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Dear reader,

In the aftermath of the long rains that caused havoc in most parts of the country are mixed results. Farmers in some parts of the country were adversely affected as crops stunted under extreme weather, while others stood resilient.

Even as the losses stand out, a few gains such as availability of fodder cannot be ignored. Most dairy farmers experience fodder scarcity as a major challenge in dairy production. This edition focuses on fodder production and conservation technologies. Ensure to take advantage of excess fodder by ensiling for days of scarcity.

A recent incident of death in Western Kenya following poisoning from cassava roots has prompted the need to inform our communities on dangers that can result from inappropriate use of cassava.

We elaborately explain the toxins found in cassava and recommend methods of preparation to minimize the risk of consuming the poison at the family and at the consumer level.

The Newcastle Disease can become a menace in poultry farming especially where farmers lack knowledge on its causes and how it is spread. A scientist from KALRO Kakamega breaks this information down empowering the farmer to identify it in poultry, and ways to manage it.

With the increasing cases of non-communicable diseases, it is about time we embraced traditional knowledge on medicinal plants and the nutrition value in our indigenous trees especially fruit trees.

Take a look at the myriad benefits hidden within the thorn melon, a fruit that often grows wildly in our farms, yet it contains invaluable benefits for human health. These and much more, only in this edition of TOF Magazine.

FORAGE CROP CULTIVATION

Forage grasses to grow for your dairy cattle

The first step of establishing fodder on the farm is land preparation. Cultivating forage crops on the farm is a cost-effective approach for feeding dairy cattle

By David Njenga

CULTIVATING FORAGE CROPS on the farm is a cost-effective approach for feeding dairy cattle as feeding cost constitutes about 70-80% of the cost of production. There are different varieties of fodder crops and this article focuses on grasses that farmers can grow highlighting optimal conditions, planting procedures and management practices.

The first step of establishing fodder on the farm is land preparation. You need to have decided on the type of fodder crop you would like to plant before preparing the land for planting, or the seed bed.

Land/seed bed preparation

- Plough/dig the land to a fine tilth. Ploughing can be done using tractor, oxen, donkeys etc. Avoid burning the crop residue as this affects the ecosystem balance in the soil. Crop residues help to improve soil aeration and humus, creating a good balance of soil pH, mineral availability and water holding capacity of the soil.
- Harrow severally if necessary. This depends on the size of the seed to be established; smaller seeds (Lucerne, Desmodium) require finer tilth while bigger seeds, splits and cuttings require moderately prepared seedbed.
- Dry planting is recommended for seeds while wet planting is done for cuttings/splits.

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Unlocking Thorn Melon potential

Thorn melon can grow naturally on its own, or it can also be cultivated on farms and in greenhouse. It flourishes in diverse weather conditions. PAGE 10

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Seeds planting depth should be more than 1cm and less than 1.5cm for smaller seeded fodder crops. Lightly compact soil after planting to enhance seed to soil contact.

The source of seed is key for better performance of fodder crop resulting to higher yield. Always use certified fodder planting material. The seeds establishment can be done through broadcasting or direct sowing at the recommended seeding rate.

Methods of seed sowing

- **Broadcasting** - Is a systematic spreading of seeds on a seedbed and light covering with soil. This is common with grasses, for example Boma Rhodes.
- **Drilling** - Placing of seeds in shallow rows and covering with soil. Common practice for legumes and forage sorghum.
- **Direct sowing-** Establishing a pure stand of pasture without any other crop in the field.
- **Under sowing**- Establishing pastures in a field with already existing crops.
- **Over sowing** - Introduction of improved pasture species (grasses or legumes) to a natural pasture.

The table below shows the material and method of planting for various fodder:

Grasses	Planting material	Mode of planting	Seed rate
Napier	Cuttings (3 nodes)	Row planting 90 by 60cm	18,750 cuttings /Ha
Napier	Root splits	Row planting 90 by 60cm	18,750 Splits/Ha
Napier	Cuttings (3 nodes)	Tumbukiza 60 by 60cm	28,000 cuttings/Ha
Brachiaria	Seeds/ splits	Drill/ holes 25 by 50cm	2-3 Kgs/Ha
Maize	Seeds	Drill / holes	25Kgs/Ha
Seteria grass	Seeds/splits	Broadcasting/Drilling	12 Kg/ Ha
Guinea grass	Seeds/splits	Broadcasting/Drilling	2-3 Kg/Ha
Guatemala	Splits	Holes space at 90 x 60cm	18,750 Splits/Ha
Cechrus ciliaris	Seeds/splits	Broadcasting/Drilling	1-2 Kgs/Ha
Oats	Seeds	Broadcasting/Drilling	75-100 Kgs/Ha
Kikuyu grass	Stolons/ Seed/ splits	Drilling/Broadcasting	1 - 2 Kg/ Ha
Rhodes	Seeds	Broadcasting/Drilling	5Kg/Ha
Sorghum	Seed	Fodder: Drill at 75 x 10 cm,	6–8 Kg/Ha

Soil PH requirement for different Napier grass varieties

Variety	Attributes
Kakamega 1 and 2	Both varieties are tolerant to Napier grass head smut and stunting disease.
Pakistan hybrid-Super nappier	Suitable for dry areas. Very prolific.
Uganda hairless	Highly susceptible to smut and stunting disease.
Ouma	Tissue culture, resistant to smut and stunting disease.
South Africa	Tissue culture, resistant to smut and stunting disease.

