



6 CLEAN WATER AND SANITATION



13 CLIMATE ACTION



Climate



WATER



With no river, lake or any other natural water source traversing Kakuzi land, the farm has constructed a series of dams to harness rainwater. Taking advantage of rainwater is the most viable and nature-friendly way to make use of our precious water resources and reduce competition with other users during the dry season. This rainwater, trapped in an array of 19 dams, is enough to meet the water needs of Kakuzi PLC. All this water use is authorized, documented and each rain drop can be accounted for by the company. This approach not only helps us to

utilize more of our natural resources—it also provides water security which is critical for our operations.

Across the land surface we redirect surface runoff into our water catchment areas which in turn feed our dams. The catchment areas are carefully managed to optimize the recharge of water and prevent the dams from silting up. A balance always has to be struck between maximizing the area of cropping and having adequate water catchments.



3 years

After 3 years the deflector is broken off the swivel and then each micro sprinkler can wet an area of 2.5 metres in radius.

Crop irrigation requirements

Irrigation requirements are calculated based on evaporation, rainfall and soil moisture data. A combination of data (daily tensiometer reading, weekly average evaporation and daily rainfall records) is used to determine the frequency and the volume of irrigation to be applied to the crop.

An efficient irrigation system (micro sprinkler) is used to deliver water on all avocado and macadamia areas. For avocado irrigation during the first 3 years after planting, use is made of a swivel having a deflector to ensure that the irrigation water applied does not wet a too large an area where no roots would be. After 3 years the deflector is broken off the swivel and then each micro sprinkler can wet an area of 2.5 metres in radius. Periodically, physical outputs are taken and recorded to ensure efficiency in the system.

Clean Water and Sanitation

Kakuzi has put up a total of 981 houses for its staff and their dependents at all levels. Each household has access to potable, fresh water and sanitation facilities. In addition, clean drinking water and sanitation facilities are provided in the workplace for both field and factory workers. Kakuzi has also donated and installed rain water harvesting systems in schools to ensure that surrounding schools have access to clean water. This intervention has helped 63 schools harvest and store total of 70,000 lts of rain water.

14%
reduction in water

Optimisation of water usage is very vital in Kakuzi PLC. The rainfall also contributes a great deal in irrigating the crop. Rainfall was better in 2020 compared to 2019 thus less irrigation was required, this explains the 14% reduction in water consumption from dams.

Stretching the rains at Kakuzi



Our strategy is that we don't have trees around the dams, but we have planted grass because it will reduce the amount of evaporation around the dam area meaning that the water pans we have no longer get exhausted due to evaporation," says Division Manager at Kakuzi Kelvin Gathee.



Kakuzi is a modern agricultural company involved in the cultivation and processing of an array of crops ranging from avocados, macadamia nuts, blueberries, livestock, to tea and commercial forestry.

We continuously strive to build a sustainable agricultural portfolio that mitigates weather risks which the agricultural sector has for ages been subject to.

Makuyu is regarded as a semi-arid area, but Kakuzi has changed this by investing in water harvesting, storage, and afforestation, changing the rainfall pattern of the area. With no main river, lake or any other natural water source on the estate, all the water that is used is harvested from the rain to ensure that there is consistent and reliable supply throughout the year.

Kakuzi is ardent about capturing rainwater and has proactively developed a series of dams to harness rainwater, which is directed into filtration traps and then stored for future use.

The company is keen on Sustainable Development Goals (SDGs) 6, 12 and 13, which call for clean water and sanitation for all, responsible consumption and production, and taking of urgent action to combat climate change and its impacts on the availability and sustainable management of water.

Dams

To this end, Kakuzi's water is primarily harvested in dams. There are 19 earth dams divided into holding and irrigation dams with a total capacity of approximately 12 million cubic

meters. A holding dam is simply used to hold water that can be transferred to another dam that will be used to irrigate crops.

"If we have to get water into these dams, the water comes from the rain. The rain pattern is such that it rains twice a year and that's the time we get water into these dams. The most basic way of getting water into the dams is to dig trenches and direct that water into the dams, but that would cause soil erosion, so again it is a minus. Our idea is that the run-off water is directed into areas where it sinks into underground reservoirs then eventually finds its way into the dams," says Mr. Kelvin Gathee, Division Manager at Kakuzi.

