the slope's gradient. The ridges can be dug manually, with an animal driven plough or by suitable tractors.

To dig an effective ridge, dig as precisely as possible along a contour line to allow the free flow of water to the lowest point without accumulating within the contour (See photo below).

Small pits

This is a technic of harvesting water most favourable for rehabilitating degraded agricultural lands. The pits are 0.3-2 m in diameter. The depth of the



Contour ridges constructed across slopy land to reduce soil erosion during the rainy season

hole can be between 5-15 cm. Manure and different types of grass mixed with soil is put in the dug holes. A combination of small pits and bunds techniques to harvest runoff water complement well, and allows much degraded agricultural land to be put back into agricultural use. Annual crops like millet, maize and sorghum can be grown well using small pits system.

Semi-circular and trapezoidal bunds

These are earth bunds in the shape of a semi-circle facing directly upslope. They are created at a spacing that allows sufficient catchment to provide the required run-off water to accumulate in the bund where the crops can be grown. The dis-

tance between the two ends of each bund varies between 1m-8m and the bunds are 30-50 cm high.

Small run-off basins

These are small rectangular-shaped structures surrounded by low earth bunds that have the maximum land slope to allow runoff flows to the lowest corner of the hole where the crops are planted. The size of a runoff basin could be 5-10 m in width and 10-25 m in length. Such basins could be constructed on almost all plains and slopes. When constructed on plain gradients, the height should be higher to control soil erosion.

For more information on water harvesting <http://www.infonet-biovision.org/water-management>

Additional materials from: Water Harvesting, Indigenous knowledge for the Future of the Drier Environments by ICARDA

Farmers in Ukambani benefit from water harvesting

The lush green forest in Mr Charles Kusenga's land in Kathiani Sub-County in Machakos County is not only attractive to the human eye, but, it is also a source of water for his domestic animals and the wildlife. Irrespective of rainy or dry conditions, Mr Kusenga's farm is green and his animals have plenty of water throughout the year. "I've dug contours, trenches, trapezoidal bunds and a large water reservoir of at least 10,000 litres where water collects during the rainy season. I use it on my farm during the dry season," he says.

Mr Kusenga knows the importance of harvesting and conserving water; "I sell my farm produce every month and I fetch around Ksh 200,000 from the sale of crops and milk from my animals," he reveals adding, "I try to collect all the rainwater for use during the dry season. If I let it wash away the topsoil and destroy roads, I would be an

irresponsible farmer."

The farmer belongs to Ambassador Farmers Group with 50 members whose main activities are fruit, dairy and poultry farming. Just like Mr Kusenga, other members of the farmers' group too use similar water harvesting and conserving techniques for food sustainability throughout the year.

Mr Stephen Kithuku from Kaathi Sub-County in Machakos county suffered losses caused by continuous floods which drowned his shop due to a slopy terrain. Although much water was wasted, Mr Kithuku's family needs were mostly not met due to lack of money.

"I decided to direct the flow of the water that flooded in my shop to my farm. I dug many trenches, small pits and contours which led much of the water to a dam which reduced floods in the shop," he states.

"To diversify my sources of



Mr Kithuku shows a water harvesting terrace in his farm

income, I decided to practise various forms of farming using the harvested water. I grow apple-mangoes, cowpeas, maize, beans, keep poultry and dairy cows besides horticulture farming. My family's income is now diversified, and their nutrition has improved," he says happily.

The testimonies of the two people is a common confession from more than 500 farmers in Machakos County. They are reaping the benefits of food sustainability throughout the year because of harvesting and conserving water during the rainy seasons. **Venter Mwongera**

Learn how to manage diabetes through diet and exercise

Proper nutrition and exercise can reduce blood sugar levels and prevent damage to vital organs in the body such as the heart and kidneys.

Linah Njoroge | Diabetes is a chronic condition in which the body produces too little insulin or cannot use available insulin efficiently. Insulin is a vital hormone that helps the body use digested food for growth and energy. Much of the food we eat is broken down by digestive juices into a simple sugar called glucose, which is the body's main source of energy. Glucose passes into the bloodstream and, from there, into cells, which use it for energy. However, most cells require the hormone insulin to "unlock" them so that glucose can pass through. Insulin is normally produced by beta cells in the pancreas (a large gland behind the stomach).