Types of Forage grasses

As already enlisted in the table above, forage crops include grasses and legumes. Feed unavailability is a major challenge to livestock production especially in the Kenyan ASALs due to extensive land degradation.

Five grass species, Rhodes grass, Cenchrus ciliaris, Chloris roxburghiana, Eragrostis superba and Enteropogon macrostachyus have been identified as good grasses for forage production and have been promoted for hay production and rehabilitation of degraded rangelands.

This article focuses on establishment and management practices of three most common types of grasses in various parts of Kenya: Rhodes grass, Kikuyu grass and Napier grass. Bracharia grass has also gradually gained popularity and more information on it can be found in Issue 187 of TOF (https://www.infonet-biovision.org/tof-issue-no-187-february-2021).

(i) Rhodes grass: Rhodes grass is the most important pasture grass in Kenya due to its ease in establishment and management. First you need to prepare a good seedbed by ploughing and harrowing twice for virgin lands. On a previously cropped land you will need to plough and harrow just once before the beginning of the long rains.

Sowing should be done very early, usually in April, so that weeds do not overtake the germinating seeds. Others prefer to sow during the short rains to take care of weeds.

Drilling is preferred because it ensures that the seeds are buried and distributed uniformly and others are not left on the surface to dry as in broadcasting. The seeds are first pelleted for them to flow readily during drilling, which is done at a rate of 0.5-1 kg/ha in rows 30 – 40 cm apart.

The seed is best sown on the surface not deeper than 2 cm followed by rolling. For broadcasting, the seed is best mixed with sawdust or sand. Seeds germinate in 1-7 days and seedlings develop rapidly. Apply manure during planting to promote strong root development. Broadcast manure at 10 ton/ha and harrow before planting.

KIKUYU GRASS – Pennisetum clandestinum: A perennial high quality grass. It spreads vigorously from rhizomes and stolons which root at the nodes. It is drought tolerant because of its deep root system and occurs naturally mainly on deep fertile soil. To establish it, hand planting of vegetative stems and root cuttings is common but can also be established through seeds on seed beds with a fine soil tilth.

Planting Kikuyu grass: Plant seeds to a depth of not more than 5cm and roll the soil for good soil seed contact. Root splits are planted attached on stamps of soil for quick root establishment at the onset of rains.

The Kikuyu grass yields about 5-6 tons of DM/acre per year. It remains evergreen throughout the year, maintains palatability and can withstand heavy grazing.

Napier grass: Napier grass is a robust perennial grass with vigorous root system, characterized by a creeping rhizome. It prefers deep, fertile friable loam soils and grows best in high rainfall areas 1500 mm and above /year.

It forms the basic feed for dairy cows. Napier grass can be ensiled, but it is not good for hay. Below are varieties of Napier grass and their attributes.

Variety	Attributes
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Pakistan hybrid-Super nappier	Suitable for dry areas. Very prolific
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Nappier Grass management practices: Apply 5 Tons/Ha farmyard manure at planting, 60 Kgs of slurry, in furrows after cuttings.

Ensure your Napier crop is free from unwanted plants (weeds) for reduced nutrient competition and better yield. Always cut Napier at a height of 1.5m for maximized nutrition and improved yield.

Avoid grazing on new stand during wet periods, test for root development and do not graze lower than 6-10cm. Grazing is not reccommended but in case you are grazing, ensure to graze only when the soil surface is firm and dry and implement rotational grazing. Rest the pastures for a period of 24-30 days.

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Yields expectation from grass forage

Income from grass farming depends on how effectively you manage the pasture stand. The most important is weed control. Grazing should not be allowed as this will deplete the crop. While the numerous fungi and nematodes have been isolated from the grass, they rarely have any economic impact. Control the weeds during the first year by hand weeding. In subsequent years, keep fields clean by slashing, hand pulling or mowing of weeds.

During the establishment year, soil nitrogen is adequate for grass productivity. Additional nutrients in the form of organic fertilizer or farmyard manure are required in subsequent seasons. Top dress grass with 5-10 tons of farmyard manure.

Yield per hectare range is 400 to 650 bales of 15kg/bale for each season and usually harvest is done twice per year. Of importance is Dry Matter (DM) yields which generally range from about 10-25 t/ha, depending on soil fertility, environmental conditions, and cutting frequency. Yields in the second year may be double those of the establishment year, but this also depends on management and environmental conditions. Yields of 35-60 t/ha DM are reported under optimal management.

