



Photo: MLN project, ICIPE

The outbreak of The Maize Lethal Necrosis disease has led to an increase in other fungal diseases and pests that have reduced farmers maize yields in all maize growing areas of the country.

Maize disease a big threat to food security

TOF - Since we reported the outbreak of the Maize Lethal Necrosis (MLN) disease two years ago, the disease seems to have spread to all parts of the country bringing huge losses to farmers in almost all maize growing areas.

Increased infections

A survey of Uasin Gishu and Trans-Nzoia Counties early in September showed that there

has also been an outbreak of other diseases in the two maize growing regions.

During the survey, ICIPE scientists together with *The Organic Farmer* found that many farms with maize affected by MLN also had other diseases such as cob rot, Grey Leaf Spot (GLS) and Maize Streak Virus (MSV).



a nationwide survey to establish the magnitude of the disease and the diversity of single pests that transmit it.

Need to improve maize seed quality

Strict controls are needed to ensure companies producing and selling seed do so within the established procedures and standards. According to current seed production guidelines, the Kenya Plant Health Inspection Service (KEPHIS) allows seeds in farms with at least 10 per cent MLN infection to be used as seed. According to a number of studies already conducted, such seed has the potential to transfer the disease to new areas. We will feature this problem in more detail in one of our next issues.

Training farmers

In Trans-Nzoia County, the Ministry of Agriculture, Livestock and Fisheries has set up 13 Plant Health clinics in the county where farmers can take samples of diseased plants for diagnosis and advice. Farmers are being trained on how to control the disease. Among the control measures is the recommendation to plant early and practise crop rotation.

The government through the Ministry of Agriculture, Livestock and Fisheries, KEPHIS, KARI, ICIPE and the University of Nairobi, with support from the World Bank, is carrying out

Dear farmers,

The harvesting season is here with us again and as usual, farmers are preparing to harvest maize. As TOF has cautioned many times before, it is always wise to harvest your maize early enough and store it well to avoid losses that come with late harvesting. Many farmers have heeded this advice and have saved a large proportion of their maize that would have gone to waste through rotting and pest infestation.

However, there are, some farmers who have stuck to the old tradition of harvesting too late, sometimes in late November or December, in order to get help from their children during school holidays. Such farmers often lose a lot of their crop, thus reducing their profit and food that could have been saved for their families. Maize that is planted in March and April is usually ready for harvesting in September and October, just before start of the short rains. If the maize stays longer than this, it rots and attracts pests.

Proper maize storage is also important. Farmers should invest in good stores where they can stock up their maize until they can sell it profitably. While many farmers prefer to sell their maize immediately after harvesting, to avoid storage costs, unfortunately the market prices at this time are usually very low because everyone is selling at the same time.

Dairy farming is becoming a very good venture for small-scale farmers. Market prices for most of the food crops fluctuate every day, making them very unreliable sources of income for all farmers. This is one reason many farmers are going into dairy farming where they are assured of a stable source of income.

But farmers have to practice dairy farming the right way to get maximum benefits from their investment. They need to house, feed and take care of their animals in the right way to make them more productive. In the next three months we will show farmers how to practice dairy farming in the right way to be successful (page 5).

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Harvest early and store your maize well

Farmers in Africa lose 15 to 40 per cent of their maize harvest due to late harvesting and poor storage of the grain. They can easily reduce these losses if they harvest their produce on time and store it properly.

Peter Kamau | Moses Kipchumba, a farmer in Eldoret, has a 6-acre farm in Moiben, Uasin Gishu County. Every year, he harvests less than 50 bags of maize from the farm. Last year, he counted the number of bags of rotten maize in his *shamba* and discovered that more than 60 bags had been spoilt due to rotting. As is the practice in his area, he kept it as animal feed.

“From this experience, I have decided to be harvesting my maize early to prevent the huge losses I incur from rotting,” he says.

Moses is not alone. Most Kenyan farmers lose a large portion of their maize due to late harvesting. The spoilt maize is later used in animal feed while in some communities, it is used in making traditional brews locally known as *'busaa'*. This exposes consumers of such brews to the dangers of aflatoxin poisoning resulting from mycotoxins that develop in rotten maize.

This year the situation may not improve if farmers harvest late. According to a survey done by *The Organic Farmer* in maize growing areas in Uasin Gishu and Trans-Nzoia counties in early September, most of the maize was ready for harvest but many farmers had not started harvesting.

Diseases compound problem

To worsen matters, a lot of the maize from the two regions is affected by fusarium ear rot and the Maize Lethal Necrosis Disease (MLND).