In healthy people, the process of eating signals the pancreas to produce the right amount of insulin to enable the glucose from the food to get into cells. If this process fails or does not work properly, diabetes develops. When the pancreas produces little or no insulin, or the body's cells do not respond to the insulin that is produced, glucose builds up in the blood, overflows into the urine and passes out of the body.

Diabetes is categorized into three or four main types.

Type 1 diabetes: This form of diabetes is less common than type 2 diabetes and accounts for 10 percent of diabetes cases. In type 1 the pancreas makes little or no insulin because the insulin-producing cells have been destroyed.

Type 2 diabetes: This type of diabetes most often occurs in overweight or obese adults after the age of 30, but may also develop in children. In type 2 diabetes, the pancreas makes insulin but the body does not respond to it properly (insulin resistance). In time, the pancreas may fail to produce enough of its own insulin and requires insulin replacement. Some of the factors that contribute to insulin resistance and type 2 diabetes include genetics, obesity, physi-



Eating processed foods has been blamed for the increase in diabetic cases in many countries

cal inactivity and advancing age.

Gestational diabetes: Is the third type of diabetes and is one of the most common problems during pregnancy. During normal pregnancy, hormones produced by the placenta increase the mothers' resistance to insulin. Gestational diabetes results when the insulin resistance exceeds the body's capacity to make additional insulin to overcome it. This resistance usually disappears when the pregnancy ends.

Pre-diabetes: Is a term that describes an increasingly common condition in which blood glucose levels are higher than normal. But not high enough for a diagnosis of diabetes. Research shows that most people with this condition go on to develop type 2 diabetes within 10 years unless they make modest changes in their diet and level of physical activity.

Some long-term damaging effects to the body, particularly the heart and circulatory system, may start during the pre-diabetes phase of the disease. People who are overweight and do not exercise, with a family history of diabetes are at a higher risk of developing type 2 diabetes.

Untreated diabetes can lead to complications

Without proper management, individuals with either type 1 or type 2 diabetes can develop serious complications from high glucose levels including blindness, nerve damage, as well as vascular disease that can lead to heart disease, strokes and

kidney failure. Diabetes complications include both long-term and short-term complications.

The long-term complications involve the large blood vessels as well as damage to the nerves. About 20 % to 40 % of people with diabetes develop evidence of Nephropathy (Kidney condition).

Diet important in diabetes management

The nutrition management in diabetes is important to manage the several complications. Nutrition therapy is an important component in reducing risk factors for chronic complications especially those related to large blood vessels.

Although uncontrolled diabetes can potentially be life-threatening, people with well-managed diabetes can expect to live healthy lives. Some of the symptoms of diabetes include:

- Excessive urination.

- Increased thirst and hunger.
- Weight change especially weight loss.
- Poorly healing wounds.
- Recurrent infections.
- Tiredness.

Management of diabetes is mainly through 3 main factors

- Nutrition.
- Exercise.
- Diabetes medication.

In general, food raises blood sugars, exercise lowers blood sugar and insulin or diabetic pill lowers blood sugars. The main goals for nutrition and proper diet is to maintain the blood glucose levels to as near to normal as possible through the provision of adequate food high in fibre, natural vegetables, avoidance of highly processed foods and maintaining a desirable weight.

This in turn helps the individual in preventing or delaying of long-term complications and in the improvement of overall health. In order to avoid high blood sugar levels, diabetic people need to adhere to nutrition and meal planning which is one of the most essential component of successful diabetes management.

The diet of a person with diabetes puts emphasis on complex carbohydrates (carbohydrates that have not been processed) which should be evenly distributed throughout the day. Eat meals rich in fibre. Do not skip meals. But, eat small portions regularly.

Exercise reduces sugar levels

The protein content should be adequately provided and should include both animal and plant protein. Other special considerations include exercise. Exercises help reduce blood sugar levels by making insulin action more productive. Exercise also improves the overall health. Although diabetes is a life-threatening condition, it can be controlled and managed once diagnosed.

