



Johnson Mwaura of Kahuho village in Karati location, Nyandarua county tends his potato crop. Like many farmers in the region, potato production in Mwaura's farm has been going down over the years despite his use of certified seeds and good management practices. This raises fears of the possible spread of Potato Cyst Nematode, a devastating potato pest that was discovered in the region last year.

Kenya on the verge of serious potato crisis

TOF - Kenyans should prepare for a serious potato shortage following the spread of a new pest, The Potato Cyst Nematode (PCN) to all potato growing areas in the country. The pest can destroy between 80% to 100% of a potato crop once it establishes in a field.

Already farmers in Nyandarua County where the pest was first reported last year are reporting a drastic reduction in potato production with some reporting 60 to 80 % per cent



drop in potato yields. Nyandarua produces more than 40% of all potatoes sold in the country.

The two PCN species (*Globodera rostochiensis* and *Globodera pallida*) are common in European countries such as the Netherlands, Sweden and Norway where they are quarantined to stop their spread to other potato growing areas. In Africa, the PCN pest has been reported in North African countries of Morocco, Libya, Tunisia and Algeria where they are also confined through quarantines to stop their spread. The pest has also been reported in Senegal in West Africa and South Africa where it is quarantined.

In the last 15 years, Kenya has been importing potatoes in form of tubers mainly from the Netherlands despite a provision in Seeds and Varieties Act Cap 325 that prohibits importation of seed tubers except in form of *in vitro* plantlets – these can only be imported and stored in

Kenya Plant Health Inspectorate Services quarantine station until they are tested and found to be free of diseases and pests. This provision was removed in 2014 to allow importation of potato tubers.

When *The Organic Farmer* broke the story of the presence of PCN in the country last year, the Ministry of Agriculture Livestock and Fisheries took soil samples in all parts of the country where it established that the pest had spread to all potato growing areas. Even after establishing the presence of the pest in the country, the government is yet to take measures to stop its spread. The pest can remain in the soil for up to 30 years, meaning that no crop in the potato family can be grown in the infested fields.

Scientists at the Kenya Agricultural and Livestock Research Organization (KALRO) say the invasion of PCN in the country could lead to a serious potato crisis because of the sharing of potato seeds among farmers. About 99% of potato seed used in the country is uncertified, meaning that potato farmers source most of their seeds from other farmers or uncertified sources. When such seed is infested with PCN and other diseases, it easily spreads to uninfested fields.

Dear farmers,

Last year, TOF informed farmers of the presence of Potato Cyst Nematode (PCN) in Nyandarua County. This problem may lead to Kenya's potato subsector facing a crisis that would be difficult to resolve if not addressed urgently. PCN is a type of round-worm that affects crops like potatoes and tomatoes. It is a quarantine pest, meaning that wherever it is discovered in the world, governments immediately restrict potato movement from the affected areas into the other parts of the country. PCN is a serious pest and potato farming is usually banned in infested areas to stop its spread, otherwise it can wipe out a whole crop.

Last year the Ministry of Agriculture Livestock and Fisheries through their extension services took soil samples in potato growing areas across the country and established that the pest had spread to potato growing areas through the exchange of potato seeds by farmers. Wherever PCN is reported, investigations are conducted immediately to determine the extent of and severity of its spread and impact of the pest in the infested areas. Thereafter, measures are put in place to contain its spread.

It is also necessary to start training and creation of awareness amongst potato farmers through the extension services especially on early detection and management of the pest. Potato is the second most important crop after maize. It is, therefore a very important crop in the country's food security. One can only imagine what will happen if the pest is not managed on time and pest free areas identified. East Africa is now a free trade zone where agricultural produce can be traded freely. This means that infested potatoes may also find their way into Tanzania, Uganda and Rwanda, Burundi and even Southern Sudan.

Last year a consortium of stakeholders in the potato subsector came up with a budget of Ksh 18 million to be used in carrying out a scientific survey to determine the spread of the pest in the country, but so far the government has not been able to provide these funds to undertake the survey.

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Ways to control soil erosion and conserve water

The long rains have already started. Due to land preparation, run-off water may sweep away the loose top soil, taking with it fertilizers and the best soil that plants require for proper growth. Farmers should therefore take measures to stop the loss of soil and nutrients before and after planting.

Belinda Weya | Soil and water conservation practices are very important to farmers so as to make the best use of rainfall. These practices include:

1. Controlling soil erosion
2. Harvesting rain water
3. Minimizing soil disturbance

1. Controlling soil erosion

Soil erosion is the removal of soil particles and organic matter from a given site by the action of water or wind. Soil erosion reduces crop yields due to loss of plant nutrients, reduction of soil's water holding capacity and degradation of soil structure. The practices that help to reduce or prevent soil erosion include:

Covering the soil as much as possible

A good cover crop is low and fast growing thus covering the soil very fast. It is also drought tolerant, fixes nitrogen and has deep root system. A cover crop can be planted at the same time with the main crop (intercropped), planted at an advanced stage of the main crop (relay) or it can be planted after the main crop has been harvested (crop rotation). Examples of cover crops are beans, cowpeas, pigeon peas, lablab and velvet beans (mucuna).

