Biovision Africa Trust

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Dear reader,
HERE COMES THE harvesting season, when farmers are expected to reap from their hard work. Despite extreme weather in previous seasons, we are optimistic of good yields. This edition focuses on harvesting and storage techniques for staple foods such as maize and vegetables. We highlight good practice in harvesting maize, new technologies that make threshing efficient and methods of storage that keep the grains safe from contamination and pests. With the right knowledge, you can evade post-harvest losses and maximize your yields. You don't have to lose your valuable produce.

Are you a vegetable grower, who harvests huge produce at a time when the market is flooded, and have to endure scarcity during offseason?

Read on to discover a new way to preserve fresh vegetables for use up to six months after harvesting,

without investing in any equipment. Additionally, with the increasing need to diversify income sources, farmers are turning to poultry keeping and dairy farming motivated by the growing market. This edition also offers information on suitable legumes to grow as fodder for dairy cattle and tips on how to run a successful poultry business right from caring for day-old chicks. Experts share tips on these and many more topics in this edition of the TOF Magazine.

RESIDUE RETENTION

Maximizing Residue Retention: Enriching your Soil for the Next Planting Season

By Mourice Barasa

THERE ARE VARIOUS agricultural residues that are produced in both small- and large-scale farms. In Kenya, most of the farm left overs include; rice straw, rice husks, maize cobs (corn stover) and wheat straws. The residues in many farms are used as fodder for animals, landfill or others end up being burnt during land preparation. In areas where agroforestry is practiced, dead leaves, branches are considered as residues. As farmers approach the maize harvest season, it is essential to consider practices that will enrich the soil for the next planting season. One such practice is residue retention, which involves leaving crop residues on the field after harvest.

Key Farm Residues
Leaves
Maize/corn stover
Sugar cane stover
Rice husks
Rice straw
Wheat straws
Uprooted weeds
Overgrown and dead vegetables

After-Harvest Management of Residue
After harvesting, the field is often left with stalks, leaves, and other plant materials. Proper management of these residues is crucial for maximizing their benefits to the soil. Here are some key steps to consider:

Assess the Residue
Before deciding on a management strategy, assess the amount and type of residue left on the field. Maize typically leaves a substantial amount of residue, which can vary depending on the variety and yield. Understanding the volume and composition of the residue helps in planning its retention, degradability and management effectively.

Decide on the Method of Retention
Once you understand the nature and volume of your farm residues, it is important to make the choice on the retention approach. This is guided by understanding the period it will take your residues to completely decompose. There are various methods to manage crop residues, including mulching, composting, and incorporation into the soil. For maize, direct retention by leaving the residues on the surface or lightly incorporating them into the soil are common practices. Each method has its own benefits and should be chosen based on soil type, climate, and farming practices.

Timing of Residue Management
The timing of residue management is crucial. Ideally, residues should be managed immediately after harvest to prevent them from interfering with subsequent farming activities. This also allows for maximum decomposition time before the next planting season. Timely management ensures that the residues do not hinder soil preparation activities like plowing or tilling.

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How to effectively raise day old chicks

As a farmer ensure you get quality vaccinated day-old chicks from a reputable farmer or well established hatchery. This ensures a good start in the brooding process. **PAGE 4**

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Ensuring Even Distribution of Residue
Uniform distribution of crop residue across the field is essential for achieving consistent soil benefits. Uneven distribution can lead to patchy decomposition and variable soil fertility. Here's how to ensure even distribution:

i) **Use Proper Equipment:** Modern combines and other harvesting equipment are often equipped with choppers and spreaders that can evenly distribute residue across the field. Ensure that these mechanisms are well-maintained and properly adjusted. Chopping the residues also enhances efficient decomposition.

ii) **Manual Redistribution**: In some cases, especially on smaller fields, manual redistribution might be necessary. Use rakes or other tools to spread the residue evenly. This labor-intensive method can be particularly effective in ensuring that all parts of the field receive equal benefits from the residues. Manual spreading can address areas missed by machinery and ensure a thorough distribution.

iii) **Avoid Piling**: Avoid creating piles or windrows of residue, as these can decompose unevenly and create areas of excessive organic matter, which might hinder seedling emergence in the next planting season.

iv) **How to Speed Up Decomposition of Residue**: Accelerating the decomposition of crop residues can help in quickly releasing nutrients into the soil, making them available for the next crop cycle. As a farmer, you should use the following techniques to speed up this process:

v) **Chopping and Shredding;** Breaking down the residue into smaller pieces increases the surface area exposed to decomposers, thus speeding up the decomposition process. Equipment like rotary mowers, use of pangas and slashers, or flail choppers can be used for this purpose. These machines cut the residues into finer pieces, which decompose faster compared to whole stalks and leaves.

vi) **Moisture Management;** Microbial activity, which is essential for decomposition, is heavily dependent on moisture. Ensuring that the soil and residues are kept moist, especially during dry periods, can significantly enhance decomposition rates. Monitoring soil moisture levels can help in deciding when to irrigate to maintain an ideal environment for microbes. However, the residues themselves helps to trap and conserve moisture, which is fixed to the soil.

vii) **Adding Decomposition Agents;** Introducing organic matter decomposition agents, such as compost inoculants or microbial cultures, can accelerate the breakdown of crop residues. These agents enhance the microbial activity in the soil, facilitating faster decomposition.