Storage is the other big challenge for farmers. Most farms do not have stores where the grain



The maize shown above has almost 50 per cent damage due to late harvesting and poor storage. Farmers should always ensure maize is harvested early and stored in good sheds.

can be kept. Those that do have, maintain poorly ventilated stores which are unsuitable for storing grain, and this hinders proper drying of the maize and exposes it to pests and weather damage. Farmers can take the following measures to prevent loss from the dangers mentioned above:

Harvesting early: Maize should be harvested as soon as it matures and dries. This prevents the grains from rain water and pests. Maize should be harvested immediately it reaches physiological maturity (when the silk at the top of maize cob turns black), the maize can then be dried to 13 per cent moisture level and stored. Dry the grain in the sun and while testing the moisture until it attains at least 13 per cent moisture- no aflatoxins can develop at this moisture level.

Use a good store: A good store should have 40-50 per cent open space for the maize to dry properly when stored (use wire mesh to cover at least half of the sides of the store to allow air circulation, not timber offcuts). The floor of the store should be raised 60 -90 cm above the ground to allow for air circulation from below. Use iron sheets for roofing as grass and wood are favored by the Larger Grain Borer (LGB). Clean the store well before storage since weevils from maize stored in the previous season may hide in cracks in the wood in the store. All empty maize sacks, synthetic or sisal sacks should be disinfected to kill any pests or their

eggs.

Sort all the maize to remove rotten cobs or broken grains. Do not keep the maize in cobs for long - shell and store the maize in gunny bags as soon as it dries well.

Treat maize before storage: As a further precaution during storage, maize should be protected from weevils during storage. One method farmers can use is ash/chilli mixture in a thick layer of rice bran mixture. The chilli should be dried and pounded into fine powder. Sieve cold wood ash from the fireplace. Mix 2kg of wood ash with 1 teaspoonful of chilli powder. Mix them thoroughly. Add 1 part ash/

chilli mixture to 4-dried maize grain. The method keeps away the Larger Grain Borer (LGB).

Red soil: Common red soil can be used to protect maize from weevils. Crush the soil into fine powder, and dust in the stored maize and beans. The dust prevents the pest from drilling holes or even laying their eggs. The laterite in the soil rubs off the waxy coating on the insects body dehydrating and killing them. In sealed storage pots, insects suffocate because enough dust is poured in with the grain to exclude air which suffocates the pests. Trapped insects get dehydrated and die as their outer covering is damaged by abrasion.

Use the PICS bag to store your grains

The use of PICS bag is another effective method for storing grains. This bag is made of three layers of plastic material. Pests in grain stored in PICS bag die of suffocation because the bag is tightly closed and no air can move through the three layers of high density polyethylene material. The outer woven bag enables easy handling of the bag. When the bag is closed, the insects in the grain use up all the oxygen in the bag and release

carbon dioxide. In this state, the insects cannot feed and their growth and reproduction are stopped. They eventually stop growing and die. The bag also preserves grain quality until it is opened and the grain used for milling and consumption. The bag costs Ksh 300. Farmers interested in buying the bag should visit their local KFA shops or agrovet shops and enquire about the bags. Alternatively they can contact the manufacturers: **Call Bell Industries Ltd Tel. 020 6535 828/9, 0733 764 562.**



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New pest poses danger to tomato production

Tuta absoluta has so far proved difficult to control using the common pesticides in the market. Research is being done to identify natural enemies of the pest together with other environmentally friendly control methods that the pest cannot develop resistance against.

Waweru Mugo | Tomato farmers in East Africa have a new invincible enemy. A new tomato pest known as *Tuta absoluta*, whose origin is traced to South America and which has in the last few years been reported in Spain and thereafter in other southern European countries, Middle East and North African countries such as Tunisia, Libya,



Tomato leaves infested with *Tuta absoluta*.

Algeria and Morocco. The pest continues to move southwards where it has invaded Senegal, Sudan and Ethiopia. Early this year the pest has reported in Kenya for the first time in Mpeketoni and Witu and later in Isiolo and Kirinyaga. Currently the pest is widely spread across the country as it has reached other tomato growing areas such as Meru, Nairobi, Nakuru (Njoro area), Kakamega, Kajiado (Loitokitok), Nyanza and Rift Valley counties.

There is more reason to worry, bearing in mind that the pest is known to infest other crops in tomato family grown in the country such as the Irish potatoes, nightshades, eggplant and tobacco. The pest poses danger of huge losses to thousands of farmers in Kenya and the continent at large. Currently loss to affected crops range between 50 to 100 per cent.

Even more worrying is that the pest has been found to be resistant to most of the chemical pesticides in the market, leaving scientists with no option but to work on its control through



The *Tuta absoluta* is one of the most destructive pests.

biological means. Furthermore, farmers using chemical control methods face the danger of killing beneficial insects that control *Tuta absoluta* naturally.

Insect scientists point out that the larvae mine into the leaves, fruits and stems making early detection of crop infestation in the field very difficult. *Tuta absoluta* infestation results into wounds that expose it to secondary bacterial and fungal infections. Affected tomato fields dry up and appear as if the entire field has been burnt.