Mulching

Mulching involves covering the soil with dry plant materials such as pruning material from trees, cuttings from hedges, weeds and crop residues such



A well-terraced farm: Good soil conservation practices increase soil fertility and productivity in a farm.



as straw. Dry mulch prevents the soil from being washed away by rain and reduces loss of water through evaporation, thus retaining soil moisture. However, any plant material infected with viral and fungal diseases should not be used as mulch.

Important soil conservation methods

It is important for farmers to invest in building conservation structures to either stop the movement of rainwater or reduce its speed. These structures allow rainwater to soak into the soil and also control soil erosion by intercepting any moving soil. Such structures include:

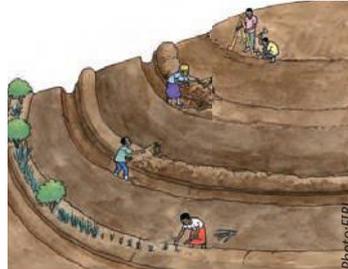
(a) Grass strips

Strips of grass are planted along the contours. Grass strips are planted with fodder grass such as Napier or are left to grow with natural grass.



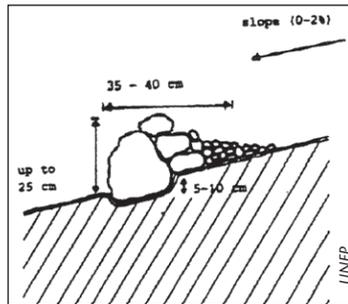
(b) Terraces

Crop residues and other bulky plant materials are laid along the contours. They slow down runoff and trap eroded soil, eventually forming terraces.



(c) Stone lines

Stones are collected and aligned as rows along the contours. The stone lines slow the flow of water across the farm.



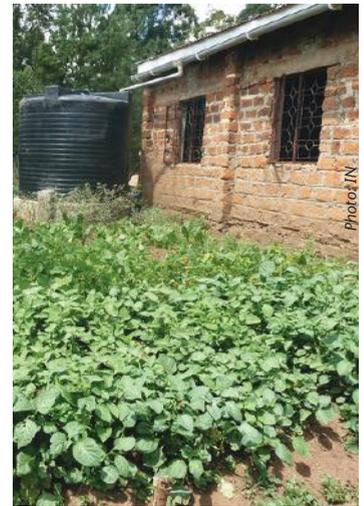
(d) Contour ridges

Trenches are dug along the contours and the soil is thrown uphill or downhill along the trenches to build ridges.



2. Harvesting rain water

Rainwater can be harvested by planting crops in water retaining pits such as zai planting pits and tumbukiza. In addition, rain water runoff can be harvested from roads and stored for later use.



Minimizing soil disturbance

It has been established that over cultivation of soil is harmful. This is because it leads to an increase in soil erosion and increase in loss of nutrients through decomposition of organic matter. To reduce or prevent erosion, it is recommended that there should be minimum disturbance of soil. This can be achieved through minimum tillage.

Zero tillage where seeds are planted without seedbed preparation, or minimum tillage where soil is ripped only where necessary, most of the land is left untouched.

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

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Farmers raise alarm on falling potato production

Despite using clean seed, more fertilizers and improved potato management, farmers in Nyandarua county say potato yields are going down, raising fears of the spread of Potato Cyst Nematode (PCN), a devastating pest that can wipe an entire potato crop.

Peter Kamau | For 40 years, Danson Gitau, a farmer in Kahuho village in Karati, Nyandarua County successfully produced potatoes and managed to get very good yields. Like many farmers in his village, potatoes have been his main source of income. In the last five years, however, potato yields from his 4 acre farm have been so low that he is considering abandoning the crop for another option.

"I have tried to increase the amount of fertilizer and even compost but the yields are still going down and there has not been any improvement. I know it is not the rains because we usually have good rains," he says.

Declining yields

Gitau says that before the problem started about five years ago, he could harvest up to 20 bags in a ¼ acre of land. But in the last few years since, his potatoes have been stunted, some with yellow or wilted leaves. Eventually the potatoes develop very small tubers or none at all. "I think there is some type of bacteria in the soil because the potatoes do not show signs of other diseases such as bacterial wilt, which we have managed to control before through crop rotation," he adds.

His neighbour, Mweha Githakwa has the same story. He



Comparison: Johnson Mwaura tends a healthy potato crop in August 2006 (Left). Mwaura works on the same potato plot last month (Right). Farmers in Nyandarua are baffled by declining potato yields. However, scientists have identified Potato Cyst Nematodes (PCN) in many farms in the area.

used to grow 6 acres of potatoes which would give him between 60 and 80 bags of potatoes per acre. Now he can hardly harvest 20 bags in the same fields.

"Last season I got only 15 bags which I want to sell as seed. Potatoes have been our cash crop since Kenya's independence. Now we do not know what to grow because the only other crop that does well here is cabbages whose price is very low in the market," he adds.

Joseph Mwangi, another farmer in the same village has also noted a drastic reduction in potato yields in the last five years. Before that, he says he could harvest as many as 40 bags an acre, but now he may harvest about 15 bags.