Soil PH requirement for various forage crops

Soil Condition	Fodder crop
Acidic	Sesbania, Lab lab, Rhodes, Maize,
Slightly Acidic/ Neutral	Tree Lucerne, Maize,
Non-Acidic / Slightly acidic	Calliandra, Gliricidia
Alkaline	Sesbania, Rhodes
Neutral – Alkaline	Leucaena, Lucerne, Napier, Seteria, Oats, Vetch
Non-Alkaline	Desmodium,

In the next edition we feature a comprehensive article on growing legumes for fodder. For more information on fodder crops visit: https://www.infonet-biovision.org/fodder-production/fodder-production

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MAIZE PESTS MANAGEMENT

Agroecological maize pests management

By Grace Kinyanjui

MAIZE IS TARGETED by several pests, which cause significant yield losses. The most damaging pests are the caterpillars (larvae) of Fall armyworm and other night-flying moths such as African armyworm, cutworms, and African maize stalk borer. Other important pests include spotted stem borers, maize beetles, earworms, leafhoppers (vectors of maize streak virus), and aphids (vectors of maize dwarf mosaic virus). These insects attack different parts of the plants and their feeding damages can be observed on the leaves, whorls, stalks, tassels, and ears. The Fall armyworm, for instance, attacks all stages of plant development including seedling, vegetative, flowering, and ear formation with crop losses reaching up to 100%.

Pest problems on maize farms can be managed using "ecological pest management" strategies, which focus on the principles of agroecology. The key agroecological principles that are directly applicable to pest management include input reduction, biodiversity, and soil health.

Agroecological approaches harness nature-based solutions and form the pillars of organic farming. These approaches can be implemented in maize fields together with other essential pest management practices, listed below, for reduced pests' infestations and optimal crop yield.

- Regular monitoring of maize fields from the seedling stage to allow early detection of pest populations and infestations. Monitoring of armyworms and stemborers can be done using pheromone traps. Crop scouting can be done for all maize pests by checking feeding damages such as defoliated leaves, dead hearts and the presence of frass and holes on plant parts.
- Use of flower-rich field margins in maize monocrops to provide food and harborage for natural enemies. Intercrops of maize and legumes are highly encouraged because maize monocrops encourage biodiversity loss.
- Cultural practices such as good crop hygiene, proper weed management to enhance crop vigour; handpicking and destruction of egg masses and caterpillars.
- Homemade biopesticides reduce infestation of many insect pests. Examples include plant extracts of neem, wild marigold, chili pepper, and Tephrosia vogelii. Application of ash or dry soil into the leaf whorls of young plants can also suffocate the hiding caterpillars.
- Commercial microbial biopesticides for fall armyworm include MAZAO ACHIEVE from Real IPM Company (K) Ltd and HALT NEO from Osho Chemical Industries Ltd.
- Release of parasitoids into the maize fields to parasitize eggs and larval stages of specific pests. For instance, Trichogramma, Telenomus, and Cotesia species target Fall armyworm. Mass rearing of these parasitoids is done by the International Centre of Insect Physiology and Ecology (icipe) and the Dream Team Agro Consultancy Limited.

SUSTAINABLE AGRICULTURE

Cassava: A Beacon of Hope That Can Turn Catastrophic

Cassava is one of the resilient staple crops that plays a vital role in ensuring food security and nutrition, while at the same time providing by-products for animal feed and bioenergy

By Elias Biwott

AS CHALLENGES OF harsh climatic conditions characterized by erratic rainfall increase, farmers are gradually embracing farming of resilient and sustainable crops. Cassava is one of the resilient staple crops that plays a vital role in ensuring food security and nutrition, while at the same time providing by-products for animal feed and bioenergy.

Cassava's remarkable resilience to drought, pests, and diseases makes it well-suited for cultivation in regions where water scarcity and environmental stresses are prevalent. With its adaptations, low external input requirements, deep root system, cassava efficiently taps into moisture and nutrients stored deep within the soil, enabling it to withstand low fertility, prolonged dry spells, and erratic rainfall patterns.

Cassava also has the economic importance in that farmers who embrace circular economy principles, such as recycling cassava waste into biodegradable packaging or compost, can further enhance their resilience.

Nutritive value and use

The roots of cassava are rich in carbohydrates, mainly starch. Cassava is consumed in a variety of ways, including eaten as whole root, grated root or root chips. In addition, it is prepared into flour which in turn can be used for cooking or production of cassava-based products such as ugali, breads, crisps, cakes, crackers, puddings or beverage and production of pharmaceutical beauty products among others.

Apart from being used as human food, cassava products are also used as animal feed if well dried. Cassava is also an important source of raw material for the industries of starch, alcohol, glucose, acetone, glues, paper, stabilizers, etc.

What are Cyanogenic glycosides found in cassava?

Cyanogenic glycosides are a group of chemical compounds which occur naturally in all parts of the plant, but the leaves are more toxic than the roots, the concentration is higher in the central cord and in the bark but are relatively non-toxic alone. The potential toxicity of cyanogenic plants is largely dependent on their ability to produce lethal concentrations of hydrogen cyanide when exposed to humans. In cassava, hydrogen cyanide, which is toxic and poisonous to both animals and humans when ingested. Bitter cassava is more detrimental to one's health as compared to sweet cassava. Their content varies according to the age of the plant, the variety, environmental conditions, type of soil, climate and pH. Cyanogenic glycosides act as a natural pesticide to protect plant against animal pests.