Why *Tuta absoluta* is difficult to control

Unlike other pests that farmers have been able to control, *Tuta absoluta* has been found to be very difficult to control for the follow-

ing reasons:

- It reproduces very fast- in a year, it reproduces up to 12 generations, leading to increased populations in the field.
- The adult stage of *Tuta absoluta* is only active at night when it feeds and lays its eggs, so it is difficult to control through spraying.
- The pest larval stage is concealed inside the plant parts, which makes it difficult for farmers to kill it through spraying.
- Due to its high reproductive capacity (≥ 12 generations per year), the pest is able to develop resistance to conventional pesticides commonly used in pest control.
- The pest is more active in hot conditions or dry conditions

when most farmers plant tomatoes through irrigation to cash in on good market prices. Tomato production is more conducive in dry conditions because there is less danger of losses through fungal disease such as early and late blight among others.

- Most tomatoes in Kenya are grown in open fields making it difficult to control the pest.

Scientists in Italy have been able to control the pest using *Bacillus thuringiensis* (Bt)-the biological pesticide was used once in every two weeks, 30 days after tomato transplantation and managed to reduce damage to tomatoes for farmers in this country.

Scientists in Africa are working to develop a comprehensive package for managing this pest using environmentally friendly methods. Meanwhile scientists at icipe are advocating a number of biological control measures that can manage the pest population and reduce damage to tomatoes.



Infested tomato fruit.

ICIPE working to reduce *Tuta absoluta* threat

Dr Samira Mohamed, the *Tuta absoluta* project coordinator at ICIPE reiterated that a number of strategies are being developed to control the pest, which include the identification of natural enemies of the pest (also called parasitoids) that are indigenous to East Africa and exploration for a more efficient from the pest's aboriginal home of Peru. Among the measures being explored is the use of the attract and kill strategy that targets the male of *Tuta absoluta* moths in an effort to reduce the population of the pest and their rapid multiplication. Dr Mohamed advises farmers to take the following measures to reduce the pest population in their farms:

- They should remove all infested plants and fruits in their *shambas* and destroy them.
- All tomato, potato, nightshades and egg plants that



Dr Samira Mohamed

grow on their own should be removed and buried or burnt.

- Farmers in the affected areas should practice crop rotation in order to reduce the pest population in their farms. Farmers should avoid planting all crops in the tomato family during the

rotations in order to reduce the danger of transferring the pest to the next crop.

- Farmers can also practise intercropping (planting other crop with tomatoes) in order to reduce *Tuta absoluta* population while increasing the population of the natural enemies.

- Farmers in the affected areas can work together, for example by spraying their crops at the same time to reduce the possibility of the pest moving to the neighbouring farms where no control measures are taken.

- Tomato fields should be kept clean and free of any crop residue that may harbour the pest.

- The local authorities such as the county governments can impose quarantines to ensure tomatoes from affected areas are not transported to other areas that are not affected by the pest.

Indigenous vegetables more nutritious

African indigenous vegetables had been abandoned for many years but they are now finding their way back into dining tables due to their high nutritional value.

Trotsky Lumiti | Africa has the highest number of malnourished people and faces several challenges in meeting its Millennium Development Goals on poverty and hunger. It has been reported that over 50% of the Kenyan children less than five years are underweight, stunted or suffer from iron-deficiency anemia. The most serious cause of malnutrition problem arise from eating inadequate amounts of micronutrients. This condition is usually referred to as 'hidden hunger' and is caused by people's preference for processed diets, which do not have enough vegetables and fruits.

African indigenous vegetables such as amaranth, spider plant, black nightshade, Ethiopian kales, cowpea leaves, slender leaf, jute mallow (*murenda*) and pumpkin leaves. Exotic ones like kales (*sukumawiki*), cabbage, lettuce and spinach contain a lot of nutrients. The Africa varieties are particularly popular because they not only have medicinal properties, but also contain high levels of vitamins and minerals.

They are not expensive to produce as they can be successfully grown with organic manure as a source of nutrients and wood ash to control pests. Also, they can be intercropped with maize, millet, sweet potatoes, beans, cassava, ground



Pumpkin (*malenge*)



Nightshade (*managu*)



Crotalaria

nuts and bananas. This provides good income for the farmers and ensures food throughout the year. African indigenous vegetables are those vegetables whose centre of origin can be traced back to Africa.

Vegetables grew wildly

Traditionally, Africans have made use of edible leaf species growing wild as weeds, whose origin is the African continent. Farmers often planted them in their home gardens as intercrops with other staple crops such as maize. Sometimes, these indigenous vegetables would find their way into the market-if it was produced in excess.