Benefits of Residue Retention
Residue retention offers numerous agronomic and environmental benefits. Here are some of the key advantages:

i) **Enhanced Soil Fertility**: As crop residues decompose, they release essential nutrients back into the soil, such as nitrogen, phosphorus, and potassium. This natural fertilization process reduces the need for synthetic fertilizers, promoting sustainable farming practices. Over time, the continuous addition of organic matter from residues can build up soil fertility and improve crop yields.

ii) **Improved Soil Structure**
Residue retention contributes to the formation of soil organic matter (humus), which improves soil structure. Better soil structure enhances root penetration, water infiltration, and overall soil health. Organic matter binds soil particles into aggregates, creating a crumbly texture that is ideal for plant growth.

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iii) **Moisture Retention**: Residues on the soil surface act as a mulch, reducing evaporation and helping to retain soil moisture. This is particularly beneficial during dry spells, ensuring that crops have a more consistent water supply. During residue decomposition, the soil will be covered and protected from direct sunlight hence moisture and nutrients will be preserved for the next planting cycle.

iv) **rosion Control**: Crop residues provide a protective cover for the soil, reducing the impact of raindrops and wind. This helps to prevent soil erosion, preserving the topsoil which is crucial for crop growth. Topsoil is rich in nutrients and organic matter, and its preservation is vital for maintaining soil fertility and productivity.

v) **Weed Suppression**: A layer of crop residue can suppress weed growth by blocking sunlight and preventing weed seed germination. This natural weed control method reduces the need for herbicides, promoting a healthier and more balanced ecosystem.

vi) **Fixing of beneficial soil micro-organisms**: Humus attracts vital micro-organisms such as azotobacter and worms which helps in fixing of vital macro and micro nutrients into the soil and crops. Microorganisms are also critical in increasing the volume and to aerate the soil.

FERTILIZER

Molo farmer discovers Mazao Flourish; eagerly beckons farmers to try it out

I would harvest approximately 50-60 bags per acre in the previous seasons, but this time we harvested 80 bags of potatoes, from the same parcel of land

MY NAME IS Rahab Njeri, a farmer based in Molo. I grow crops such as vegetables, potatoes, green peas and maize. In the past, I would use three bags of synthetic fertilizers per acre during planting and two bags per acre for top dressing, which is very costly.

High cost of farm inputs is a major challenge I have grappled with over the years. Other challenges include harsh climate conditions, shortage of certified seeds and soil degradation caused by over-reliance on chemical fertilizers and pesticides. With the prevailing challenges and circumstances, I would harvest 50-60 bags of potatoes from the one acre utilized in growing potatoes.

I came to learn about Real IPM's product, Mazao Flourish from a training they had organized in Molo. Mazao Flourish was positioned as a bio-fertilizer, which captured my interest as I had decided to go all organic in my farming ventures going forward, and Real IPM provided just that.

During the training, the Real IPM representative stressed on the benefits of this bio-fertilizer and its application. I decided to buy 1 litre of Mazao Flourish, try it out in the next planting season and see the results for myself. The first instance I used Mazao Flourish was as a drench to my 2 weeks old crops. We also administered Mazao Flourish two more times as a drench at an application rate of 50ml per 20 litres of water, and a final time during flowering. The potatoes were doing so well, that there was no need for top dressing.

The crops grew with so much vigour compared to my neighbour's crops which were planted on the same day. It even got to a point where my neighbour came up to me to enquire on what I had used on my farm. Mazao Flourish has done wonders in my farm like never seen before.

Real IPM has been very supportive in my crop protection journey. The Real IPM representative educated me on (IPM) Integrated Pest Management during one of his visits to my farm. He offered a biological solution against Early blight and Fusarium wilt with Mazao Regain and Mazao Sustain respectively. Moving on swiftly to the harvesting season, and we are set for harvesting. Since I transport my produce to Nairobi, I sought some help in harvesting. Now here is where the shocker is, 80% of the potatoes were grade A.

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The crops grew with so much vigour compared to my neighbour's crops which were planted on the same day. It got to a point where my neighbour came to enquire on what I had used on my farm

As I had previously stated, I used to harvest approximately 50-60 bags per acre in the previous seasons, but this time we harvested 80 bags of potatoes, from the same parcel of land.

I started using it as a bio primer to various crops and crop emergence was notably remarkable as the germination rate was almost 100%. As a farmer, I'm routinely used to replanting where the seeds did not germinate. But Mazao Flourish has proven that this is a problem that can be solved.

After these impeccable results, I have never gone back to my previous farming practices. I have adopted Mazao Flourish biofertilizer in all my crops and my life has never been the same. I advise all farmers to use Mazao Flourish in all their crops and they will never look back.

I have walked with Real IPM now for the last 5 years and it has been an exhilarating and healthy journey for me, my clients and my family. Biological farming is the way to go.

Over-reliance on chemical fertilizers and pesticides aches our soil, leading to the speedy soil degradation that I and other farmers have experienced, which adversely affects us in one way or the other. Let's protect our food source globally.

Reach out to Real IPM on 0725 806 086.

DAY OLD CHICKS

How to effectively raise day old chicks

As a farmer ensure you get quality vaccinated day-old chicks from a reputable farmer or well established hatchery

Vivian Machanury

RAISING DAY OLD chicks is a challenge to many farmers. Day old chicks are very delicate and require utmost care for them to survive. As a farmer ensure you get quality vaccinated day-old chicks from a reputable farmer or well established hatchery. This ensures a good start in the brooding process. Before you bring the day-old chicks to the farm, here is a checklist you need to work with.