For more information on diabetes <http://www.infonet-biovision.org/HumanHealth/Diabetes>



Exercises in a gym

Farmer uses turkey to hatch chicken eggs

A turkey takes 29 days to hatch its own.

However, Mr Karanja Mungethu has taken advantage of this brooding period to hatch chicken eggs.

Karanja Daniel | In Kitale, Trans-Nzoia County, Mr Karanja Mungethu 88, has perfected the art and science of using turkeys as 'natural incubators'. How does he do it? The incubation period of turkey and chicken is 29 and 21 days respectively. He substitutes turkey's eggs with chicken's fertilised eggs to save time and use nature to his advantage.

Turkey continues brooding

After 21 days have elapsed, Karanja separates chicks from a turkey foster mother. He rears from a brooder. Since the turkey has not finished the 29 days, he places another set of eggs for incubation. The turkey will sit on them, again, for another 21 days. Once the chicks have hatched, the process starts over again; at least, three times, considering the health of the bird.

"You wouldn't want an emaciated bird to bring forth chicks. They use a



Karanja with some of the recently hatched chicks

lot of energy to generate heat and stay for long without eating." He points out.

Good hatching rate

A turkey can brood on up to 30 eggs at once. However, Karanja prefers brooding 20-25 eggs per incubation period. Why does he do this? The benefits are immense such as reproducing more using fewer resources including time. With a hatching success rate of 95 per cent, besides, turkeys are not good at nurturing young chicks, this is why he uses them only for incubation purposes.

Sells chicks as a business

Karanja sells the chicks at some point at a profit making it lucrative business venture. "I would encourage farmers out there to be innovative with natural methods as much as nowadays technology is being embraced to increase agricultural production," he advises.

"You are all invited to my home in Kibomet, which is only 5 kilometres from Kitale town along Kitale-Kapenguria highway to come and learn more about this method," he tells farmers.

For more reading on chicken <http://www.infonet-biovision.org/live-stock-species>

Arrow roots have many nutritional benefits

Racheal Wangari | Arrow-roots have many nutritional benefits. Some of them are as outlined below:

- Arrowroot leaves are rich in vitamins and minerals. They are a good source of thiamin, riboflavin, iron, phosphorous, zinc, vitamin B1, B6, C, niacin, potassium, copper and manganese.
- Arrowroot corms are high in starch and a good source of dietary fibre.
- Arrowroots are a rich source of folates that will help in the cell division or the DNA synthesis.
- It is free of gluten thereby reducing the risk of any form of allergy from it.

Health benefits

Improved heart health: The significant levels of potassium found in arrowroot mean that it can be a definite line of defence against heart-related issues. Potassium is a vasodilator where it relaxes the tension in the blood vessels and arteries, thereby lowering blood pressure and reducing your risk

of atherosclerosis, heart attacks, and strokes. Potassium is a cognitive enhancer, promoting the flow of oxygenated blood to the brain.

Safe for infants: The starchy content and mild flavour of arrowroot make it a safe ingredient in baby foods including teething cookies for babies. It poses no risk of allergies and is ideally a gum-soothing food.

Fights salmonella virus: It fights various foodborne pathogens such as salmonella virus, preparing the body's defense system against various diseases and disorders.

Lower birth defects: A particular member of vitamin B family is folate. High levels of folate are found in arrowroots. Folate is important for expectant mothers. It prevents neural tube defects in the unborn child. Folate is also an important element in the synthesis of DNA and division of healthy cells besides promoting a rapid healing and healthy growth.

Reduced stomach concerns: Arrowroot is a gluten-free substance, making it very popular in recent years, as it can prevent



Arrow roots can be cooked in many ways

the gastrointestinal discomfort, pain, and danger that those handling gluten intolerance must face every day.

Growth and development: Arrowroot contains a good amount of protein present. By increasing the intake of plant proteins, which are easier to process than animal proteins, healthy growth and development is guaranteed.