Health benefits

These indigenous species have high nutritional value. They contain high levels of vitamin A and C, iron, calcium, phosphorus and proteins. These indigenous vegetables are compatible with other starchy staples and are relatively cheaper and

provide quality nutrient to both urban and rural populations.

Besides the rich nutritional value, most of the indigenous vegetables also have medicinal value. Spider plant has been reported to aid in constipation and facilitate birth while the night shade has been reported to cure stomach ailments.

Adapt to the environment

The ability of some African vegetable to withstand harsh conditions in Africa, makes them preferable to the exotic ones, which do not do well in harsh environmental conditions. For instance, amaranths (*terere*) are highly tolerant to drought and are resistant to most crop diseases. They require temperatures of about 18 - 25°C. Lower temperatures below 18°C may induce flowering and reduce leaf yield. On extremely dry conditions, amaranth has an ability to wilt temporarily. The plant then revives after rainfall.

They can tolerate drought

Most of the African indigenous vegetables have a short growth period, since most of them are vegetables. They are ready for harvest after three to four weeks. Maize needs 3 months to mature, in contrast to the amaranth, which requires only two months and requires less rainfall as compared to maize. Moreover, they respond very well to organic fertilizers and have an in built ability to withstand and tolerate stressful environmental factors. They can also flourish under sustainable and environmental friendly cropping conditions like intercropping and use of organic fertilizers. Furthermore, because most of them have not been intensively selected, they have wide genetic bases, which will be important in sourcing for new genotypes and/or genes for adaptation to climate change.

How to plant indigenous vegetables

Most of the vegetables require a spacing of 30 by 10 except for the cowpeas (*kunde*), which requires a spacing of 50 by 10. Most of them require only 30 days to reach maturity. They do well in cool wet climate and may produce a yield of 5,000kgs per acre. Cowpeas can produce up to 7,500kgs per acre.

Since most of the vegetables have very small seeds, they can be broadcasted or sown in rows on well-prepared seed bed. They can be grown through direct seeding or by first planting on the nursery then later transfer red on the seedbed. Direct seeding is used when there are

Comparison of nutrients between indigenous and exotic vegetables

| Indigenous vegetable | Proteins (%) | Calcium (mg) | Iron (mg) | Vitamin A (mg) | Vitamin C (mg) |
|----------------------|--------------|--------------|-----------|----------------|----------------|
| Amaranthus | 4.0 | 480 | 10 | 10.7 | 135 |
| spider plant | 5.1 | 262 | 19 | 8.7 | 144 |
| Nightshade | 4.6 | 442 | 12 | 8.8 | 131 |
| Cowpea | 4.7 | 152 | 39 | 5.7 | 8.7 |
| Pumpkin | 3.1 | 40 | 2.1 | 3.9 | 170 |
| Jute mallow | 4.5 | 360 | 7.7 | 6.4 | 187 |
| Exotic vegetables | | | | | |
| Sukumawiki (kale) | - | 187 | 32 | 7.3 | 93 |
| Cabbage | 1.4 | 44 | - | 1.2 | 33 |
| lettuce | 1.2 | 62 | 2.2 | 0.04 | 18 |
| spinach | 2.3 | 93 | 32 | 04 | 28 |

Source: Maundu et al, 1999, Abukutsa-Onyango 2003.

Although they are adapted to harsh conditions, subjecting them to harsh conditions will reduce the yields. In extreme conditions, the crops should be irrigated to supply them with the required moisture. With the current increases in global temperatures, African indigenous vegetables are the key to increased food production. This makes them well suited to help reduce the effects of climate change.

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Feeding dairy cows well for high milk yields

Feeding your animals well increases your income. Dairy cows require a balanced diet for milk production, body maintenance and good health. The animals should have adequate water at all times.

Peter Kamau and Caroline Nyakundi

No dairy cow, no matter how good the breed, can remain productive without proper management, especially feeding. The amount and quality of milk produced by the animal is largely affected by what it is fed on and how feeding is done. If the cow is grazed in a farm with little pasture and water and housed in dirty sheds littered with cow dung and urine, the result is poor milk yield and incidences of diseases.

In addition to selecting good breeds, proper feeding, housing and handling of dairy cows are sure ways of getting good yields and income. A good breed that receives good feed and clean water, proper housing and friendly and gentle care gives more milk and money. A poorly managed one gives less milk and the farmer incurs huge veterinary expenses that reduce profits.

Experienced farmers ensure that their animals have a balanced diet - the right feed and in the right amounts. They know that for example, feeding dairy cows only on fodder (like Napier grass) and banana leaves and stems is not sufficient. Although Napier grass is good for dairy cows, about 70 to 80 per cent of this fodder is composed of water, which means that the animals gets only 20 to 30 per cent dry matter.

Roughage

The majority of the fodder should consist of roughages:

Pasture grasses: (Nandi setaria, kikuyu, Boma Rhodes and star grass).