1. Housing and clean environment
2. Heating and lighting
3. Clean drinking water
4. Adequate nutritious feeds
5. Vaccination schedule
6. Transport

Housing and clean environment: Day old chicks are raised in a brooder which is basically an enclosed space preferably circular in shape. Why circular? To prevent chicks from huddling together in a corner causing stampede or death. The brooder should be made of cardboard or plywood material. The housing and surrounding environment should be safe, well ventilated, dry, and very clean. Ensure surrounding area is clear of bushes, swept regularly and the structure made in such a way that predators cannot access the day-old chicks. The housing should be well ventilated to allow for fresh air circulation. The floor of the brooder should be lined up with deep litter such as wood shavings spread evenly at a height of 3 inches. This acts as a mattress for the chicks providing some level of warmth and comfort. More importantly, the wood shavings absorb moisture. Please note wood shavings and saw dust are different.

Avoid using saw dust as deep litter as this may cause respiratory problems to chicks as well serve as a breeding ground for fleas. The wood shavings should be aired and dried in the sun and applied with dudu dust before being placed in the brooder. This should be done last after cleaning and fumigation. Wet litter forms a conducive environment for coccidiosis. If water spills, remove the wet litter and dispose. Help the chicks turn the wood shavings every two days. At the entrance of the chick house there should be a foot bath with disinfectant where a farmer or attendant dips their feet before entering the brooder. This is to avoid spreading germs collected outside. Clean and fumigate the house and its surrounding environment a week before the chicks arrive. All equipment should be cleaned and disinfected.

Heating and lighting: Heating and lighting is a prerequisite for day old chicks. Identify a source of heat that you can use in the brooder. It could be a lamp, neon bulb or a plastic container with hot water. Personally, I make charcoal briquettes. I mix charcoal dust with soil and roll them in round balls and dry them in the sun. So, for heat I use a pot with perforated holes which is hang in the brooder. I use charcoal and the briquettes for heat which enables me to save on heating.

The temperature should be at least 34 degrees celsius for the first 2 weeks. The brooder should be preheated at least 3 hours prior to chicks being placed in there. The brooder is heated because when chicks are cold they will not eat. Instead, they will spend time looking for warmth, huddling together and this affects their growth. Be very cautious where you place the heat source. If you place a jiko on bricks, the chicks can go under the jiko looking for warmth and end up getting roasted. Others may get burnt. Hang it cautiously in the brooder. Monitor the temperature closely. You can tell if the temperature is right by the chickens' behaviour. If it is cold, you draw the curtains in the brooder house to protect the chicks. When it is warm, they are bubbly, eating, drinking and growing. If chicks are too hot or cold, they will chirp noisily. Check on them regularly.

Lighting is also necessary because they need to see the food to eat. Ideally 12 hours of light per day is good enough for their growth. On the day of arrival, ensure you have clean drinking water placed strategically in the brooder. For day old chicks, a ratio of 1 drinker to 10 chicks works. For the first 3 days, add chick start in their water to provide the needed energy. Water drinkers should be

washed daily- every morning before refilling with fresh clean water, this will prevent spread of bacteria. The chicks should always access fresh clean water. Keep checking to refill during the day.

Adequate nutritious feed: Day old chicks need a high protein diet to support their growth and development. I buy commercially available feeds - chick mash that are well formulated to provide necessary nutrients for growing chicks to thrive. On day 1-3, place the feeds on a spread-out carton or newspaper.

This is to help the chicks distinguish feeds from litter. After that use feeders. Arm yourself with a vaccination schedule. When you buy the chicks confirm the vaccines that have already been administered. Then get a schedule for vaccinating your chicks. Vaccinated chicks have a higher survival rate as opposed to those without vaccination. Prevention is better than cure. Protect your chicks from diseases such as Mareks, New Castle, Gumboro and Fowl pox.

Transport: The day you pick the chicks ensure you have no other business. Pick the chicks and go straight to the farm. The birds get stressed as they travel and need to be settled as fast as possible. Day old chicks are transported in small boxes that are well ventilated. With small boxes, the chicks can huddle together for warmth. Managing day old chicks is a valuable skill for any poultry farmer.

All you need is to assume you are now the mother hen. The chicks depend on you to meet their needs - warmth, food, water. If you do a good job, you can attain 100% survival rate. A loss of up to 5% is acceptable given the various challenges. It is not difficult to brood day old chicks, but one must be committed and dedicated to the poultry project. I encourage us to rear what we eat especially if you live on a farm.

VEGETABLE PRESERVATION

Preserve your vegetables by blanching

By Pamela Otieno

BLANCHING IS A process of scalding vegetables in boiling water or steam from boiling water for a short time, after which they are immersed in cold water to stop further cooking. Blanching inactivates enzymes which cause loss of flavour, colour and texture. To cool them off, rinse under cold running water or into a cold-water bath, while stirring the vegetables to transfer the heat from the vegetables to the water. Just before blanching the vegetables, add salt to the boiling water as salt helps to maintain colour and improve flavour.

Steps of blanching vegetables

1. Pick and sort the vegetables from damaged leaves, remove all foreign materials and wash the vegetables until clean.
2. Chop the vegetables in small pieces.
3. Boil clean water in a big sufuria and add 1 tablespoon of salt in every litre of water.
4. Using a piece of cloth put the cut vegetables in a cloth and tie.
5. Immerse the tied vegetables in the boiling salty water for 1 minute, then remove and immerse them in cold water for 5 minutes to stop further cooking.
6. When vegetables are cool, spread them on a raised rack and leave them to dry, this should be done under shade to retain the chlorophyll matter. You can use a solar dryer if available. Well dried vegetables can easily be crushed into flour by pressing them.
7. Once they are well dried pack them in an airtight container and store in a cool dry place.
8. Dried vegetables can be stored for six months.

Advantages of blanching

1. Inactivates enzymes which cause loss of flavor, colour and texture.
2. Helps slow loss of vitamins.
3. Blanching removes surface dirt and micro-organisms.
4. It increases the shelf life of vegetables.
5. Blanching allows a farmer to have vegetables for future use in time of scarcity.