At the estates, there is a water management plan that critically explains the water sources, the potential sources and contamination, and risk assessment is done in all these sources proposing corrective action in case a source or a dispensing point is found not to be compliant. Mr. Gathee says water used from the dams is authorized by law and legalized by respective regulatory bodies and Kakuzi is keen on riparian areas as precise vegetation exists to ensure that dams are compliant and are in good shape throughout the year to guarantee steady supply of water. The riparian areas are well maintained providing an excellent environment for mammals, birds, snakes, frogs and insects. "Our strategy is that we don't have trees around the dams, but we have planted grass because it will reduce the amount of evaporation around the dam area meaning that the water pans we have no longer get exhausted due to evaporation. Cattle can also graze on the grass," he says.

Water pumping from the dams to crops is done through pump hoses. First, the attendants that operate these equipment are trained. This implies that the pumping and transfer of water is done within the required regulations.

The estate mostly uses drip irrigation through the use of micro-sprinklers. A micro-sprinkler gives the exact water that is required by a particular crop. For instance, for a young avocado tree plant aged between one and three years, the micro-sprinkler will ensure that water is only spread to the roots and does not where the roots cannot reach. Water needs per tree are guided by specific readings, contrary to overhead sprinklers that would spread water beyond where the roots and crops are.

Kakuzi uses chippings and avocado pruning and leaves as mulch to contribute to soil health and help retain moisture. "When these leaves and chips spread at the base of a tree, overtime they decay and become humus. The leaves are nutritious meaning nitrogen fixation that comes with leaves and chipped materials find its way back to the tree, reducing the requirement for in-organic fertilisers," says Mr. Gathee.

Interestingly, these dams have become habitats of hippopotamuses, crocodiles, and aquatic life. What started as water catchment project now is home to a beautiful environment of woodland and aquatic life. Kakuzi has a cohesive and integrated relationship with these animals. "Our operations are aligned to when these animals are in-active to avoid human-wildlife conflict," he says. However, in extreme cases, Kenya Wildlife Service (KWS) takes over the situation.

Water consumption between 2018 and 2020

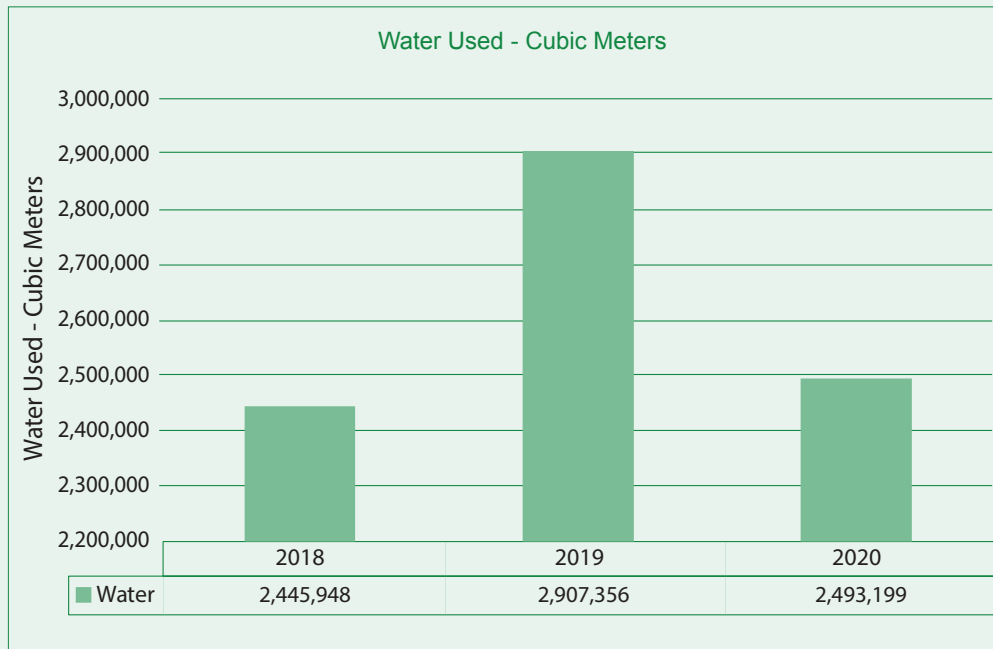


Fig 1: water usage from dams (Cubic meters)



Water harvesting and storage strategies in nearby schools are well catered for. This is meant to impact the ideals of water harvesting, storage, and develop a culture and an attitude of conservation and environmental sustainability in young people.