Fodder crops: Napier grass, green maize, fodder sorghum, sweet potato vines, sesbania, calliandra, leucaena and oats.

Legumes: lucerne, desmodium, lablab bean.

Hays: Boma Rhodes grass, Lucerne.

Silage: Napier, maize, sorghum,

Straws: wheat, Barley, oats.

Stalks: Maize, sorghum.



Nutrient and feed requirements of a dairy cow

The feed requirements for lactating cows is different from that of calves and heifers. The amount of feed provided to the cows depends on the amount of milk it produces, its weight, temperature and levels of activ-



ity. Whatever the case, the cow needs balanced feeds that provide energy (carbohydrates and fats), protein, fibre, minerals, vitamins and water in sufficient amounts. The feed given must be digestible so that the nutrients can be absorbed in the body and should not contain toxic substances.

1. Provide fodder with enough dry matter

Fodder crops like Napier grass are considered the most important feed in feeding dairy cattle as they provide energy for body maintenance, milk production, growth, weight gain and reproduction. Fodder crops also contain roughage (fibre) which helps in digestion and improves the levels of milk fat. An animal can be given extra energy sources from molasses, maize

and wheat germ. A mature cross breed cow weighs an average of 400kg. Such a cow requires 10-15kg of fodder in a day (if you are feeding Napier grass, ensure it is at least 3ft in height, any grass less than 3ft contains less dry matter and more water in it, which means that the cow may not get adequate nutrition when fed on such fodder).

Meeting the cow's basic energy needs

A dairy cow needs a basal diet - one that provides sufficient amounts of nutrients to meet the animal's daily basic energy needs but may not provide all minerals and vitamins required. This diet is commonly obtained from pasture grasses, fodder or silage (see box below left). In simple terms, the cow needs a basal diet to fill its big stomach - this diet provides the animal with energy. For dairy cows, goats or sheep, such diets provide roughage or fibre and form the bulk of the animal's daily ration.

The expected daily consumption of energy feeds depends on the quality of the feeds, the size of the animal, level of milk production, quantity of supplements given and dry matter content of the feed material. Supplementary feeds such as concentrates cannot replace the basal diet.

In the dry seasons, cows often do not get enough fodder. Many small-scale farmers try to take care of this shortage by feeding the animal with mosre dairy meal; they however, get disappointed when the milk production does not increase and may blame the animal feed companies for producing poor quality feed or the breed of dairy cow. Farmers should know that

without sufficient fodder to fill the animal's stomach, even the correct portion of the best quality dairy meal will not increase milk production.

If given less fodder, the cow uses the feed to maintain its body and cannot increase milk production. Very often, the farmers feed their animals with rotten maize, which is dangerous as it may contain aflatoxins. Aflatoxin contaminates cow's milk and is dangerous even for humans who consume it.

2. Provide enough protein in feeds

Protein is the second most important component of the diet. It builds the cow's body and helps in milk production. Adequate protein in the diet also helps microorganisms in the rumen (stomach) convert the roughage into nutrients. It is important for farmers to ensure that they supplement the forage diet with proteins. Lack of protein in the animal diet results in poor growth, reduced milk production, loss of weight and late maturity.

Good protein sources include legumes like lucerne, white clover, and bean straw. Fodder trees such as calliandra, sesbania and leucaena also provide protein for animals. Farmers should dry calliandra before feeding the animals as it causes the milk to smell when given fresh to the animals.

Research has shown that 3 kg of tree fodder and other legumes such as sweet potato vines give the same milk yield as 1 kg of dairy meal. Therefore, the farmer can give the cow 12kg of legumes instead of 4kg of dairy meal.

3. Minerals and vitamins are important

A cow should also be provided with mineral licks - the minerals provide calcium, phosphorus and other important minerals that support milk production and other body functions. Pregnant cows especially require adequate amounts minerals to help in bone and tissue development of the calf. Never give cows ordinary table salt as it does not have the required minerals. Vitamins like A, D and E are not produced in the cow's body and must be supplied in the diet. These help maintain the animal's health and can be

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Indigenous vegetables are more nutritious

enough seeds for the entire area to be planted.

On maturity, the crops should be uprooted and the roots washed. This depends on the crop grown. They may be harvested through the piece meal method, where the crops are harvested in small amounts at a time. The produce can then be packaged transported to the market. Water is sprinkled on the crops to reduce withering off and to give them a fresh appearance.

Market for African vegetables

African Indigenous vegetables have a high chance of becoming an income earner for the rural community and also the people living in the urban areas. This would enable the poorest people in the rural communities to earn a living and, therefore, live a decent life. Currently, there is an increase in demand for the vegetables in the cities and major towns. This proliferation entry of the vegetables in cities and major towns has broadened their market for African indigenous vegetables. Just a bunch of vegetables goes for an average price of 10 Kenya shillings, which is affordable for most Kenyans. A bunch weighs just



Amaranth (*terere*)

a few grams. With an average yield of 5,000kgs per acre, a farmer may obtain good income from indigenous vegetables.