What are the symptoms of cyanide poisoning?

In humans, the signs and symptoms of acute cyanide intoxication include rapid respiration, drop in blood pressure, rapid pulse, anxiety, dizziness, headache, stomach pain,

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vomiting, diarrhoea, mental confusion, twitching and convulsions, paralysis and even coma. The effects begin to manifest a few minutes after consumption and poisoning can develop over minutes or hours, and eventually cause immediate death if there is a delay in seeking medical attention.

Other illnesses caused by chronic cyanide intoxication include; diabetes associated with calcification of the pancreas, cancer caused by the formation of carcinogenic nitrosamines in the stomach and an abnormally high incidence of congenial malformations where children are born with imperfection of the limbs.

How should cassava be processed to render it safe for consumption?

The techniques and processes generally used involve sun-drying, grinding and grating, pressing, immersion in water, fermentation, roasting or cooking, or usually a combination of these. In these processes the glycosides are eliminated by hydrolysis, freeing the very volatile HCN to be lost in the surrounding atmosphere.

Sun-drying: The roots are peeled, cut in slices or longitudinally and dried in the sun, while the mass is turned occasionally for 2 to 4 days, depending upon the weather conditions. This reduces the cyanide levels in the cassava before preservation or milling into flour.

Grinding and grating: This breaks down the fresh plant tissue, promoting biochemical reactions between the glycosides, endogenous and exogenous enzymes. The grated cassava should be left long enough. Detoxification depends on the length of time the sample rests, temperature, particle size, and pH.

Immersion and fermentation in water: The immersion helps in the process of detoxification because it breaks the cells by osmosis and some fermentative action, which contributes to glycoside hydrolysis. Product is immersed from 2 to 8 days and then grated or grounded, pressed by hand into small cakes, and sun-dried, and finally roasted and milled to produce flour. This product has very good palatability, digestibility and is completely safe. This process will not be effective if the soaking time is too short.

Reducing cassava cyanide improves cognitive development

Even low levels of cyanide exposure over time can cause cognitive impairment that may have lifelong effects especially among children. Heavy consumption of cassava as a primary food source during most meals or lack of dietary variety can lead to cyanide poisoning, (a paralytic disease) or even death. Children are particularly at risk because of their smaller body size.

How to avoid cassava poisoning?

Even though cassava poisoning is considered highly fatal, if processed and prepared well, all these fatal repercussions can easily be avoided.

Advice to consumers and traders

- Cassava roots should be peeled, cut into small pieces or grated/ ground into flour, soaked in cold water in a basin and let to stand in the shade for five hours or in the sunlight for two hours and then cooked thoroughly in boiling water to reduce the harmful cyanide toxins.
- It is also highly advised to take and maintain a balanced diet to avoid overexposure to hydrogen cyanide present in cassava roots from a small range of food items. Varied diets and access to foods like eggs, dairy, meat and fish that can transform dietary cyanide into more harmless compounds is good.
- Buy cassava food products from reliable suppliers. Prepare cyanogenic plants such as cassava properly before consumption.
- Don't buy cassava roots in the market and chew them. Avoid eating raw cassava because it has high cyanide levels, which is poisonous and harmful to health.
- Cassava should be harvested as soon as it matures since when it overstays in the farm, it becomes woody and high

quantities of cyanide develop.

- Grow low cyanide varieties in order to reduce intake. New and safer varieties developed through plant breeding and the application of biotechnology could make an important contribution.
- Source food and ingredients from reliable sources. Adhere to the Good Manufacturing Practice to minimize the risk of natural toxins in food.

Treatment of cassava poisoning

In the case of cassava poisoning, immediate medical attention is highly advised, as it can be treated if diagnosed early. It is mostly treated by using the cyanide antidote kit which can be found in a hospital. The kit includes three medications (amyl nitrite, sodium nitrite, and sodium thiosulfate) administered together.

The amyl nitrite is given for 15 to 30 seconds, while sodium nitrite is given intravenously over three to five minutes. Intravenous sodium thiosulfate is administered for about 30 minutes.

This medication neutralizes hydrogen cyanide in the body by allowing an enzyme called rhodanese to reduce the toxicity of the chemical by catalyzing the conversion of cyanide to thiocyanate. It is also usually accompanied by using an oxygen ventilator.

Even low levels of cyanide exposure over time can cause cognitive impairment that may have lifelong effects especially among children. Heavy consumption of cassava as a primary food source during most meals or lack of dietary variety can lead to cyanide poisoning, or even death. Children are particularly at risk because of their smaller body size

LIVESTOCK DISEASE

Understanding Newcastle Disease

Newcastle disease outbreaks are widespread, resulting in significant economic losses in chicken production systems globally

By Dr Ann Wachira

NEWCASTLE DISEASE (ND) affects birds globally, and chicken are particularly vulnerable. It is caused by a virus called avian paramyxovirus serotype type 1 (APMV-1). There are five types of APMV-1 strains, which are categorized based on their strength in chicken: a) strong and affecting organs (viscerotropic velogenic), b) strong and affecting nerves (neurotropic velogenic), c) moderately strong (mesogenic), d) weak or affecting respiratory system (lentogenic), and e) showing no symptoms (asymptomatic). Lentogenic strains are the mildest, mesogenic strains are moderately severe, and velogenic strains are the most severe. Velogenic and Lentogenic strains are present in poultry worldwide.