Boreholes

The estate is keen on having sufficient and reliable water supply in its employees' houses. With about 981 houses for its staff and their dependants at all levels, each household has access to potable fresh water and sanitation facilities. Clean drinking water and sanitation facilities are provided in the workplace for both field and factory workers. Mr David Migot, the Engineering manager at Kakuzi, says they strive to enhance community development and poverty alleviation within adjacent communities through the sustainable use of available resources and disbursement of conservation benefits. He adds they engage in community water development project/ schemes which make a considerable different to the community.

“At the estate we have about nine boreholes which are piped into specific areas within the pumping system. Again there is a guideline on what one can do and not do with this kind of water just to ensure there is efficiency and there is no wastage occurring,” says Mr Migot.

Springs

The company has further developed springs for the community which yield water throughout the year. For instance, Wariunga and Kinyangi springs serve over 200 families and two primary schools. The engineer terms this as an effort towards attainment of SDG 6 on ensuring availability and sustainable management of water and sanitation for all. Water harvesting and storage strategies in nearby schools are well catered for. This is meant to impact the ideals of water harvesting, storage, and develop a culture and an attitude of conservation and environmental sustainability in young people. At the pack houses, water used for cleaning fruits and mixing Plant Protection Products (PPPs) usually undergoes tests to ensure that it is safe. This ensures that they comply with international food safety standards, making it easier for Kakuzi to comply with the demands of higher value markets and supply chains.

Future

The company is upgrading all the systems and coming up with elaborate designs to ensure water sustainability



*REGENERATIVE
AGRICULTURE*

At Kakuzi, our crop production practices are designed based on Good Agricultural Practices. This improves soil health, expands biodiversity, improving the water cycle, increasing organic matter in soil structure, and sequesters carbon. We advocate the use of Integrated Pest Management (IPM) that is based on using natural interventions to control pests which damage the crop whilst trying to preserve beneficial insects. IPM aims to avoid economically significant crop losses while reducing pesticide use and risks. Regenerative agriculture is ultimately about how agriculture can have a beneficial impact on climate change by taking atmospheric carbon and capturing it into the soils by rebuilding the soils organic matter content. At Kakuzi we achieve this by combining our tree pruning material and composted organic matter into the soil on an annual basis.

Promote biodiversity - We plant cover crops (Rhodes) in order to protect the soil from weather erosion, improve biodiversity, control weeds and retain nutrients. We also plant nitrogen fixing plants (nitrogen fixer) to assist in fixing nitrogen that the crops absorb.

Minimum tillage - Our soils are only 'touched' during planting through cross-ripping. Our weeding practices ensure that we eliminate soil erosion.

Reduce the use of artificial fertilizers - While we use synthetic fertilizers, our fertilization program is based on solid data. Prior to fertilizer application, we carry out soil analysis and leaf analysis. This information coupled with expert input informs our fertilizer program. All fertilizers

applied in our fields are analysed for heavy metals and other contamination before application. Simply put, we replace the exact quantity of nutrients that the crop has absorbed from the soils by using both organic and inorganic fertilisers. This preserves a healthy balance of microbes in soil enabling natural relationship between plants and soil organisms.

Through our early detection systems (underground and surface water analysis, bee population in the colonies and the population of beneficial insects), we are able to avoid the negative effects of chemicals seeping into water sources and the atmosphere.

Liming is also based on soil tests - Liming requirement is generally to correct soil pH especially in new plantations which were previously not under good regenerative management. Liming unlocks the locked nutrients in the soil making them more accessible to plants.