"People say it is climate change but even those using irrigation are complaining. I think there must be a problem in the soil which only the government can investigate and give us a solution. Otherwise it is just a waste of money to grow potatoes again," he says.

Samuel Mungara, a farmer in Passenga in Nyandarua County has had a similar experience with potatoes. "When I consider the losses I have incurred in potato production, I am really disappointed. I should have bought dairy cows and gone into dairy farming on a full time basis," he laments.

Mungara says he has been growing potatoes for the last 8 years but the yields have been going down every year despite improved potato management.

Joseph Mwaura, a farmer in Murungaru blames it on potato overcultivation. He suggests

that the problem could be 'tired' soil and advises farmers to come together and ask the government to test the soils, and advise on the type of fertilizers they should use. The same potato yield loss problems are narrated by many farmers in Ndaragwa, Njabini, Magumu, Munyaka Ndunyu Njeru, Engineer and Ol Kalou in central Kenya.

Potato pest a mystery

Potatoe production in the country is affected by diseases and pests. But farmers are usually able to control them through crop rotation and other good management practices. However, the current drop in potato yields in many farms has baffled them.

Two years ago, James Mwangi, a Kenyatta University student who was doing research on nematodes in Nyandarua County came across the Potato Cyst Nematode (PCN). TOF published an article on the invasion of the PCN pest in Kenya (*TOF No.117, February 2015*). Investigations later revealed that scientists at the Kenya Plant Health Inspectorate Service (KEPHIS) and KARI (now KALRO) had established the presence of the pest in the country 11 years ago in Nyandarua and passed on the information to the government. However no serious action was taken to contain it.

After the story of the PCN invasion was published last year, the government carried out a passive survey where it was established that the pest had spread to all potato growing areas. There is no evidence of government measures to contain the pest.

What is Potato Cyst Nematode (PCN)?

Nematodes are tiny, thin worms that live in the soil. They cannot be seen with the naked eye unless when placed against light. They are usually one millimetre in length and are cylindrical in nature (like an earthworm).

The potato cyst nematode is indigenous to Peru, South America but it has spread to other parts of the world such as Europe where potatoes have been cultivated for thousands of years. In Europe PCN cannot spread because of strict quarantine measures that have confined it to particular regions. In Africa, PCN nematodes have been identified in Northern Africa countries such as Morocco, Algeria, Tunisia, Libya and Egypt. It has also been identified in Sierra Leone in West Africa and South Africa.

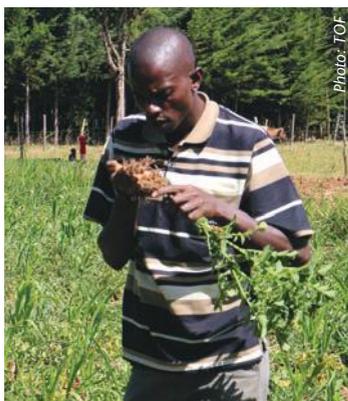
How can farmers identify PCN?

It is not easy for farmers to identify Potato Cyst Nematodes in the potato farms. Potatoes infested by the nematode show similar symptoms as those affected by other pests and diseases such as stunted growth, yellow or wilted leaves. The potato tubers are very small, while others do not put in any tubers at all.

How can farmers control PCN?

At the moment, there is no known chemical or biological pesticide that can control PCN. In affected regions, the

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Researcher James Mwangi checks a potato plant for the PCN pest in Tumaini, Nyandarua County.

Take good care of seedlings to grow into maturity

Young seedlings of trees or vegetables need great care to ensure they grow into strong and healthy trees and crops.

Continuous nurturing and good management is necessary for proper growth.

Joyce Wambui | The rainy season has started and is a good time to grow different crops and trees. The first step in successful trees and vegetable production is to raise healthy vigorous seedlings. This means that if a farmer is to get high yields and more returns from their trees and vegetables, proper care of seedlings must be done. This is also important in preventing crop failure.

Young plants need a lot of care particularly during the early stages of growth. They have to be protected from unfavourable temperatures, heavy rains, drought, wind, pests and diseases. When small-seeded vegetables are sown directly in the field, germination is not often guaranteed and the young plants grow very slowly and take a long time to mature. The season can also be too short for full development in the field.

To overcome these problems many trees and vegetable seedlings can either be bought or grown in nurseries before being transplanted in the field. Seedlings have the best chance of survival when planted soon after purchase.

Storage

Storage of seeds before planting affects the performance of seedlings. It is important for the farmer to store newly purchased seeds in a cool dark area.

If your seedlings especially tree seedlings are stored for more than a few days, open the bag and dampen the roots periodically. Do not soak or leave the roots submerged in water while the seedlings are in storage. For vegetable seedlings, keep them moist but not soggy. Seedlings need moisture, so it is important they do not dry out.

When to plant

Plant seedlings as soon as possible, preferably at the beginning of the rainy season. This period is often ideal because soil moisture is very high. Farmers can expect a certain amount of losses through drying up,

although this will depend a great deal on how carefully they are planted and weather conditions during the early period of transplant shock.