Indigenous vegetables neglected

The changing eating habits have affected the production and consumption of the African indigenous vegetables. People somehow relate them to the older people while others take them as poor man's food that should be used as a last resort. The larger population has a preference for the exotic vegetables and foods. The rural communities find themselves consuming the exotic species as they try to imitate the urban population's



Spide plant (*sagaa*)

feeding habits. This has led to neglect of indigenous vegetables.

Vegetable seeds hard to find

Insufficient knowledge on the merits and opportunities of indigenous vegetables contributed to the negative attitudes developed towards them. Although there was some indication that they had nutritional benefits, most people don't take the facts seriously. In addition to this, lack of quality seeds has been a challenge to the sustainable production of indigenous vegetables. Some vegetables perpetuate themselves unattended. Farmers just harvest

them wherever they occur. Their success depended on their ability to reseed.

Seed quality a problem

Most often, seed production is left in the hands of the farmers. These farmers often grow the indigenous vegetables for subsistence farming. The farmers save their seeds from season to season and sell to one another. Most of the times these seeds are not of high quality and this reduces their yields.

Pest control

African indigenous vegetables are susceptible to damage by pests such as leaf miners, leaf roller, caterpillars, cutworms, aphids, flea beetles, and mites. The damage may reduce leaf production and subsequently yield. These insect pests can be reduced by application of biological pesticides such as neem, ashes or soapy water.

The bio-pesticides do not harm beneficial insects. Some of the diseases affecting indigenous vegetables include damping off, which causes the seeds to rot in the soil before emergence. The diseases can be reduced by using disease free seedlings, proper watering and by ensuring proper spacing during planting. ■

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Preparing feeds for proper management of dairy cows

supplied through supplements.

4. Provide enough water

A farmer must also have a reliable water source because water comprises more than half the weight of an adult dairy cow. It transports the food the animal eats to body tissues and organs and cools the animal when it is hot. Water should be available at all times so the animal can take as much as it needs. On average, dairy cows need more than 60 litres of water in a day. This helps the animal increase milk production and to maintain its body condition.

Planning is important for profitable dairy business

Keeping dairy cows depends on a farmer's knowledge and planning. Dairy farming is a viable business, which needs enough resources and capital. These include; adequate land for keeping the desired number of animals and for growing the required fodder, legumes, or grasses to feed the animals.



Farmers must also plan for animal feed requirements during the dry season. Farmers should prepare silage from the excess fodder and preserve it during the rain season so that it can be fed to the animals during the dry season. The farmer should also budget well to ensure there is enough money to buy concentrates, mineral licks, vitamins and drugs to maintain the animals' health.

Before starting a dairy

farming venture, farmers should have adequate skills on dairy cow management which they can get by visiting successful dairy farmers or working with livestock extension personnel. This helps them avoid costly mistakes that can lead to failure and even losses. If well managed, dairy farming is one of the most profitable ventures in farming. In most towns a litre of milk sells at between Ksh 40 and Ksh 50 in the informal market while processors pay Ksh 33 to Ksh 35 per litre. For example, a farmer keeping 6 dairy cows each giving 25kg of milk per day can get 150 litres of milk per day, which fetch Ksh. 6000 per day at Ksh 40 a litre.

In 30 days, the farmer can have a gross income of Ksh 180,000. If you subtract the expenses - the cost of feeds, drugs and labour which take up about 30 per cent of the earnings, the net income is about Ksh. 126,000 per month. This is a good income that can enable one to pay fees, pay for other expenses in the farm and

even invest.

A farmer with such an income can easily qualify for a loan to buy more dairy cows or develop the farm. Many local banks have various loan products for dairy farmers with a regular income.

Most small-scale farmers know (or have at least heard of) methods of feed conservation such as silage, hay or use of polythene tubes. KARI has a lot of helpful useful brochures about silage or hay-production. *The Organic Farmer* has featured articles on how to make hay and silage (See *TOF issue No. 19*).

In organic farming, feeding should be mainly based on the fodder produced on the farm itself. Furthermore, organic dairy farming management demands that the animals have sufficient freedom to move around and exercise their natural behaviour. That is why landless animal husbandry where animals do not have enough space for movement and rest is not permitted. It affects the animal's health and creates stress. ■

Role of green manures in soil fertility

How much nitrogen can be fixed by green manure?