Preparation of arrowroots

Ingredients

- 4 large arrowroots
- 3 potatoes

- 4 tomatoes
- 1 large onion
- 2 carrots

Method

1. Peel your arrowroots, potatoes and chop them into medium pieces and then wash them thoroughly.
2. Slice the carrots and the tomatoes into small pieces.
3. Prepare your onions in a *sufuria* (pan); add oil and leave it to cook till it turns brownish. Add tomatoes then the arrowroots and the potatoes at the same time. Stir and cover the *sufuria*.
4. Cook for five minutes and add your sliced carrot and stir uniformly then cover the *sufuria* once again and wait for it to cook for 10 minutes
5. Add a little water and cook till it's ready.
6. Serve the meal with any type of greens in season.

When eating them as a snack or a breakfast accompaniment, they can be steamed or boiled with a little salt to taste.

How to detect nutrient deficiencies in crops and correct them

My maize is turning yellow despite applying adequate fertilizer during planting time. Could it be a disease or just a loss of nutrients? Please advise.

Dear farmer,

Sometimes it is difficult to distinguish between nutrient deficiencies from diseases to insufficient rains. However, due to the recent heavy rains in many parts of the country, nutrient deficiencies are the most likely cause of colour changes. Plants reveal what they lack mainly through the colour of their leaves. It is through a careful observation that a farmer can identify the cause of the colour change.

In an ideal organic farming environment, crops grow in soil rich in organic matter obtained from decayed plant residue and farmyard manure that is well-composted. Compost prepared in the right way provides all the nutrients that the crops require such as the macronutrients like nitrogen, phosphorus and potassium.

Importance of organic matter

The organic matter provides the right soil structure which enables the soil to keep the important nutrients. Organic matter holds the soil particles together and enhances free air and water circulation. The soil with an organic matter content of between 3.5 to 7 per cent is the best for high crop production. Soils in many farms lack adequate organic matter because crop residue is not recycled.

Farmers burn crop residue while preparing land or feed it to the animals without returning farmyard manure into their crop farming fields to restore fertility. Exposed soils lose a lot of carbon which is an important element to building soil fertility.

Plants with inadequate nutrients show it on their leaves. It is easy to identify deficiencies of the following nutrients Nitrogen, phosphorus and potassium. Each of these nutrients deficiencies in the maize crop is as shown on the right:

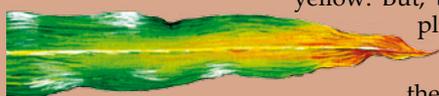


Photo: TOF

A maize crop deficient in nutrients: Plants show the nutrients they are missing

Nitrogen: Nitrogen is one of the most important nutrients needed to promote the growth of plant leaves and shoots. It is the most important nutrient not only for the plant to grow but it also forms a part of the many essential compounds such as proteins and chlorophyll. The chlorophyll gives plants the green colour which is an important part of manufacturing food for the plant using sunlight and carbon dioxide.

Nitrogen deficiency symptoms: A low supply of nitrogen results in a change of the plant leaves to yellow. But, the green colour is restored by supplying nitrogen to the plant.



Prevention of nitrogen deficiency: Farmers can build-up the organic matter levels in the soil by growing nitrogen-fixing green manures or legumes or use nitrogen-rich organic fertilizers. Excessive nitrogen on the other hand results to leaves that are very soft and which are prone to insect attacks, fungal infections and other disease-causing agents. Excess nitrogen supply extends the maturity period in maize and other crops. In fruit trees, excessive nitrogen leads to the growth of many leaves and small fruits. In root crops, excess nitrogen leads to big leaves and small tubers.

Phosphorus: Phosphorus is the second most important nutrient that is required for proper development of the roots and shoots of any plant especially during the early stages of growth. Young plants absorb phosphorus rapidly and a crop like maize has peak demand for phosphorus at just three weeks of growth. Lack of phosphorus during the early stages of growth can cause many problems that the farmer cannot correct later in the season leading to poor crop yielding.

Phosphorus deficiency symptoms: Plants without adequate phosphorus show stunted root system, stunted leaves and stem. A dull greyish-green leaf colour with purple colouration especially for maize and other cereal crops.

Prevention: Apply rock phosphate or plant tea from tithonia. For rock phosphate, add a lot of humus to the fertilizer to release phosphorus.