Where to plant

Like trees and shrubs, vegetables also have soil and light requirements that must be considered when selecting where they will be planted. They grow well if planted in locations with enough sunlight and in soils that have good drainage and enough top soil.

Seedling management

Watering

The seedbed or seed box should be watered carefully with a fine stream of water. After the plants are well established, watering should be done thoroughly but not too often. It is advisable to irrigate seedlings in the morning, not in the afternoon as this leaves the soil surface moist overnight, a condition favouring damping off condition.

Shading

Shading should be done to protect the young seedlings from high heat intensity in sunny areas and also from heavy rain. Shade can be provided by polythene nets or even grass. The shade should be removed some days before transplanting to allow the seedlings to acclimatize to field conditions.

Thinning

This is a way of regulating plant density in rows and in holes. During thinning, weak, diseased plants are pulled out to allow healthy seedlings to grow well. It is normally done when seedlings have formed a few true leaves.

Insect pest and disease control

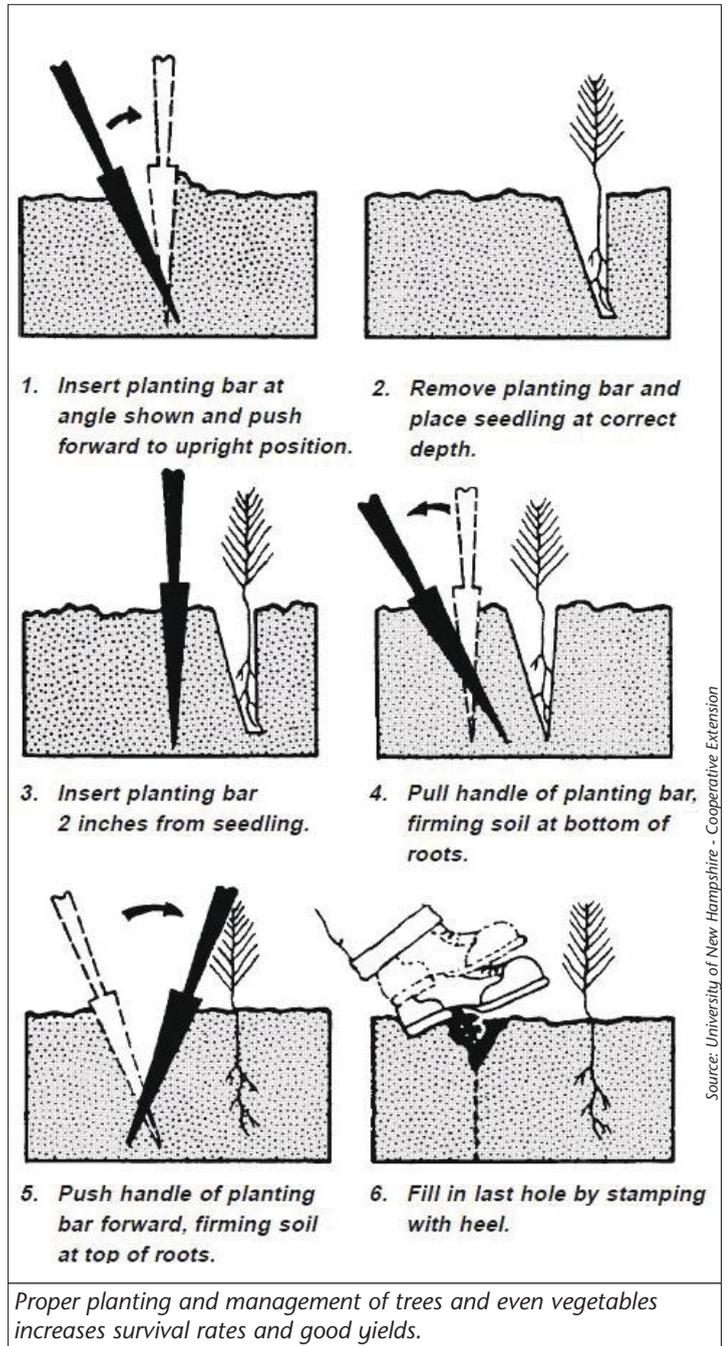
This is a continuous process from seedling emergence to transplanting. It is normally done by physical means but organic control methods like use of ash can also be used.

Weeding

This is done by pulling out any unwanted weeds by hand.

Hardening-off

Transplants must be 'hardened-off' so that they can withstand the change from a relatively sheltered and protected environment to a sometimes harsh open situation.



Source: University of New Hampshire - Cooperative Extension

Generally, hardening is done from about 1 to 2 weeks before transplanting seedlings, hardening is achieved by gradually exposing them to higher (or lower) temperature and the higher light intensity prevailing in the field.

It should, however, not involve any treatment that may reduce the rate of photosynthesis, such as nutrient stress. Care should be taken not to overharden plants, as this may delay maturity and in some instances even reduce crop yields.

Transplanting

This refers to the act of lifting the seedlings from the seedbeds or containers and transferring them to the field where the

actual planting is desired. When transplanting, one should aim to interrupt growth as little as possible- if this is not done properly it can severely delay growth or in extreme cases cause death of transplants. Most vegetable seedlings are ready to be moved 4-8 weeks after sowing.