Economic Impact

Newcastle disease outbreaks are widespread, resulting in significant economic losses in chicken production systems globally. In developing countries such as Kenya, where indigenous chicken production systems constitute over 70% of the poultry population and play a crucial role in food, nutrition, and income generation, controlling Newcastle disease is of paramount economic importance. Unvaccinated chicken are the most severely affected, with up to 100% experiencing infections or mortality. This not only reduces chicken numbers but also disrupts the entire supply chain, affecting livelihoods dependent on chicken farming. The economic strain also affects industries like feed suppliers, vets, processors and consumers. Overall, preventing and controlling Newcastle disease is crucial for the poultry sector to avoid these economic losses.

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How Newcastle Disease is spread

Newcastle Disease virus can infect chicken through the nose and mouth, and sometimes even through their eyes, although it typically requires a high amount of virus to cause an infection, depending on the strength of the virus. The virus is also shed through the nose and mouth, and also in the droppings or faeces by an infected chicken. Most types of Newcastle Disease virus cannot last long in the environment because they cannot handle high temperatures. However a few can survive heat, and these are mostly the weaker types that spread through droppings into the mouth.

In commercial poultry farms, Newcastle Disease can infect flocks through various breaches in biosecurity, such as contaminated food, individuals, eggs, or vehicles. It can also enter through infected birds introduced into multi-age farms or via aerosols from neighboring properties or wild birds. Once a few birds get infected, the virus tends to spread within the flock mainly through aerosols. In large flocks, significant amounts of aerosol virus can be generated, which may disseminate to other flocks through air movements.

Wild birds and rodents can potentially spread Newcastle Disease. They can carry the virus in their feces, nasal secretions, or feathers and transmit it to chicken through direct contact or by contaminating feed, water, or the environment. While wild birds are considered natural reservoirs for Newcastle Disease virus, rodents may also play a role in its transmission, especially in situations where they have access to chicken facilities and can contaminate feed or water sources. Therefore, controlling access of wild birds and rodents into chicken houses and maintaining good biosecurity practices are important measures to prevent the spread of Newcastle Disease.

Outbreaks of Newcastle Disease known as epizootic ND, typically stem from infected chicken, with the spread often linked to the movement of chicken in live bird markets and among traders. A chicken carrying ND can transmit the virus to a separate flock that is entirely susceptible, leading to mortality rates of up to 100%.

In indigenous chicken populations, there's a recognized form of ND that occurs regularly but only causes occasional deaths. This form has not gained official attention because the number of deaths is relatively low. The affected flocks typically arise from breeding birds that have survived a previous outbreak. Although many birds become immune, the virus can still pass from one susceptible bird to another. This endemic form often results in mortalities among young birds. Over time, as more birds remain susceptible, the virus can spread rapidly, leading to numerous deaths. Computer models suggest that a population of 1,000 birds is large enough to sustain this endemic virus. Such a population could be flocks of chicken in a large village or several nearby small villages.

70%

Poultry population in Kenya courtesy of indigenous chicken production systems

2-15 days

Incubation period for Newcastle Disease in chicken

Newcastle Disease Prevalence during festive season

The occurrence of Newcastle Disease outbreaks exhibits a seasonal pattern influenced by human activities. For instance, during festive seasons the increased turnover of chicken in live bird markets has historically coincided with outbreaks of ND, which were previously attributed to seasonal weather conditions. However, it's likely not directly linked to weather but rather to the practice of farmers visiting relatives and gifting chicken during these times.

In many regions, villagers are aware of the season when ND tends to occur or recognize the early cases. As a response, they often sell their chicken, which can inadvertently contribute to the initiation or continuation of outbreaks. Vaccination can change the pattern of ND occurrence to a degree by preventing disease, but they don't stop infection entirely.

When vaccinated birds come into contact with the virulent virus, they will not show any signs of illness. However, some of the virus they encounter will replicate, and the birds will still shed ND virus. Although vaccinated birds may not shed as much virus as susceptible birds, there will still be enough to infect other chicken.

Clinical Signs

The incubation period for ND in chicken varies from two to 15 days. Lentogenic strains typically result in subclinical infections or mild respiratory disease. Mesogenic strains can lead to acute respiratory disease and neurologic signs in some chicken, although the mortality rate is low. Velogenic strains prompt a range of clinical signs, from sudden death to lethargy, conjunctival reddening, swelling of the head, watery greenish diarrhea, and respiratory signs. Additionally, they induce neurologic signs such as tremors, paralysis, and torticollis (twisted neck).