Sustainable livestock rearing - Kakuzi has 4,500 heads of cattle grazed on nearly 5,000ha of land. This is a stocking density of 1:1 ensuring sustainability. Our cattle are an integral part of our integrated farming systems with the grazing patterns carefully managed to preserve our water catchment areas. Overgrazing would result in potential erosion whilst undergrazing would diminish the grazing quality. We also employ the use of mobile night enclosures (bomas) – which reduces the build up of manure at central holding areas and its associated environmental problems. These mobile bomas also help in making the cattle trample on tough and less nutritious grass and ensures that manure is distributed evenly across the grazing lands.

4,500
Number of heads of cattle Kakuzi has on nearly 5,000ha. This is a stocking density of 1:1, ensuring sustainability.

The infographic features a yellow background with a white silhouette of two cows and their calves. Below this, there are green illustrations of leaves, a row of green dots representing soil or manure, and wavy green lines representing water or grass. The page number 61 is visible in a green triangle on the right side.

“ Regenerative agriculture is ultimately about how agriculture can have a beneficial impact on climate change by taking atmospheric carbon and capturing it into the soils by rebuilding the soils organic matter content. ”



WASTE
MANAGEMENT

The waste generated at Kakuzi is managed as per the waste avoidance, reducing, reusing and recycling policy. The company has measures to control and limit the amount of waste generated. Waste storage, treatment and disposal practices do not pose health or safety risks to workers, other people or ecosystems. The waste management plans include documenting origin of waste, volume and safe means of disposal. Waste is segregated at source to facilitate re-use, recycle and composting. The company gives priority to product suppliers that minimize waste associated with their products and that access used packaging and containers for recycling. Examples of our efforts towards achieving zero waste include but not limited to;

Macadamia shells and husks – Macadamia husks are composted and taken back to the farm. This adds to the soil nutrient and helps reduce the use of artificial fertilizers. The shells are used as fuel at the macadamia factory and in internal road repairs to manage excess dust.

Liquid waste – Kakuzi uses biodigester and waste stabilization ponds to manage liquid waste from processing facilities. To ensure that we break down the waste, the constructed wetland are designed and build to allow natural sunlight ultraviolet (UV) to penetrate. We also introduce essential microorganisms and water plants to optimise the efficiency of the system