AZOLLA FARMING

Farmer supplements poultry feed and earns some income from azolla farming

By Miriam Makato

POULTRY FARMING HAS gained popularity in Kenya due to the ease in management and fast returns, as compared to other livestock enterprises such as dairy cattle keeping. However, this sector has faced a major challenge-an increase in feed prices, which has caused small scale farmers to reduce the number of birds kept in the farm. This has been the case with Wilson Muindu, a farmer based at Kyai, Kangundo Sub county. The challenge had made him reduce the bird population, up to 20. This situation changed when he learnt about azolla farming for poultry feeding.

Wilson learnt about Azolla farming for the first time through Plant Village and through information from The Organic Farmer Magazine and with support from *Hand in Hand East Africa*, he established a demonstration plot. "I learnt on how to grow Azolla from The Organic Farmer Magazine, and with the help of Hand in Hand East Africa, I obtained the starting material to establish the farm, which is now a demonstration plot where other farmers come to learn," says Muindu. Azolla farming has been adapted fast by farmers in Kenya, due to its high protein content and ease of propagation. The commonly grown azolla variety is Azolla Pinnata. Azolla farming has been done for centuries in Southern China and Northern Vietnam, where it is used as a bio fertilizer and green manure for rice crops due to its Nitrogen fixing ability.

The stages of establishment were as follows:

- A pond was established, measuring 2m by 1.5 m and 1 foot deep. The pond was dug in a shaded area (under a tree) since azolla doesn't do well in direct sunlight.
- A black polythene paper was placed in the pond, and the edges in the banks covered with soil.
- 10kgs of soil were added into the pond.
- Slurry was also added (1 bucket)-to provide phosphorus, which fastens azolla growth.
- Water was added, up to 15 cm height.
- The pond was left to settle for 3 days
- Azolla (sourced from another farm) was introduced into the pond. The plants were broken by rubbing in the hands, for faster multiplication.

After establishing the pond, the azolla multiplied and the first harvest was done after 2 weeks. After that, Harvesting is done on daily basis, and he harvests 1 kilogram daily. Harvesting is done using a tea sieve, after which the azolla is cleaned and fed to the poultry. Azolla has nutritive values to poultry such as: proteins, fatty acids, amino acids and vitamins (A, B12 and beta carotene). The best way to feed azolla is by incorporating it in 15% of the poultry feed.The plant can also be grown in tanks (the blue water tanks). They are cut vertically into halves, and placed on the ground or on an erected area.

Management practices when growing azolla include:

- Replacing 25% of the pond water after 10 days, to prevent Nitrogen build up.
- Adding a kilogram of cow dung every week, to provide azolla with phosphorus.
- Ensuring that the water in the pond is not below 10 cm depth, to prevent azolla roots from touching the soil.
- Replace the pond/tank water after 6 months.

Other than feeding azolla for his poultry, Wilson also sells azolla for propagation to farmers, at Ksh 1000 per kilogram. This has boosted the farm's income. He has also increased the bird population to 40, which is a commendable progress. With increase in poultry feed prices, farmers can grow azolla in the farm as a supplement feed and also earn income. This will increase farm production, and diversification.

Miriam Makato is a extension Officer working with Biovision Africa Trust. Email: mmakato@biovisionafrica.org

MOTORIZED THRESHER

From Drudgery to Delight:

How Motorized legume thresher has improved threshing efficiency and yield

By Mary Kanda

AGRICULTURAL TECHNOLOGY DEVELOPMENT Centre (ATDC) Katumani is a technology development organization under Ministry of Agriculture and Livestock Development mandated to empower and capacity-build farmers and SMEs in Machakos, Makueni, Kitui, and Kajiado counties on various agricultural technologies with the aim of increasing agricultural production. One of those technologies that is readily accessible to farmers and meant to reduce drudgery in the postharvest handling of legumes is motorized legume thresher.

For generations, farmers have relied on backbreaking labour to separate different legumes from their pods. Manual threshing is a tedious, laborious, and capital-intensive activity. However, with a motorized legume thresher, farmers are able to save time, costs, and post-harvest losses that come with manual threshing. Motorized legume thresher has multiple sieves of different sizes to enable the farmer thresh a variety of legumes e.g. beans, green grams, cowpeas etc. It is also equipped with a blower that cleans the threshed product, saving the farmers the mundane task of winnowing.

Major Components of the thresher

The motorized legume thresher consists of feeding hopper, threshing unit, collection and discharge system, fan, and sieves. Since different types of legumes come in different sizes, the thresher incorporates multiple sieves that match the nominal diameter of these seeds.

Figure 1: Motorized legume threshers with multiple sieves

Precautions to observe during threshing

Motorized threshing is a critical operation that if not properly executed can result in seed breakage. For effective threshing, the legumes should be dry to a moisture content of 14-18%. Moisture content beyond 18% lowers the efficiency of the thresher by making it difficult to separate the grains from the pod while moisture below 14% poses the risk of grain breakage. The following precautions need to be observed before and during threshing. One should;

1. **Familiarize themselves with the operation and safety instructions** provided to understand the proper procedures for starting, operating, and stopping the thresher.
2. **Inspect the thresher before operation:** Check for any signs of damage, loose bolts, or worn-out components that could affect safety or performance.
3. **Wear appropriate clothing and personal protective equipment (PPE):** Wear close-fitting clothing, sturdy footwear, and appropriate PPE such as gloves, eye protection, and hearing protection if need be.
4. **Keep clear of moving parts:** Wait until the machine has completely stopped and the power source is disconnected before attempting to clean, adjust, or repair any part of the thresher.
5. **Avoid overloading the thresher:** Overloading can lead to decreased performance and damage of the machine.
6. **Avoid threshing wet and damp crops:** Threshing wet or damp crops can increase the risk of equipment clogging and reduce threshing efficiency. Aim to thresh crops when they are at a moisture content of 14-18% for optimal performance.