It normally takes four weeks for tomato, cabbage, broccoli, watermelon, kales and spinach seedlings to be ready for transplanting. Onions take about five weeks while hot and sweet peppers take seven weeks.

For additional information farmers can contact KEFRI. Call Lugadiru 0708478705

Watermelon: A popular fruit with many health benefits

Apart from quenching thirst, watermelon has many compounds and vitamins that maintain the body's health and vitality. It prevents many diseases that are associated with modern lifestyles.

Dr. Peter Mokaya | Along with cantaloupe and honeydew, watermelon is a member of the Cucurbit family like cucumber or squash pumpkins. Watermelon is a much loved fruit by both adults and children. It grows on long vines and rests on the ground while they mature. Often oblong and light green in color, watermelon can also be round, spotted, or striped with white bands running from end to end.

To produce fruit, watermelons need to be pollinated by honeybees – even the sterile, seedless watermelon. The vines alone can grow six to eight feet in a month, producing the first watermelon within 60 days. Mature watermelons grown in warm, sunny climates are usually ready for harvest in about three months. Watermelon stores very well at room temperature, but should be refrigerated after cutting. An amazing fact about watermelons is that its antioxidants, flavonoids, and lycopene content can remain for as long as seven days after cutting.

What are the health benefits of watermelon?

The health benefits include the following:

- Watermelon contains a large amount of vitamin C – 21% of the daily recommended value. This helps your immune system produce antibodies to fight disease.
- It also contains 17% daily value of vitamin A, which boosts eye health and prevents eye diseases like macular degeneration and cataracts. It contains vitamin B6 that helps form red blood cells and enables nerves to function as they should. Your body uses vitamin B6 to help break down proteins, so the more protein is consumed the more vitamin B6 is needed.
- Watermelon has potassium, although in relatively small amounts. This helps balance fluids in your cells. Low potassium levels sometimes cause muscle cramps.
- Watermelon contains citrulline, which converts in the kidneys to arginine, an amino acid that helps in maintaining good heart health and immune system. The more this conversion takes place, the less fat accumulates in the cells, helping to keep obesity and type 2 diabetes. Arginine also removes ammonia and other poisonous compounds from your body.
- Watermelon contains an antioxidant lycopene which is found in very high amounts in the fruit; it has even more than that found in tomatoes, pink grapefruit, and guavas.

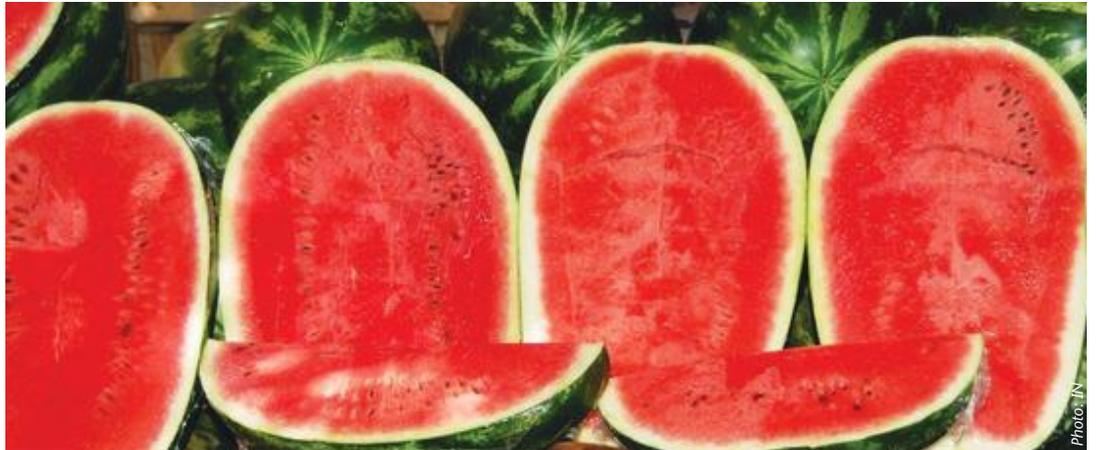


Photo: IN

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The red colour of watermelon is from its high lycopene content as opposed to most other fruits, like pink grapefruit, guavas and tomato, which get their reddish color from anthocyanin flavonoids.

- Many studies have shown that increasing consumption of plant foods like watermelon decreases the risk of obesity and overall mortality, diabetes, heart diseases, and promotes a healthy complexion and hair, increased energy, overall lower weight.

Asthma prevention: The risks for developing asthma are lower in people who consume a high amount of certain nutrients. One of these nutrients is vitamin C, found in many fruits and vegetables including watermelon.

Blood pressure: A study published by the American Journal of Hypertension found that watermelon extract supplements reduced blood pressure in obese middle-aged adults with prehypertension or stage I hypertension. The watermelon extract improved arterial function.

Cancer: As an excellent source of the strong antioxidant vitamin C as well as other antioxidants, watermelon can help prevent the formation of free radicals that cause cancer. Lycopene intake has been linked to a decreased risk of prostate cancer prevention.