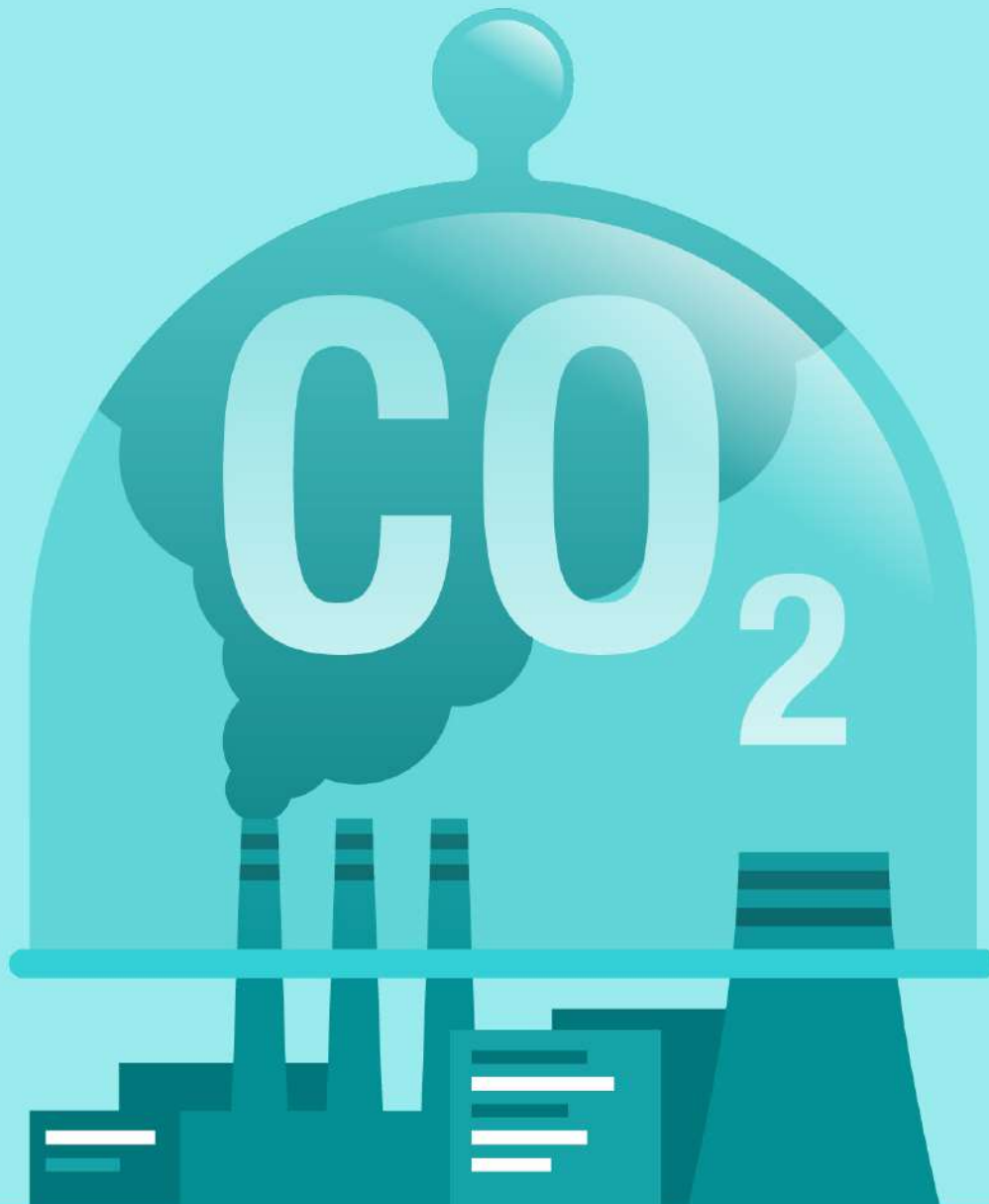
Avocado and macadamia prunnings – these are chipped and put back into the soil to rebuild the soils organic matter, capturing atmospheric carbon in the soil.

Hazardous waste (fertilizer bags and ex-chemical containers) are collected, documented and disposed of through National Environment Management Authority approved waste handlers.



Kakuzi uses constructed wetlands management

CARBON
FOOTPRINT



Since 2017, Kakuzi has been working with the Carbon Trust in the UK to carefully and scientifically document the amount of Carbon Dioxide our operations produce. By doing this we are able to identify any areas where additional remedial measures are required. The next stage is to measure the amount of Carbon Dioxide our operations sequestrate. Today's modern agriculture must look beyond just being Carbon neutral but aim at having a beneficial impact on Climate Change.

At Kakuzi, we aim at using technology to help reduce the use of energy. We also use modern agricultural techniques to minimize agricultural inputs as well as produce products in a manner that lowers atmospheric carbon.

Equally complying with all local energy regulatory requirements, we have fully implemented the recommendations from a statutory energy audit. These include the use of efficient technology, training staff in energy-saving skills and monitoring and documenting energy usage.

Carbon emission mitigating measures

Environmental conservation

Kakuzi conducts annual state of the environment audits and environmental self-audits (copies of the reports are deposited with the Director General's office at NEMA). This helps identify, monitor and mitigate any potential impacts to the environment, community, and wildlife from any of our operations. In supporting environmental sustainability and biodiversity our summary code of practice is to;

- Comply with all environmental legislation. Assess the main environmental impacts of our business activities
- Establish programmes and operational controls to minimize environmental impacts identified in each of our businesses
- Provide appropriate training to our employees and other relevant stakeholders



200,000

Kakuzi runs an active tree planting programme with a target of over 200,000 indigenous seedlings per year.