Machine output

Motorized legume thresher mounted with petrol engine uses one litre of petrol fuel to thresh 300-350kg/hr of green grams and 70-110kg/hr of beans depending on the variety and degree of vegetative materials. A farmer operating motorized legume thresher for 5 hours a day, with an average cost of one litre of petrol being Kshs 192, will require 5 litres of petrol at a cost of Kshs 960 to produce 1500-1750kg (16-19 bags) of green grams and 350-550kg (3-6 bags) of beans in a day. This is far much cheaper compared to hiring two people at a cost of Kshs 1,000 per day to produce the same quantity in 2 days using manual labour.

Fig 2: Testing of motorized legume thresher

Fig 2: Testing of motorized legume thresher

Accessibility of motorized legume thresher

Motorized legume threshers are available at our station and can be accessed by individual farmers or farmer groups following formal requisition through the centre manager. The station also links individual farmers/ farmers groups to local manufacturers or dealers to acquisition of own machines.

Other technologies offered by station:

Walking tractor and its attachment for land preparation, chopper shredder, manual hay baler, and brush cutter for livestock feed making. The station also has value addition technologies e.g. fruit pulper, vegetable slicer, cassava chipper and honey processing equipment.

Mary Kanda is the CEO of Agricultural Development Centre

FODDER LEGUMES

Top Fodder Legumes for Boosting Dairy Cattle Productivity

Legumes offer 15-35% crude protein, outperforming grasses (5-19%) and dairy meal (15-22%). They are also rich in calcium, phosphorus, and vitamins A and D

By David Njenga

FODDER LEGUMES PLAY an important role in the smallholder farmers' dairy farming system as they improve soil fertility through Nitrogen fixation and have high Crude Protein (CP) in leaves and foliage and they can replace commercial supplements.

Crude Protein range for legumes is 15-35%, compared to grasses whose CP ranges between 5 and 19%. It also ranges higher than dairy meal which is 15-22%. Also, legumes are rich in calcium and phosphorous minerals as well as vitamin A and D. Below is a list of legumes that could benefit dairy farmers.

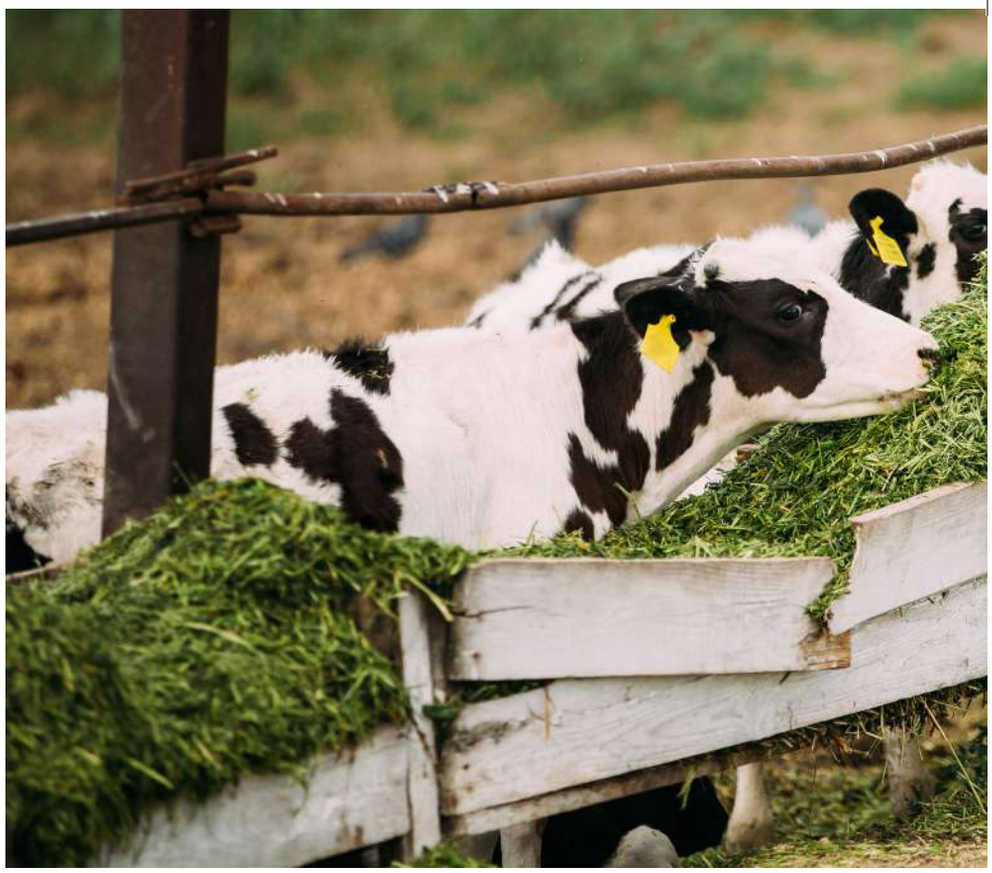
a) LUCERNE (Medicago sativa)

Lucerne is a high yielding perennial forage legume that grows upright to about 1 meter. It is good for hay conservation or silage. Once planted, Lucerne stays productive for 4-6 years. It is generally grown on pure stand. It is drought resistant and deep-rooted, highly palatable and has Crude Protein of about 19-22%.