Control

Vaccination stands as the primary method for controlling Newcastle Disease. However, the currently available vaccines predominantly cater for commercial chicken producers who manage large flocks of chicken confined to specific areas and of

the same age. These vaccines, which are sensitive to heat, are manufactured in multi-dose vials containing either 500, 1,000, or 2,000 doses and above. Ensuring a consistent cold temperature throughout the entire supply chain, known as the "cold chain," is essential from manufacturing to the point of use.

On the other hand, local chicken are typically raised in small, free-range flocks of varying ages, making the use of large multi-dose vaccine vials impractical. Furthermore, sustaining the cold chain in rural settings poses significant challenges, and the cost of purchasing large multi-dose vaccines is prohibitive.

AVIVAX I-2 Newcastle Disease vaccine, locally produced by KEVEVAPI, is a live, non-pathogenic, and thermotolerant vaccine addressing limitations associated with large multi-dose vaccines and access to cold chain infrastructure in rural areas, within the indigenous chicken sector. AVIVAX I-2 is packaged in vials with minimum 50 doses.

AVIVAX I-2 Newcastle disease vaccine is stored at +2 to +8 degrees Celsius or under refrigeration, away from direct sunlight. The vaccine can maintain its protective capabilities for 8 weeks at 28 degrees Celsius when in freeze-dried form and stored in the dark. Once reconstituted, the vaccine will remain effective for two days under field conditions. AVIVAX-1-2 vaccine is best administered using a dropper to place one drop into the eye of the chicken.

To control outbreaks of Newcastle disease in chicken, measures such as quarantine, removal of all infected and exposed birds, and thorough cleaning and disinfection of chicken facilities should be employed. In regions where outbreaks typically happen annually, the vaccine may be strategically given before the usual time when seasonal outbreaks are expected to begin. Commercially available vaccines for Newcastle Disease come in live, inactivated, and recombinant forms. However, it's important to note that these vaccines do not offer complete immunity, and chicken need to be revaccinated from time to time. Talk to your animal health service provider for more information.

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SILAGE PRODUCTION

Silage Making

The silage production process involves four stages, namely, forage harvesting, transport to the silo, compaction and silo sealing

By Dr Jesse Kagai

To make silage, you need to have excess fodder during the season of feed abundance to be used in the season of feed scarcity. Silage making has a cost involved and can only be cost-effective if what is being preserved is in excess of what is being consumed by the animals. The silage production process involves four stages, namely, forage harvesting, transport to the silo, compaction and silo sealing. Before making silage, you need to know the amount of silage required (feed budget), which depends on the following factors:

1. Number and type of livestock to be fed on the silage.
2. Length of the feeding period (feed scarcity period).
3. Percentage silage in the full ration.
4. Material resources available (equipment, labour, finances, technical
5. assistance, etc.).

To make good quality silage, the following basic principles have to be followed irrespective of the amount to be made.

1. The material to be conserved must have a high nutritive value, harvest fodder at the right stage.
2. The forage must not be contaminated with soil.
3. The forage should be chopped into pieces no longer than 2 cm to facilitate good compaction and reduce air retention.

It is necessary to expel the maximum amount of air within the forage before closing the silo preventing air and water penetration. This is achieved by good compaction.

When using silage, the area exposed to air should be as small as possible and the time between opening and finishing the silo as short as possible. The best system is to create silos that can be emptied over short periods, so the actual silo size depends on the amount of silage per animal and the number of animals to be fed from the silo. For farmers with few animals, it is better to have several small silos than one big silo that takes a long period of time before being emptied during feed out.

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The following are the advantages of using silage:

Drought reserve: Silage is made from pasture or crop in times of plenty and stored for a long period. The silage is fed to animals only in times of extreme feed scarcity. Increased productivity- where some fodder types are of high quality but only available at a particular time of the year, e.g. maize silage in dairy production systems.

Help in the management of fodder crops: Silage making gives farmers the opportunity to harvest fodder at the right stage as opposed to cut and carry system where the grass is daily cut and directly fed to contained livestock. Harvesting the fodder for silage making also gives time for regrowth and thus increasing biomass production over time.

Ensiling process

The key to making silage is to create the right conditions for a good fermentation. Micro-organisms digest the sugars in the fodder and molasses to produce lactic acid, which acts as a natural preservative. This fermentation also makes the starch and fibres of the fodder easier for livestock to digest.

Harvest the fodder at the most nutritive stage; Napier at 4 feet high or maize at dough stage and wilt it to lose excess moisture. Chop the fodder into small pieces (2-3 cm) by either hand, (but this requires a lot of labour) or a chopping machine. This is the best size for faster fermentation process and your cattle's digestion. If you do not have a chopper, then find one to rent when making silage. The chopped fodder should not be left piled for long because it will heat up and this will increase the chance that everything will spoil.

Then prepare the silo which can either be tube silo or pit silo, depending on the amount of silage to be made and the materials available. For fermentation to occur, the fodder must have enough fermentable sugars. For maize silage, the fodder already has enough of these sugars and therefore we do not need additives, however, for Napier grass silage, prepare molasses and water mixture at a ratio of 1:2.

Make silage in a space protected from potential disturbances. Make sure it is protected from direct sunlight and water as this will rot the silage, and from animals that may dig into your silage pile.