To meaningfully appreciate the natural wonders that our beautiful planet has to offer, Kakuzi runs an environmental programme that champions tree planting with schools to provide a greener environment. The exercise aims to have students and their teachers plant trees and take responsibility for post-planting care.



students and their teachers plant trees and take responsibility for post planting care. We donate the seedlings and offer expertise on planting and after care. Trees provide direct, observable benefits to the schools and the teachers and students transfer skills gained to members of their community. Energy efficiency

We also conduct energy audits, document, and manage waste generated, and document our water usage for the purpose of monitoring and managing our carbon footprint. Implementation of the energy audit recommendations has presented opportunities to save energy.

Further, our agronomic practices are designed as per Good Agricultural Practices to ensure our commercial production is both safe and sustainable. We strive to practice the most responsible production and our approach is always to be environmentally sensitive.

Buffer zones of 50 metres against a requirement of 30 metres are planted with indigenous trees that act as a natural carbon sink. We run an active tree planting programme with a target of 500 indigenous seedlings per year per division. For this reason, our operations are both GLOBALG.A.P accredited and Rainforest Alliance certified.

Adopt a tree

Kakuzi runs an environmental programme that champions tree planting with schools to provide greener environments. The exercise aims to have

We have early detection mechanisms (e.g. monitoring insect - bee populations, ground and surface water analysis, noise level mapping, soils analysis) in place to monitor and identify potential environmental pollution that allows earliest possible corrective action.

Carbon foot print

Power consumption is majorly high where powered machinery is involved. The main power consumer is the avocado packhouse and the macadamia factory. High production recorded in both avocado and macadamia fields in 2020 created a high demand of power especially during packaging. A 36% increase in kWh was recorded (Fig 2). On the other hand, the conversion factor for power (carbon emission factor allocated by the Carbon Trust for 2020 electricity generation in Kenya) was much lower resulting CO₂ emission that was much lower when compared to 2019. The Kenyan low carbon electricity mix has progressively relied more and more on renewable sources of electricity generation – mainly more of geothermal compared to hydropower.

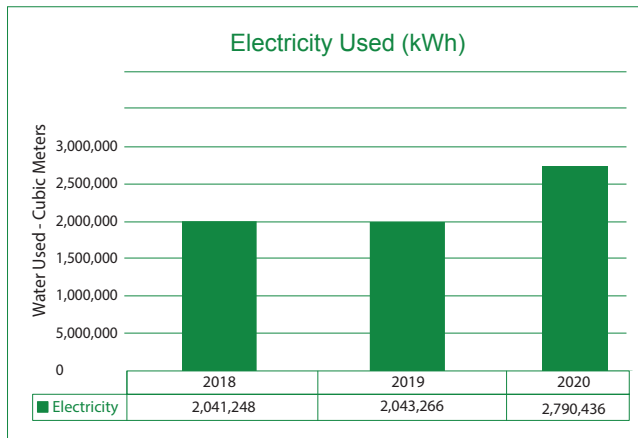


Fig 2: Electricity from the grid (Kwh)

Carbon dioxide equivalents is a measure of how much a gas contributes to global warming, relative to carbon dioxide. Diesel usage increased due to the numerous outages and the continuous power demand during packaging operations and land preparation for the establishment of new blocks both in Macadamia and Avocado divisions (Fig 3). Notwithstanding, Kakuzi PIC recorded a net reduction in emissions from 2019 to 2020 (Fig 4). This was achieved through a combination