Nitrogen is an essential nutrient needed by plants but which is easily lost when the soil is poorly managed. In sustainable agriculture, green manure or cover crops play a major role in improving soil fertility and farm productivity. This type of manure refers to crops or plants that are grown between the main crops to provide soil cover and to improve the quality of the soil. This is especially important among small scale farmers who find it expensive to buy

mineral fertilizers. Using legumes like lablab and mucuna, it is possible to ensure adequate supply of good quantities of nitrogen into the soil. This is through fixation of nitrogen in the roots of these legumes. When ploughed back into the soil, the legumes ensure nitrogen and other nutrients are recycled (returned) into the soil. The nutrients are released slowly to the soil as the dead plants rot.

Since legumes grow fast, they accumulate a lot of biomass within a short time. They can increase plant nutrients in the

soil, especially nitrogen through biological nitrogen fixing and therefore improve crop yields. These crops minimize soil erosion by reducing the impact of rain on the soil. They suffocate and kill weeds even the destructive ones like Striga, thus reducing labour costs for weed control. They are also an important source of human food and livestock fodder.

Studies conducted in Kenya by the Legume Research Network show that green manures when used with farmyard manure save farmers the cost of buying



Tithonia



Crotalaria

Photos: TOF



Lablab



Desmodium



Purple vetch

Nutrient content of organic materials

| Organic material | Nitrogen % | Phosphate % | Potash % |
|------------------------|------------|-------------|----------|
| Cow manure | 0.4-0.6 | 0.2 | 0.2-0.5 |
| Horse manure | 0.5-0.7 | 0.3 | 0.6 |
| Goat manure | 1.4 | 0.2 | 0.3-1.0 |
| Sheep manure | 0.7 | 0.3 | 0.4 |
| Pig manure | 0.5 | 0.3-0.4 | 0.5-0.8 |
| Poultry manure | 1.1-1.5 | 0.8-1.3 | 0.5-2.7 |
| Rabbit manure | 1.1-2.4 | 1.2-1.4 | 0.6 |
| Boma (mixed animals) | 0.7 | 0.1 | 0.7 |
| Compost (household) | 0.5 | 0.2 | 0.8 |
| Grevillea leaves | 1.37 | 0.06 | 0.64 |
| Bean trash | 0.8 | 0.07 | 1.57 |
| Banana stalks | 0.73 | 0.18 | 4.10 |
| Sugar cane trash | 0.47 | 0.06 | 1.23 |
| Banana leaves | 1.3 | 0.1 | 1.72 |
| Coffee husks | 1.63 | 0.14 | 4.45 |
| Sweet potato vines | 1.73 | 0.48 | 6.63 |
| Leucaena leucocephala | 3.74 | 0.26 | 3.37 |
| Napier grass | 1.97 | 0.14 | 3.85 |
| Lantana camara | 2.5 | 0.26 | 1.93 |
| Tithonia leaves | 3.97 | 0.3 | 4.6 |
| Cajanus | 3.62 | 0.21 | n/a |
| Jackbean | 3.45 | 0.16 | n/a |
| Crotalaria ('marejea') | 4.45 | 0.16 | n/a |
| Desmodium | 3.44 | 0.15 | n/a |
| Soybean | 3.52 | 0.15 | n/a |
| Lablab | 4.02 | 0.18 | n/a |
| Mucuna | 3.56 | 0.17 | n/a |
| Lima bean | 3.79 | 0.13 | n/a |
| Purple vetch | 3.68 | 0.16 | n/a |
| Groundnuts | 3.79 | 0.18 | n/a |

Source: Gachene & Kimaru 2003

chemical fertilizers. The table left can help farmers choose the best green manure crop they can use to increase nitrogen and other nutrients to their soils for increased farm productivity and income.

How to determine nutrient in plant extracts, compost

How can farmers determine the nutrients content in compost manure, liquid fertilizers and foliar feeds as it is in the case of synthetic fertilizers?

Farmers who would like to know the exact amount of nutri-

ent each of the plant extract used contains can take a 1/2kg sample of mature compost for analysis in order to know the exact amount of each nutrient present. The same can be done for foliar feeds (plant extracts). The samples can be sent to the nearest KARI Research Station for analysis. Alternatively, farmers can send the samples to the KARI National Agricultural Research Laboratories (KARI-NARL) Nairobi. Tel 0724 007 585, 0722 691 577. (before sending the sample call the Laboratories to advise how the sample can be packaged and labelled for dispatch to Nairobi).

Apply plant extracts as frequently as possible

How many times should pesticides extracted from plants be applied on affected crops?

Farmers should know that plant extracts are not the same as chemical pesticides. Chemical pesticides are made in high concentrations such that when used, they act fast on the pest or kill them on contact. Plant extracts are different as they have low concentrations of the active ingredients; and also act slowly. If a farmer uses plant extracts for pest control, they need to use it several times before they can see the desired results. Plant extracts should be applied at least two or three times a week

to be effective and to eradicate the target pest. This is because most act by repelling the pest, instead of killing them. Plant extracts therefore require frequent application to show good results.