During compacting, add small layers of chopped fodder as you compact using bare feet and repeat this till you fill the silo while sprinkling the molasses mixture (for Napier grass silage) after each layer of fodder added. To reduce the risk of air pockets in the pile, compress the edges well. The more you compress it, the more air you push out of the pile to ensure a good fermentation.

When you have finished, make sure the silo is well sealed to avoid air getting into the silage. To keep the silo compressed, place a heavy object e.g. stone on top of the silage bag or soil on top of pit silage. Silage will be ready after 21 days but should only be opened for feeding when there is shortage of feed.

During feed out, it is normal that the top thin layer will be a little darker when opened due to residue air. Once the silage is ready for use, feed it continuously and close the silo after every feeding. Remove the silage in layers of smooth and even surfaces to avoid letting in air deep into the silo. Any silage that is too dark or rotten, do not feed it to any animals.

Like any new feed, it is always best to introduce the silage gradually, so the animals get used to the taste. It is best not to feed silage to animals under 6 months as their digestive systems are not fully developed. Silage is not easily digested by calves, so they will not benefit from its nutrition.

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THORN MELON

Unlocking the Potential of Thorn Melon

Thorn melon can grow naturally on its own, or it can also be cultivated on farms and greenhouse. It flourishes in diverse weather conditions

By Vincent Kinyanjui

Thorn melon, often referred to as kiwano, is a highly nutritious drought resistant exotic fruit from cucurbit family. A thorn melon has a thick skin, a juicy fleshy pulp with savory taste and seeds in the inside. Its skin is covered by horn-shaped spikes, weighs between 200g and 400g and a green colour that turns orange when ripe. The pulp can be eaten raw, added as fruit salads or blended to juice.

Thorn melon can grow naturally on its own in the field, it can also be cultivated on farms and greenhouse. It flourishes in diverse weather conditions; hot - warm weather conditions in the arid and semi-arid lands (ASALs). Top growing counties in Kenya are Kirinyaga, Makueni, Murang'a, Nakuru, Mandera, Kiambu, Lamu, Bungoma, Embu and Machakos.

In the information era, where internet access has proliferated all aspects of the society, individuals are actively seeking knowledge on nutrition and diet while also researching information on agricultural crops with significant returns and health benefits.

This convergence of nutritional needs and interest in agriculture has made thorn melon emerge as a super fruit with numerous health benefits, affordability, all-weather crop and ease of cultivation. It makes it an attractive agribusiness opportunity for small scale farmers to capitalize into the growing market for thorn melons.

Health benefits of thorn melon

1. **Promotes cardiovascular health** – Thorn melon is rich in vitamin E which promotes blood circulation, regulates blood pressure and is rich in iron which is responsible for formation of red blood cells.
2. **Promotes eye health** – Contains vitamin A essential for improving eye sight and preventing eye related problems.
3. **Boosts immunity** – It has antioxidant properties that strengthen the body by fighting bacterial infections, calcium, magnesium and zinc minerals which promote strong and healthy bones. The antioxidant properties suppress the formation of cancer cells.
4. **Promotes skin health** – Provides vitamin C which produces collagen responsible for skin detoxification, skin repair and wrinkle reduction.
5. **Thorn melon fiber promotes digestion of food** through increased metabolism and helps reduce the cholesterol levels in the body.

Ecological requirements for growing thorn melon

Thorn melon crop can thrive in any type of weather; it requires well drained fertile soil rich in organic matter with a pH between 6 and 7. A warm temperature range of 20-30 degrees Celsius during its early stages of growth is favourable for thorn melon cultivation and can withstand temperatures of up to 40 degrees Celsius at late stages. Low rainfall of 400mm - 800 mm is suitable for the crop to flourish. Irrigation is advised during germination. Thorn melon performs well in low to high altitudes of 300m - 1800m above sea level.

Seed propagation and planting

There are two methods for growing thorn melon: direct soil seeding and nursery-grown seedlings that are then transplanted to the field. Ripe fruit can be used to extract the seeds, which are then sun-dried for up to three days.

1. Plough land twice, harrow it to break hard pans to achieve fine tilt and level surface.
2. Create 25 cm height seed holes, each hole should be separated by 1m from each plant and 1m between rows. Two thorn melon seeds should be planted in a hole mixed with sufficient compost or animal manure.
3. The crop germinates after 4 weeks, watering is key at this stage, mulch if necessary to prevent moisture loss through evaporation.
4. Ensure each crop has a support system as thorn melons are climber plants that require support structures to grow.
5. Thorn melon is drought resistant but irrigation is recommended after germination until they have stable stems.
6. Weeding should be carried out continuously to prevent competition for nutrients and pest attacks.

Pest and disease management

Although thorn melon is a pest-resilient crop, pests that can attack thorn melons are aphids, white flies, melon flies, thrips and termites. They can be controlled through integrated pest management techniques, spraying the crops with neem and soap extracts and application of organic pesticides where infestation has persisted. Thorn melons are commonly affected by diseases that are susceptible to the cucurbit family such as fruit rot, cucumber mosaic virus, tobacco ringspot virus and cucumber mosaic virus. These diseases can be prevented by practising crop rotation, proper farm hygiene practice and disposal of infected crops.