Lucerne is sensitive to soil acidity and requires almost neutral soil pH.

Agronomical requirements and yield for Lucerne:

- **Rainfall:** Well distributed rainfall of 870 mm and above.
- **Soils:** Well drained fertile soils. pH 6 -6.5 (Sensitive to soil pH).
- **Propagation:** - By use of seeds.
- **Planting:** Normally drilled but can be broad casted or sown in a depth of not more than 10 cm. Seed bed should be well prepared and firm for good germination.
- **Seed rate:** 5kg/acre drill and 8kg/acre broadcast.
- **Spacing:** 20x25 cm.
- **Maturity:** 4-5 months depending on the weather.
- **Yields:** 375-550 Hay bales/acre/year. Cutting intervals of 4-8 weeks are viable.
- **Feeding value:** Crude Protein:19-22, Dry Matter:21, Crude Fiber 21 %.



Lucerne Variety	General information
1. Delight lucerne	Suitable for high and medium rainfall areas, higher producer, high leaf ratio and tall. Perennial type.
2. Delight Ultra	Suitable for high and medium rainfall areas, higher producer, high leaf ratio and tall. Bi-annual type.
3. Cuf 101	Suitable for low rainfall areas, average production, high stem ratio
4. Trifecta	Hybrids, suitable for all AEZs under irrigation, high producer, average stem/leaf ratio
5. Aurora	Hybrids, suitable for all AEZs under irrigation, high producer, high leaf ratio

b) DESMONDIUM (green leaf-Desmodium

intortum and silver leaf-Desmondium uncinatum). Desmodium is a climbing perennial with deep roots, long stems that branch freely and with roots at the nodes. It can tolerate low temperatures. It is a good intercropping legume with Napier. There are two varieties which are basically the same but the silver leaf variety has been reported to tolerate frost more than the green leaf one.

- **Rainfall:** Well distributed rainfall of 870 mm and above.
- **Soils:** Prefers light to clay loams, PH >5.0.
- **Planting:** Seeds may be broadcasted or drilled. Sown not more than 1cm deep and rolled.
- **Propagation:** By use of seeds, vine cuttings or root splits.
- **Seed rate:** 2kg/acre or 4,000 pieces of vines/acre.
- **Spacing:** 20x25 cm for seed or 1x1M for cuttings.
- **Yields:** 5-8 tons of DM /acre/year.
- **Feeding value:** Crude Protein:15-20, Dry Matter: 20-26, Crude Fiber:25-30 %.

Lucerne at flowering stage

Silver leaf (Desmondium uncinatum)

(c) LUPIN (Lupinus albus).
There are many varieties of Lupins but the common ones are the White lupin (Lupinus albus) and Blue lupin (Lupinus angustifolius).

- **Soils:** Lupin is most productive in high rainfall, cool climate and tolerates low temperatures.
- **Seed rate:** 12-15 Kg/acre depending on the variety/size of the seed/Hand or machine planting.
- **Spacing:** 45x30cm.
- **Maturity:** 120-150 days.
- **Disease/pest control:** Planting in well drained soils, rotation and use of certified seeds helps control diseases and pests. Treat soil with bio-fungicide (Trianum bio-fungicide) just after germination to control fusarium wilt infection. Lupinus angustifolius is particularly more susceptible to Aphid infestation and attack by wild rabbits at the early stages of growth.
- **Grain yield:** Approximately 600-1000kg/acre, grains are milled for feed compounding with a mixing ratio - 1 part Lupins to 3 parts Maize.

Feeding value:
- **Variety:** Lupinus albus - Crude Protein:29-32, Dry Matter:95, Crude Fiber:10%, kcal/kg 2,444.
- **Variety:** Lupinus angustifolius – Crude Protein:34- 38, Dry Matter:93, Crude Fiber:4 %, kcal/kg 2173.

Purple vetch pure stand crop

David Njenga is a seeds expert at Advanta Seeds
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AGRIBUSINESS

Young farmer thrives in organic pawpaw farming for the market

From a half an acre piece of land, Jackson sells 40 pawpaws weekly on average. He has established market at a nearby school and takes the remaining fruits to the market

By Keziah Otieno
IN THE SUN-SCORCHED area of Machakos County's Mbuuni village, where the earth often seems reluctant to yield, Jackson Chalo a 29 year old, has defied the odds by successfully producing a high yielding variety of pawpaws.

Jackson's interest in fruit farming developed when he met Anthony Musili, an extensionist working with Biovision Africa Trust, based in Machakos County. "Musili opened my mind on the potential of fruit farming especially pawpaw production for the market. He also introduced me to the practice of organic farming which is not only cost efficient but also beneficial as it leads to production of toxin free farm produce," says Jackson. Through acquired information from TOF Magazine and Infonet Biovision *https://www.infonet-biovision.org/crops-fruits-vegetables/papaya-revised* Jackson conducted a thorough investigation into pawpaw farming methods specifically designed for dry regions. He decided to grow the versatile Malkia variety whose cultivar he sourced from a trusted agrovet.

Why Choose Malkia?
There are various pawpaw varieties such as: Solo, Red Royale, Sunrise Solo, Kapoho and Waimanalo. Among these varieties, Malkia stands out for the following reasons:

Adaptability: Malkia pawpaws are known for their adaptability to a wide range of environmental conditions, including arid climates like those found in Machakos County. Their resilience makes them well-suited for cultivation in challenging growing environments.

Robust Growth: Malkia pawpaws exhibit vigorous growth and prolific fruiting, producing abundant yields of high-quality fruit. This trait ensures a consistent harvest and reliable income for farmers like Jackson.