Digestion and regularity: Because of its water and fibre content, watermelon, helps prevent constipation and promotes regularity for a healthy digestive tract.

Hydration: The fruit is made up of 92% water. It also has important electrolytes (like sodium and potassium), and therefore makes a great snack during the hot dry months – when you sweat a lot you can

easily become dehydrated and lose electrolytes. Watermelon helps prevent dehydration. It also improves satisfaction and prevents one from overeating.

Inflammation: Choline is a very important nutrient in watermelon that aids our bodies in sleep, muscle movement, learning and memory. Choline also helps to maintain the structure of cell membranes, aids in the transmission of nerve impulses, assists in the absorption of fat and reduces chronic inflammation.

Muscle soreness: Watermelon and its juice have been shown to reduce muscle soreness and improve recovery time following exercise in athletes. Researchers believe this is likely to do with the amino acid L-citrulline contained in watermelon.

Skin: Watermelon is also great for your skin because it contains vitamin A, a nutrient required for sebum production that keeps hair moisturized. Vitamin A is also necessary for the growth of all bodily tissues, including skin and hair.

Hair: Watermelon also contributes to overall hydration, which is vital for having healthy looking skin and hair.

Other benefits of watermelon

More than 8% of watermelon is composed of lycopene, a compound that protects and nourishes your heart, prostate and skin.

Lycopene discourages inflammation and may also be important for maintaining strong healthy bones.

For more information contact the article author: Dr. Peter Mokaya, is the Director and CEO, Organic Consumers Alliance(OCA), Website: www.organicconsumers.co.ke Email: Peter.Mokaya@organicconsumers.co.ke or Mokaypm@gmail.com



Photo: IN

Farmers' group manages to bypass middlemen

Usually, brokers buy bananas from farmers at about Ksh150 a bunch. Now a group of farmers in Kirinyanga County is selling a bunch of bananas at Ksh300 to a buyer from Nairobi. They have plans to do value addition by making banana flour to improve their earnings.

Peter Kamau For many years, members of Kiamuriga Banana Self-Help Group in Kirinyanga County had relied on middlemen to sell their bananas. But the prices offered by the brokers were very low, discouraging many members from growing bananas or tending them. But 2 years ago, the group's earnings improved when they found a way of selling bananas directly to a buyer from Nairobi.



Grace Muthoni shows off a bunch of bananas from her farm.

"The buyer gives us an order



Kiamuriga Farmers Group members sell their bananas at one of the members farms.

with the number and quality of bananas needed every month. Then we inform our members who deliver the bananas on the agreed day. The bananas are weighed and each of the members paid according to the bananas they have delivered," says Mr. Elijah Karari, the group's chairman.

Middlemen attempt to sabotage group

Other farmers' groups learnt about the marketing arrangement, and requested to join Kiamuriga group. Individual farmers too have realized the benefit of direct marketing and have been selling their produce

to the buyer. This has enabled the group to meet the orders placed by the buyer every month.

Despite their achievements, all has not been easy for Kiamuriga Self-Help Group. When brokers realized they had been bypassed through the direct selling to the buyer, they started inciting some farmers within the group: "They have tried every trick to stop us from this arrangement mainly through incitement of farmers within the group and even non-members. The middlemen even hiked banana prices in order to drive the buyer out of the market but the farmers refused to sell to them. Now we are earning more through direct

sales and we can no longer sell to brokers," adds Karari.

Farmers earn more

Karari says that in the last few months, the buyer has been paying Ksh 300 for every bunch of bananas they sell to him but the brokers pay Ksh 150 for the same. "I do not think any farmer around here would go back to sell to brokers," he adds.

All farmers who are non-members of Kiamuriga group have to pay Ksh1 for every kilogram of bananas they sell through the group. The farmers meet every third Thursday of the month to plan for the next market day which takes place every first Tuesday of the month.

Value addition

The group plans to buy a solar drier to dry bananas and make banana flour as one way of adding value and increasing their earnings. Members also attend regular training offered by Peter Murage, the Biovision extension officer for the region on banana management to improve the productivity of their banana orchards. The training has had a big impact on banana yields. Through the training the farmers have managed to increase banana yields. Every month, they sell 7 tonnes of bananas up from 3 tonnes produced at the beginning of the project. ■

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PCN pest (*Globodera rostochiensis*) in a potato root system.

most effective method is to ensure that no potatoes from the affected areas are transported or sold in the market both as ware (commercial potatoes for the sale) or as seed. This restriction is called quarantine. Farmers in affected regions are not allowed to grow potatoes but are instead encouraged to grow other crops that are not in the potato family.

Other measures that farmers can take include:

- Using certified potato seed at all times.
- Using quality declared seed from known or certified potato seed producers.
- Avoiding seeds bought from other farmers or those from unknown sources.

- All farmers where the PCN is discovered should stop potato production for up to 7 years. The pest can remain in the soil for up to 30 years – However, land remaining free of potatoes or other crops in the potato family for 7 years has less infestation of PCN.
- Farmers are also encouraged to practice crop rotation at all times to help reduce the population of PCN in their farms.
- Affected land can also be left to remain fallow for 7 years (where possible - however this may not work for many small-holder farmers in Kenya because land sizes are very small since they need the land to grow other food crops).
- Resistant potato varieties can be developed - this requires many years of research to come up with such local varieties.