Potassium: Potassium is the third most important nutrient in plant growth. It helps to manufacture food for plants that promote the growth of roots and shoots. It also facilitates the movement of manufactured plant food from the leaves to other parts of the plant. Potassium also strengthens the plant to resist diseases. It is particularly important in regulating water in the plants.

Potassium deficiency symptoms: When potassium is in short supply, the plants become stunted, develop small leaves, which are pale in colour. The leaves dry before they mature, first at the tips and then along the outer edges. The fruits and seeds become small in size and less in weight.

Prevention: Improve the soil structure use plant-based potash eg comfrey leaves and the comfrey liquid. Add wood ash to compost heap and apply the same to the soil.

Trace elements

Growing crops require a number of beneficial heavy metals such as iron, zinc, copper, molybdenum and two non-metals- boron and chlorine. These are called trace elements because the plants require them only in small quantities. For example, a maize crop producing 6.3 tonnes of dry matter only needs 70 grams of copper from the soil. Trace elements are important because a crop lacking them may show yellowing of the leaves leading to the death of growing points and an irregular growth. Farmers need to regularly take soil samples from their farms and carry out tests to know what nutrients might be lacking from the soils to correct the deficiencies on time. *Answers by Elkanah Isaboke*

TOF Rad answers your questions

TOFRadio is broadcast on KBC on Tuesday and 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

Push-Pull technology key in the fight against fall armyworm

Charles Kimani | Dressed in a brown trouser and a matching cap, Allan Methu admires his maize plantation. Allan is a Push-Pull farmer in Lela, 20km Northwest of Kisumu, he is reaping the benefits of adopting the Push-Pull technology in planting his maize crop. The crop is the preferable cereal crop for many families where more than 300 million people in Africa have maize as the staple food.

Push-Pull addresses farmers' needs

Key constraints on maize production include pests, degraded soils, weeds and erratic rainfall. The need to address these challenges was the main motivation behind the development and subsequent up-scaling of the Push-Pull technology.

The Push-Pull technology involves intercropping the maize crop with desmodium that acts as a pest repellent and planting Napier grass (attractive crop) as a border crop around the crop. The technology, introduced two decades ago, is helping farmers to stay in farming business.

Controlled striga and stemborer

In developing the technology, Prof. Zeyaur Khan and his team of scientists sought to address the devastating Striga weed, stemborer pest and enhance soil fertility, but with time the technology is exceeding expectations.

The fall armyworm is the latest threat to farmers. The caterpillar was first discovered in West Africa in 2016 and has since spread to other parts of sub-Saharan Africa. The caterpillar feeds on over 80 species of plants including cereal crops such as maize, sorghum and millet that are the staple for many African families.

Multiple ways have been suggested to deal with the pest, but an Integrated Pest Management (IPM) system provides the most effective and efficient way of dealing with the pest especially



A Push-Pull crop with less fall armyworm damage: Push-Pull is an appropriate technology in fall armyworm control

among small-scale farmers.

Push-Pull works against fall armyworm

Allan Metho is one of the farmers that attest to the fact that Push-Pull technology is the difference between a good harvest and another bad season. He came across the Push-Pull technology (PPT) through a field day he attended in a neighbouring village of Yenga. Using the information he obtained from the visit, he adopted Push-Pull and has seen his farm yields improved because of improved soil fertility and reduced Striga. Besides

this benefit, he has good fodder for his animals from desmodium and Napier grass.

Good harvest in Push-Pull fields

In the current season April-July 2018, Mr Metho is optimistic that he will get a good harvest. His optimism is derived from the fact that while the fall armyworm has infested neighbouring farms, his Push-Pull farm is free of the caterpillar. "I saw the fall army worm in a neighbour's farm last year (2017), when I came to my farm I noticed the worm had eaten the desmodium but surprisingly the

worms were dead." He says.

A strong advocate of Push-Pull technology, Mr Metho has set aside a Push-Pull demonstration plot to teach other farmers and show the comparison between a Push-Pull plot and a regular plot.

Farmers like Metho illustrate the potential of Push-Pull to secure food security in Africa and safeguard livelihoods of thousands of small-scale farmers.

For more information on intercropping and push pull, http://www.infonet-biovision.org/cultural_practices

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