Organic fertiliser application is essential to ensure the plant absorbs nutrients and develops a sizeable fruit. During planting, organic manure is mixed with soil; seven weeks later, organic foliar fertilisers rich in phosphorus for development of roots may be applied, copper-based fertilisers may be applied for development of leaves and fruits at 14 -days interval until harvest.

Harvesting takes place after 4 months when the fruit reaches maturity and turns colour from green to orange, green fruits can also be harvested at this point. The fruit is harvested by plucking it from the vine, it is washed and packed ready for market. Harvesting can be carried out for up to 2 months and thorn melon fruits can be stored for up to 6 months. A point of land can take up to 400 plants and a plant can yield between 7 and 10 fruits.

Market prospects

The prices of thorn melon fruits vary based on location and market. In local open markets one piece of thorn melon costs between ksh20 and ksh50 while in mini and super markets it costs between ksh50 and ksh100. According to the Agriculture and Food Authority of Kenya, 1,563 metric tonnes of thorn melons valued at Ksh. 54 million were produced in Kenya in 2022.

In conclusion, there is high potential in production of thorn melon, it is a non-perishable crop with a growing market, a farmer needs to create a market by introducing thorn melon fruits to local and super markets. The farming activity itself is a feasible activity that can be turned into sustainable venture with minimum input and enormous returns in income for producers and significant health and fitness benefits for consumers.

TOF Radio

Through weekly Kiswahili and local languages radio programmes, TOF Radio helps to improve awareness and knowledge of sound agroecological practices, strengthen the link between researchers and farmers to enhance food security, reduce poverty and increase household incomes among farmers in Kenya.

TOF Radio Stations

Emuria FM	Monday and Friday -10-11AM
Getembe FM	Monday 8PM
Milele FM	Tuesday 11-12AM
Mutongoi FM	Wednesday 10-11AM
Coro FM	Thursday 8.20-9PM
Ingo FM	Friday 8-9PM

TOF ANSWERS YOUR QUESTIONS

Physical attributes of a stable, dairy cow

Dear Musdalafa Lyaga,
My name is Amos Odhiambo. Most recently, I have been following your farmer radio program on Milele FM with great interest. Congratulations for the good work you are doing empowering farmers with relevant and timely information. I am about to retire, and my plan is to start dairy farming in my home County, Siaya. I have been reading a lot about dairy farming lately and I am convinced it is what I want to venture in my retirement. But I don't know what to look for when selecting a good dairy cow, please help. - ***Amos Odhiambo, Siaya County.***

Dear Amos, it is commendable that before you take the plunge into dairy agribusiness you are already investing in getting answers to prepare you well for the business. We are here to support you as you embark on this exciting journey. Selecting a healthy and good quality breed will go a long way in the successful running of your enterprise.

One major indication that a dairy cow is healthy and of good quality is having appealing physical characteristics. Here are tips to select a cow with good body build which in most cases if sustained translates to higher yields and long periods of productivity.

A good dairy cow has a long, lean neck blending smoothly into shoulders with straight backlines. The body is long, and wedge shaped which enables the dairy cow to convert much feed into milk. Good udder is important for high milk production. The distance between bottom of udder and ground in relation to height should be shallow and above the hock. Deep udder is prone to injury.

Look for a wide but medium sized udder that does not hang loosely. The teats that point downwards and are spaced evenly make milking easy. Teat length of 5 cm is ideal for machine milking: slightly longer for hand milking. Strong legs and feet enable a cow to feed and walk comfortably especially when pregnant. Choose a cow with straight legs but wide apart when observed from behind or the front. When observed sideways, the rear legs are slightly curved while the front legs stand straight.

Characteristics of a dairy cow are passed to her from her parents. True records will help you choose cows from good families. That is why you need to examine reliable farm records to help guide your decisions when choosing good cows.

Select a cow with history of high milk production. For a heifer, use records of its parents, grandparents or other relatives.

Remember, after purchasing the cow, how well you take care of it will determine how long it maintains stability and productivity. Ensure to have a solid plan of feeding the cows, all the year round. Take advantage of seasons when fodder is in plenty to conserve fodder for the days of scarcity.

Construct a standard cowshed that is easy to clean frequently, and one that shelters the cows from harsh weather. Well maintained cows rarely fall sick but ensure to keep your veterinary officer close for support on disease and feed management.

Mr. Amos, let me take this earliest opportunity to wish you the very best in your retirement as you venture into dairy farming.

Musdalafa Lyaga is the producer of Kilimo Hai, a farmer radio program on ecological sustainable agriculture broadcasted on national radio Milele FM, Regional vernacular stations; Kikuyu-Coro Fm, Luhya-Ingo FM, Kisii-Getembe FM and Kamba-Mutongoi FM. He also supports community radio stations and presently works with Emuria FM based in Busia County. He can be contacted via email; omusdalafa@biovisionafrica.org and phone contact 0715422460.

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