Potato imports to blame for pest

Kenya can only produce only 1 per cent of potato seed required in the country. As a result, foreign companies mainly from the Netherlands and other European countries have been involved in importation of whole potato tubers for the last 15 years against phytosanitary laws. Farmers have however rejected these varieties and prefer local varieties such as *Shangi* which has an 80 per cent demand.

Our investigations have established that the pest has now spread to all government basic seed production and multiplication sites.

During the recent restructuring of KALRO, experienced scientists involved in potato seed production were transferred leaving the KALRO basic seed production unit at Tigoni understaffed and with little capacity to produce seed.

How to use lime to correct soil acidity

TOF is often encouraging farmers to use lime, but I have not found a comprehensive article about it. I have listed a few questions below, which could help address some farmers' concerns. Lime is expensive, and I trust that gaining more information about its use would encourage small scale-farmers to invest in it.

1. What is the difference between agricultural and conventional lime?
2. How and when should it be applied?
3. Should it be mixed with compost? Applied before or after compost?
4. Should it be applied on top or below mulch?
5. What quantity should be applied per acre depending on acidity?
6. Should the land be ripped before or after if we suspect hardpan?
7. Is it a must to repeat lime application after 3 years, even with no-till?

Also, I am struggling to find affordable lime in Trans Nzoia, which is surprising, considering the general acidity of soils in the area (mine is between 4 and 4.5), and the number of small scale farmers who could benefit from it. Any advice where and how to buy cheap agricultural lime?

Can I use powder gathered from a nearby limestone factory?

Your concerns on lime are legitimate. Many farmers do not know the importance of lime, how to use it and even where they can buy it. Agricultural lime is obtained from crushed limestone, an organic sedimentary

rock made of calcium carbonate. The carbonate is formed when dead microscopic living organisms such as corals, shells and algae combine and form a rock after millions of years.

Hydrated lime is formed when calcium is heated in a kiln to a temperature of 825°C making to break down in a process known as calcination. The resulting product is either quicklime (calcium oxide) or hydrated lime (calcium hydroxide) depending on how much



water is added and the chemical purity of the product.

Agricultural lime on the other hand is made through crushing of the limestone rock and purifying it to a level where the end product is pure calcium carbonate. Agricultural lime is often sold as powder or in granule form.

The main use of agricultural lime is to reduce soil acidity in farms where intensive use of chemical fertilizers has led to high levels of soil acidity (where soil pH is low).

Test the soil first

Farmers are, however, advised not to apply agricultural lime until they have tested their soils. One reason for testing is

to know the level of soil acidity depending on the type of crops to be grown (the farmer has to consult a soil scientist to know the pH level of the soil and if it is suitable for the crop the farmer wants to grow).

You can mix lime with compost if it is available. Compost enriches your soil while also improving its structure and makes it lighter while adding the much needed organic matter.

Application

Lime should be applied at least 3 months before planting of crops that require rows (like maize, wheat and beans) and 6 months before the planting of forage crops such as pasture grasses - this gives the lime the time required to neutralize acidity in the affected soil. A rate of 80kg of agricultural lime is recommended for 1 acre of land where the farmer intends to do uniform application.

How to apply lime

It is advisable to work the lime into the soil at all times. The contact between lime and the soil helps to maximize the effectiveness of the liming material since the soil absorbs lime at the rate of 1 inch per year. On the soil surface lime can be easily washed away especially during heavy rains.

Lime powder or granulated lime?

Lime applied as dust is difficult to get into the soil as it can be easily carried away by wind or run-off water. Farmers are therefore advised to buy granulated lime where possible.

Granulated lime has been found to be more effective in correcting soil acidity.

There are three types of agricultural lime in the market. These are:

Ordinary agricultural lime: Ordinary agricultural lime contains 91% calcium carbonate and 2% magnesium carbonate.

Magmax: Magmax lime has a high level of magnesium compared to calcium (56% magnesium carbonate and 40% calcium carbonate).

Dolomite: Dolomitic agricultural lime has high levels of calcium compared to magnesium (62% calcium and 32% magnesium).

Only a soil scientist using the results of a soil test can advise



which of these types of agricultural lime a farmer requires.

Farmers can buy granulated lime from Lachlan (K) Ltd Tel. 0721 409 201 located at Sunflag Park along Mombasa road. The company can supply lime to farmers anywhere in East Africa or Athi River Mining Co. Ltd, Tel. 0731 028 062, 0722 843 546.