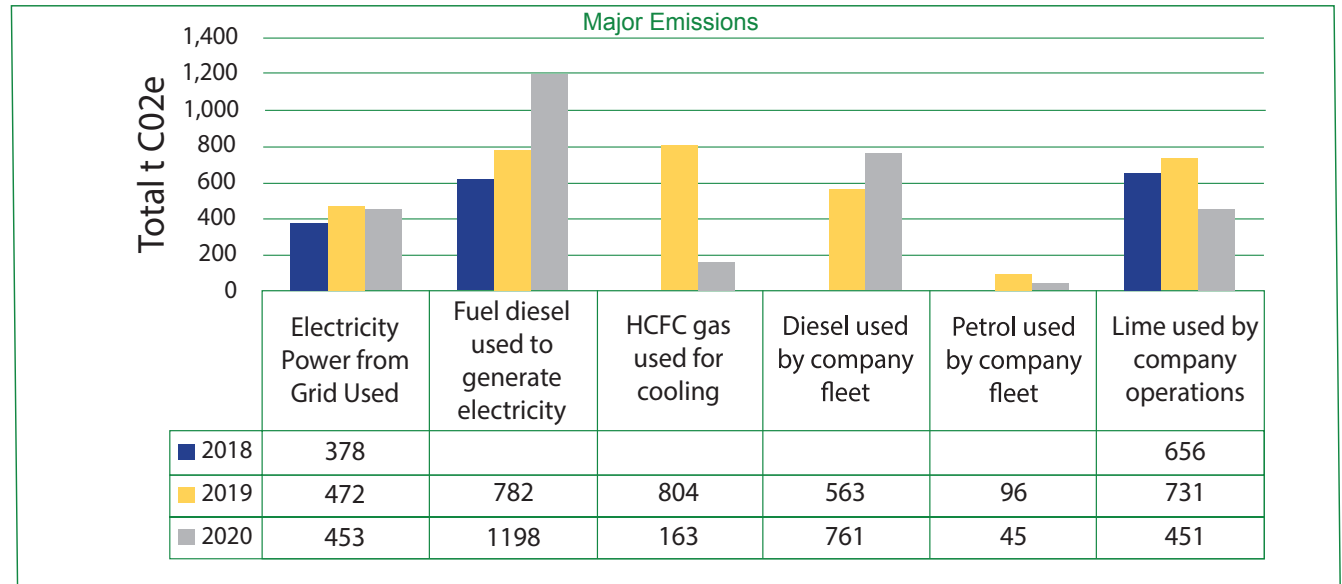


Fig 3

of factors which mainly included reduction of lime usage, replacement of cooling systems at the packhouse, eliminating leakages and the improved electricity mix from the grid. Other strategies include conservation farming, where soil is not exposed during cultivation, planting trees and reduction and optimal use of fertilizers.

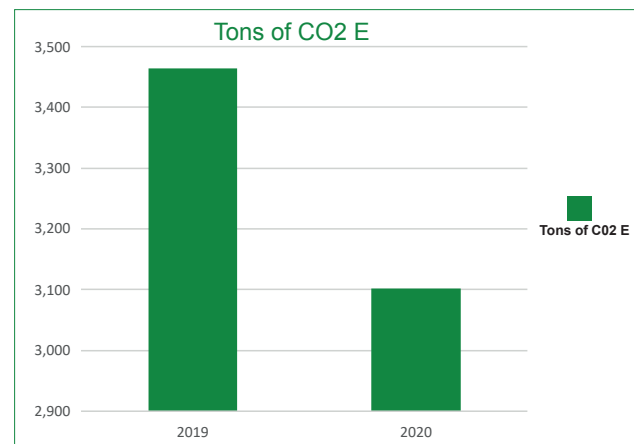


Fig 4

At Kakuzi PLC, we have developed a carbon accounting framework that has continuously improved with better data capture and management, sensitization and training. Carbon reporting is done annually to the Carbon Trust through Camelia PLC. In the near future, plans are underway to invest more in renewable energy, increase forest cover and continuously enlighten all the players and communities around the farm on the importance of reducing carbon emissions.

*DIVERSIFICATION
STRATEGY*



Case Study

Boosting blueberry farming

In June 2019, Kakuzi PLC wrapped up the construction of greenhouses to farm blueberries. This was as the company geared up to diversify into new fruits to increase its produce portfolio. The greenhouses now sit on 10 hectares where the blueberries are grown in pots in a controlled and protected environment.

The construction took 11 months and required extensive infrastructure that was made possible through a partnership with Haygrove South Africa which oversaw the work and trained a team of construction workers.

Materials were sourced from a number of countries including Kenya, South Africa, UK, Spain, China and the Netherlands. About 300 men were involved in the project, impacting not only their level of skills, but also giving them jobs. Many factors were considered before the greenhouses were set up including the tunnels.

Site selection

Since blueberries do not grow under rainfed agriculture, site selection was done to ensure that the fruit is grown separately from avocados – the firm’s largest revenue earner - and macadamias, to avoid interference.