Disease Resistance: Malkia pawpaws possess natural resistance or tolerance to common diseases prevalent in the region. This reduces the need for chemical interventions and minimizes the risk of crop losses due to pest and disease pressures.

Fruit Quality: Malkia pawpaws are prized for their excellent fruit quality, characterized by sweet, flavored flesh and attractive appearance. Their superior taste and texture make them highly desirable in both local and export markets.

Market Demand: Malkia pawpaws are in high demand among consumers due to their exceptional flavor and nutritional value.

Jackson's decision to cultivate Malkia aligns with market preferences and enhances the commercial viability of his pawpaw farm. In his pawpaw farm, pest and disease management are integral components of his holistic approach to sustainable agriculture. Understanding the potential threats to his crop and adopting proactive measures are paramount to maintaining a healthy and

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productive orchard. Here's a detailed look at Jackson's approach to pests and diseases management in pawpaw farming:

Preventative Measures: Jackson prioritizes preventative strategies to minimize the risk of pest and disease infestations. This includes maintaining proper hygiene practices within the orchard, such as removing fallen leaves and fruit debris that could harbor pests and pathogens. He also practices crop rotation and intercropping techniques to disrupt pest life cycles and reduce disease pressure.

Biological Control: He applies biological control methods to manage pests. This involves creating a conducive environment for natural predators or beneficial insects that prey on pest populations, effectively reducing their numbers. For example, by avoiding synthetic pesticides in the farm, natural enemies such as lady bugs that feed on aphids multiply and thrive in the farm. There is also a notable presence of birds that feed on caterpillars and other pests.

Natural Repellents: He creates homemade repellents using ingredients like garlic, chili, sodom apple, and neem. These repellents act as a deterrent against common pests without harming beneficial insects or compromising environmental health.

Disease-resistant Varieties: When selecting pawpaw varieties to cultivate, Jackson prioritizes those with natural resistance or tolerance to common diseases prevalent in his region. By choosing disease-resistant varieties, he reduces the likelihood of disease outbreaks and minimizes the need for chemical interventions.

Monitoring and Early Detection: Jackson conducts regular monitoring of his pawpaw orchard to detect signs of pest infestation or disease development at the earliest stages. This involves visually inspecting trees for symptoms such as wilting, discoloration, leaf damage, or pest activity. By promptly identifying potential issues, Jackson can implement targeted interventions before they escalate into larger-scale problems.

Note: Organic matter, such as compost or manure, enhances soil structure, improves nutrient retention, and fosters beneficial microbial activity. Hence promoting healthy pawpaw growth while mulching helps to conserve soil moisture, suppress weed growth, and moderate soil temperature in the farm. Drip irrigation is the most suitable method of irrigation as it controls water usage maximizing on the roots of the tree, as opposed to other methods.

From a half an acre piece of land, Jackson sells 40 pawpaws weekly on average. He has established market at a nearby school and

takes the remaining fruits to the market. "One fruit goes for Ksh50 if the buyer is purchasing in bulk, and Ksh100-120 for those buying a few, depending on the size," says Jackson. He has also leveraged on technology to market the fruits online targeting social media networks. Other buyers of his farm produce include juice sellers and local restaurants. Apart from selling the fruits, he enjoys eating the fleshy fruit and uses the peels to supplement inputs in the farm. Below are some uses of pawpaw peels in the farm.

Uses of pawpaw peels

Natural Fertilizer: Pawpaw peels are rich in organic matter, nutrients, and enzymes, making them an excellent source of natural fertilizer for plants. When composted or decomposed, pawpaw peels enrich the soil with essential nutrients, improve soil structure, and enhance microbial activity, promoting healthy plant growth and productivity.

Livestock Feed: Dried and ground pawpaw peels can serve as supplementary feed for livestock, including cattle, goats, and poultry. The nutrient-rich peels provide dietary fiber, vitamins, and minerals, contributing to balanced nutrition and improved animal health. Incorporating pawpaw peels into livestock feed can reduce feed costs and enhance the nutritional value of the diet.

Natural Pest Repellent: Pawpaw peels contain compounds with natural insect-repellent properties, making them effective as a non-toxic pest control solution in gardens and agricultural settings. Placing fresh or dried pawpaw peels around plants or garden beds can deter pests such as aphids, ants, and caterpillars, protecting crops from damage without the need for chemical pesticides.

POST HARVEST MANAGEMENT

Best Practices for Post-Harvest Maize Management

What can farmers do to increase the shelf life and maintain the quality and add value to maize grains after harvest?

By Eunice Sakong

FOOD THAT IS lost means all resources (water, land, energy, labour and capital) that were used to produce that food are wasted. Disposal of food in landfills, leads to greenhouse gas emissions contributing to climate change. This impacts on food and nutrition security, contributes to disease burden associated with consumption of unsafe food and affects the economy. Food deficit in Kenya is partly occasioned by food loss and waste with the food import bill standing at about Ksh 200 billion out of which 10% goes to maize imports.

"We need to be reminded that food discarded is in a certain sense stolen from the table of the poor and the starving" (Famous quote from Pope Francis). Food loss negatively impacts income and livelihoods for farmers, to reduce these negative impacts farmers need to do post-harvest management. This is the application of methods and techniques to increase shelf life and maintain quality of produce. In simple terms post-harvest management in maize is a good agricultural practice that adds value to maize and all maize products. Why is post-harvest management important?