Making plant extract

TOFRadio answers your questions

TOFRadio is broadcast on KASS FM, Mbaitu FM and Milele FM at 8:30pm on Tuesday, and KBC on Thursday at 8:15pm. Tune in and listen to farmer experiences and expert advice on agribusiness and eco-friendly farming methods. On this page, we respond to some of the issues raised by farmers in their correspondence to the radio program. Send your questions and comments via SMS 0715 916 136.

How to harvest and store onions

Musdalafa Lyaga | A number of farmers have asked how they can prolong the shelf life of their onion harvest as they look for markets. A large percentage of their harvest is lost, especially during the rainy season. Below TOF provides tips on how farmers can reduce such losses through proper drying and storing of onions.

Onions are important vegetables that are grown throughout the year in Kenya. They are rich in nutrient and are popular in nearly every household- 100g of onion provides about 30 g calcium, 0.5 mg of iron, vitamin B, 0.2 mg of riboflavin, 0.3 mg nicotinamide, and 10 mg ascorbic acid (vitamin C).

After all the work done to grow and manage the crop well, farmers must ensure they handle the crop well during and after harvesting. Farmers are advised to harvest the onions on time, preferably when it is not raining (on hot and sunny days).

Harvesting tips

- Follow the recommended management practices. If a farmer is not careful, the onion crop might get infected by insects, diseases, or nutrient problems. A sickly crop cannot be stored for long.
- Ensure that when the bulbs start forming, the onion bulbs are well covered with soil. This will minimize sun scalding that occurs at the shoulder of the onion, when the plants are exposed to sunlight for a long time. Sun scalding also happens when harvesting is delayed especially during the dry season. When this happens the top layers of the bulb will dry up and start to peel.
- Harvest onions when they are fully mature, 90-150 days after sowing, when you see the leaves of the plant collapse. Alternatively, the leaves can be bent over and left to dry for 10-12 days. Water stress can also cause leaves to collapse, so be careful to differentiate maturity from lack of water. When the neck of the onion is dry and tight, then the onions are ready for picking from the field.



An onion store requires good ventilation for proper drying and prolonged shelf-life to reduce losses associated with rotting.

- Harvesting before full maturity means that the water content in the onion will be higher and this reduces the period the onion can be stored. It is important for the farmer to know the variety of onion planted so as to estimate the expected time of maturity and harvest.
- When harvesting, pull out the crop by hand gently to avoid bruises which can act as entry points for bacteria. Keep the produce for some days in the field with the bulbs covered by the leaves.
- Try as much as possible to time your onion crop in such a way that harvesting happens when the weather is dry. Harvesting when it is raining increases chances of rotting. Do not handle the bulbs when they are wet.
- Remember sunshine is good as long as it is not too hot. Too much of it will cause scalding. Check the progress of the onions from time to time and remove those that have gone soft or started to rot.
- To dry the onions, you can hang the onions in small bunches and tie the tops together with a string to dry. If drying indoors, spread the onions out in a well



ventilated room (one foot away from the wall) with a lot of air circulation for 2-3 weeks. Without fresh air circulating, the bulbs will rot.

- The onions are considered well dried once the neck is tight, the outer skin is dry, makes a rustling sound when handled and the skin colour is uniform.
- Use a sharp knife or hand clipper to cut off the leaves and roots and pack the produce in nets (or crates if they are to be stored) for transport to the market or for safe keeping. Do not pack onions in closed plastic bags.

Storage tips

Before storage, sort and discard onions that are bruised, damaged by insects, diseases, sunscald or sprouted. Do not mix the good quality onions with the damaged ones.

Freshly harvested bulbs are dormant (inactive) and will not sprout for a few weeks, depending on the variety. Good storage will extend the dormancy period. Make sure the bulbs are stored in a clean, dry, cool and well aerated place.

Cooperatives for onion farmers

Onion farmers in Kenya can learn from farmers in India by working together to pool resources to build onion storage centres as they wait for market prices to improve. This will help reduce losses related to low prices, oversupply in the market and poor storage.

farmers forum

0717 551 129 / 0738 390 715

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

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

KARI Improved chickens: We have KARI improved *kienyeji* chickens. One day to 4-week old at Ksh. 150. Call Susan 0722 326 426. Ndenderu, Kiambu.

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

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

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

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

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

Goose eggs wanted: I need goose eggs (fertilized) if you have them, SMS "goose eggs" to 0722 878 635.

Fleckvieh bull for sale: I have a 9-month Fleckvieh bull for sale. Interested farmers can contact me on 0726 434 521.

Sangi potatoes: I have 3 acres of certified *sangi* potatoes for sale to interested farmers to be ready in October 2014. Godfrey Ndirangu. Call 0722 892 510.

Organic foliar fertilizer: We sell imported organic foliar fertilizer (KEPHIS certified). Call 0726 754 014 (office hours, week days).