Farming Tip

Avoid use of harmful chemicals in crop protection

As farmers approach the important phase of managing various crops that they have planted this year, many will rush to agrovet shops to buy various chemicals to control weeds, pests and diseases. Many of these chemicals have short and long term side effects that not only affect farmers themselves but also consumers of the crops. Indeed some of the chemicals farmers use in Kenya are banned in many countries but they somehow still find their way into Kenya due to weaknesses within regulatory bodies such as Pest Control Products Board. Apart from



harm to consumers, most of the chemicals kill beneficial insects in

the farms, which control harmful pests. Insects such as bees die in large numbers when foraging in fields where chemicals are used to control weeds, pests and diseases. Bees offer free pollination services to farmers; indeed research shows that bees can increase yields in crops such as beans, peas, French beans, lablab and even green grams by up to 30 per cent. Farmers should only use biopesticides and other environmentally friendly methods instead of chemicals to produce healthy food and protect our environment.



tary rock made of calcium carbonate. The carbonate is formed when dead microscopic living organisms such as corals, shells and algae combine and form a rock after millions of years.

Agricultural and masonry lime

The rock is crushed into powder to form lime. Agricultural lime

TOF Radio answers your questions

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

Improved green grams hold hope for farmers

Musdalafa Lyaga | For a very long time, farmers have been complaining of the rapid reduction in green grams yields. But now a group of farmers is smiling all the way to the bank. Research institutes like KALRO have been working tirelessly to ensure farmers have green gram varieties with much higher yields than the local green gram varieties.

Indigenous green grams have small seeds with the plants maturing at different times. Most of the time they mature late. Consumers complain that such varieties have a lot of stony seeds which makes a green gram meal difficult to eat.

The improved variety K26

On the other hand, the improved KALRO variety has large seeds that gives high yields with the plants ripening at the same time. K26 variety also matures early and does well in dry areas. Currently, a bag of green grams goes for Kshs.9,000. The seeds are available at any KALRO office. Farmers need to contact KALRO station near them.

Land preparation and planting

Prepare land early enough so that planting can start when the rains begin. Green grams can be planted alone or intercropped with other crops like maize.

When planted alone, sow at 1½ ft between rows and ½ ft between plants. One acre of land will require 2 to 4 gorogoros (4 to 8 kg) of seed for planting.

Weeding

The first weeding should be



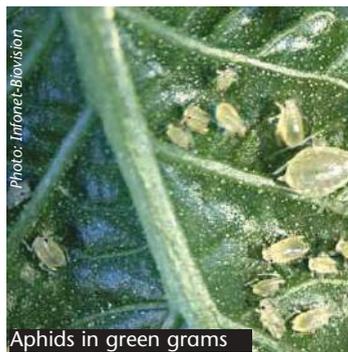
done 3 weeks after the seeds have emerged followed by the second weeding 6 weeks later.

Pests and diseases

Insect pests that attack green



Powdery mildew



Aphids in green grams



grams are bean aphids, bean fly and bruchid weevils. They can be controlled by planting early and practicing crop rotation.

The main disease that affects green gram is powdery mildew. You can detect it when you see whitish growth under the leaves.

This can be controlled by using certified seed and practicing crop rotation.

Harvesting

Harvest green grams when most of the pods have turned black. You can pick and dry individual pods or uproot the whole plant and dry it for about 2 days, then thresh and clean it.

Storage

You must dry green grams well



Hay: Boma Rhodes at Ksh 300 and barley hay at Ksh 200. Within Nairobi and Kiambu counties. Contact Peter on 0721 629 913.

Friesian and Ayrshire heifers: In Ol Kalao, Nyandarua. Contact 0732 744 284.

Tractors and implements for hire: We have tractors, and farm machinery for hire. We are one of the largest suppliers of hire tractors and machinery in Kenya. We have a couple of powerful tractors available for hire for any kind of task. We provide our customers with the most reliable equipment and a nationwide service network. For agricultural machinery we have trailers, seed drills, fertilizer spreaders, harrows, ploughs and sprayers. We offer very good rates and discounts for short and long time hire for up to 3 years. Long term is a cost effective way of running a tractor and farm equipment, rather than buying one and we can advise on the best options for you and your business. We stock a vast range of parts for all makes of tractor directly from the UK. Contact us on 0722 848 520.

before storing because bruchid weevils attack the stored grain. It is best to store the grain in covered tins, drums, pots or sealed containers. If you store it in bags, add the ash of neem leaves.

Yields

Average yields range from 1 to 2 bags (90 -180 kg) per acre. If you follow the above steps you can get up to 4 bags (360 kg) per acre. The stalk is good livestock feed.

Apart from planting high yielding varieties of green grams, farmers can increase the productivity of their green gram beans and other legumes by keeping bees in the farms. According to research, total yields in crops can increase by up to 30 per cent through pollination by bees. Avoid the use of chemicals if you want to benefit from pollination services from bees.

See Farming Tip on Page 7

Where to get the seed

Seeds can be obtained from Kenya Seed Company, KALRO Katumani P.O Box 340 Machakos, KALRO Kitale P.O Box 450 Kitale contact your local extension officer.

Source: KALRO

Green grams varieties and their characteristics

Variety	Maturity (days)	Potential (Bags/Ha)	Remarks
KUR 22	80 - 90	11 - 14	<ul style="list-style-type: none"> Seed colour golden yellow, tolerant to aphids Resistant to yellow mosaic Performs poorly due to late maturity
N26 (Nylon)	60 - 65	14 - 17	<ul style="list-style-type: none"> Light (Nylon) green in colour It performs well in drier areas due to early maturity