- Ensures food safety and quality assurance
- Contributes to better and longer storage of grains
- Protects harvested maize grains from storage pests and exposure to toxins
- Reduces post-harvest losses in both quality and quantity of grains
- Provides better marketing opportunities for farmers

Practices of post - harvest management

1. Harvesting: - Good harvesting practice minimizes losses, grain damage and quality deterioration. Harvest at the right time and right moisture content when the maize crop has attained physiological maturity as this influences yield, quality and storage life of produce. Prematurely harvested maize has high moisture content and low quality. Delayed harvesting leads to increased field losses due to grain discoloration if mature maize plants are exposed to very moist weather, predisposal to pests and mycotoxin (especially Aflatoxins) produced by fungi especially when maize plant fall or lodge and get in contact with soil. Avoid heaping and putting dehusked maize on the ground; instead place the maize on tarpaulin sheets.

2. Sorting and drying maize on cob -: Sorting should start at harvesting; separate the clean maize from the rotten or discolored ones then dry on simple matting or tarpaulin laid on bare ground. Avoid drying maize directly on bare ground or tarmac. This is the first step in improving quality of the grains as drying will facilitate efficient shelling.

3. Shelling:- Shelling is the detachment of grains from cobs. This is done manually or mechanically using motorized shellers. The shelling should be done on clean tarpaulin to reduce scattering losses and grains getting in contact with soil. It should also be done with care not to damage grains as this may predispose grains to insect pests, mould attacks and fungi that produce mycotoxins.

4. Winnowing, cleaning and sorting:- Winnowing is based on the principle that lighter materials are blown away by wind and this is used to remove chaff, straw and empty grains. It can be done by hand or mechanically. Damaged grains and any foreign material such as pieces of broken cobs should be removed from the shelled grain. Simple manually operated equipment are now available in the market for winnowing and grading of grains and the grains are depending on the size of tray mesh being used. During winnowing grains may be mixed with straw and chaff may get lost thus winnowing should be done on clean, dry tarpaulin.

5. Drying of grains:- Drying is the systematic reduction of grain moisture to safe levels for storage and should be done immediately after harvesting (before and after shelling, and after winnowing, cleaning and sorting) and it should not be delayed. Dry to remove excess moisture from the grains and aim at having 12 - 14% moisture for the grains as this minimizes storage and post-harvest losses due to moulds and enhances quality of grains significantly. There are several options for drying

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Biogas production from pawpaw peels offers an environmentally friendly way to manage organic waste and generate clean energy

Biogas Production: Pawpaw peels are a potential feedstock for biogas production through anaerobic digestion. When fermented in biogas digesters, pawpaw peels produce methane gas, which can be used as a renewable energy source for cooking, heating, or electricity generation. Biogas production from pawpaw peels offers an environmentally friendly way to manage organic waste and generate clean energy.

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

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grains; Sun dry by placing maize grains on tarpaulin laid on bare ground however in the evening the maize and tarpaulin need to be removed and same process repeated for some days until grains achieve average of 13.5 % moisture content. Sun drying can also be done on raised platforms/ drying trays which allows for effective drying. This is further improved by use of drying on raised mesh/ netting racks and turning the grains at intervals of 1 to 2 hours to expose the grain surface to the wind / surrounding hot air. When using raised platforms grain should be covered at night to protect them against moisture, rain and dew. It is recommended that the grains be covered with 3 layers of covers as follows: - jute that absorbs dew / moisture, followed by shade net that ensures that absorbed moisture by the jute does not get back to the grain and then the plastic cover that ensures moisture from precipitation does not get into the grains.

Using raised mesh racks increases the rate of grains drying significantly while protecting grains from ground dampness thus reducing microbial proliferation and soil contamination. This ensures high quality end- product. It is important to note that heavy reliance on ambient or natural air conditions for grain drying can create problems during humid, warm weather as drying might take too long with higher chances of spoilage. Forced ventilation with warm, dry air for example use of solar dryers can increase the drying efficiency.

How to determine grain moisture content

There are several methods to determine the moisture content of grains. Some of the methods are quick and easy but not precise and others require more time and effort but give more accurate results. The sample grains for moisture testing need to be randomly picked from the produce.

i. **Salt test method:-** A sample of grain is vigorously shaken mixed with dry common salt in a clean dry glass bottle for several minutes and sample allowed to settle. If damp salt is seen to stick on the walls of the bottle, then the grain is above 15% moisture content. If the jar/ bottle still looks dry, then moisture content of the grain is less than 15% moisture content.

ii. **Grain moisture meters:-** Portable or hand held moisture meters provide faster accurate results. Grain moisture meters are available in some agricultural offices and some farmers' grain aggregation centres, ask around within your locality.

6. Storage: Provide safe storage conditions for the grains once they have attained average moisture content of 12 - 14%. Protect the produce from re-wetting, insect pests, rodents, moulds, birds and theft. The storage structure/ room needs to be well aerated, clean, cool and dry with bagged product placed on pallets above the floor to avoid conditions that may lead to moulds development. Moulds may release mycotoxins such as Aflatoxins which make the grains totally unusable for both human and livestock consumption. Farmers may pack and store the completely dry grains using any of these technologies :-

Twisted and secured special polythene layer

Second layer of sack with grain

i. **Drums and plastic containers;** - Ensure they are filled with grains to expel air and close lid tightly.

ii. **Hermetic bags;-** They are readily available in agro-dealer shops in Kenya. These are specially manufactured bags with sack lined with layer of special polythene for safe storage of grains. They are air tight and moisture resistant bags and protect grains from air moisture and storage insects for several months and extend storage until next crop harvest and beyond if well packed.

How to keep grains in hermetic storage bags

Open bag and pour the clean and well dried grains into the bag. Then twist the remaining top of the special polythene to remove air and secure the twist by tying with a band or twine (sisal or plastic). After that twist the remaining part of the sack and also tie.

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