Land preparations such as levelling and marking began. These were done carefully to ensure that there was no disturbance or negative impact on environmental resources such as springs.

Computerised irrigation

The Kakuzi blueberries are not rainfed, instead, they use a computerized irrigation system which allows the fruit to receive water according to set programmes and guidelines. Some of the guidelines include information on pH, electrical conductivity and volume of irrigation water.

With the computerized system, irrigation is controlled according to the requirements of the fruit.

Additionally, the automated system helps in controlling the amount of fertiliser used depending on the stage of growth of the blueberries. There are two phases; the vegetative phase and the flowering phase which have different nutritional requirements and water consumption.

The plants are fertilized via the irrigation system in a process known as fertigation. This means that the irrigation water is applied together with fertilizer because the blueberries are grown in substrate.



The blueberry flower is bell shaped with a narrow entrance and being very tiny, only the stingless bee can easily fit into the space as opposed to other bees which tend to struggle.

Stingless bees

In collaboration with the International Centre of Insect Physiology and Ecology (ICIPE), Kakuzi PLC has been looking into stingless bees over the years. Stingless bees are indigenous to eastern parts of the country like Mwingi, and western region in Kakamega, and are now part of Kakuzi operations at the blueberry farm. These stingless bees, which are harmless to people and friendly to use, are frequent visitors to blueberry flowers and because of their small bodies, they easily make contact with stigmas while foraging for food therefore making them efficient pollinators for blueberries.

The blueberry flower is bell shaped with a narrow entrance and being very tiny, only the stingless bee can easily fit into the space as opposed to other bees which tend to struggle. Honey bees are also used but are placed strategically around the farm to ensure they do not harm people.

Adoption of drones

With the ever-evolving technology, the use of drones in agriculture is steadily growing and Kakuzi PLC is using it as an effective approach to sustainable agricultural management to help streamline operations and gain effective insight into crops.

For example, drones provide a fast and efficient way to scout crops, track their growth and identify stress areas. They can also be used in mapping, pest monitoring, spraying and photography as well. Additionally, drones cut the cost and work hours that go into capturing data.



Climate-Smart Agriculture: *An integrated approach to farming*

Climate-Smart Agriculture (CSA) is an integrated approach to managing landscapes - cropland, livestock, forests and fisheries that addresses the interlinked challenges of food security and climate change. CSA aims at increasing productivity, enhancing resilience, and reducing emissions. Under increased productivity, CSA aims at producing more and better food to improve nutrition security. To enhance resilience, it is reducing vulnerability to drought, pests, diseases and other climate-related risks and shocks; while in reduction of emissions, it is avoiding deforestation for agriculture and identifying ways to absorb carbon out of the atmosphere. CSA has a clear focus on addressing climate change, considers the synergies and trade-offs that exist between productivity, adaptation and mitigation and also seeks to capture new funding opportunities to close the deficit in investment. At Kakuzi, we have developed climate-smart bee-keeping technologies. The company has placed beehives in the avocado orchards to attract and keep bees that play an important role as pollinators and indicators of a healthy environment. The bees pollinate crops, pastures and trees, thus contributing to food security, environmental conservation and availability of a carbon sink contributing to climate change adaptation.

“Without bees and other insects that aid in pollination, we will not achieve a quality crop. Having realised this, we took upon ourselves to have beehives within our orchards and specifically developed standards in determining how many hives we require in a given area,” says Mr. Zackary Giku, the Packhouse manager at Kakuzi in-charge of avocado packing operations.

Mr Giku explains that while other fruits have simple ways of flowering and self-pollination, avocados are different. He says each avocado tree can be covered by almost hundreds of thousands of tiny flowers and the flowering process is complex and generally occurs over a two-day period. The avocado flower first opens in the female stage, when the stigma (the female part of the flower) is receptive. It closes overnight and on the second day the male stage occurs when the pollen is shed. An overlap between male and female phases may also occur under certain climatic conditions. The difference in timing of the female and male stages means that there is need to transfer pollen from one individual flower to another. The avocado flower therefore requires a vector to effect pollination which is a necessary first step in the fruit set stage.



Without bees and other insects that aid in pollination, we will not achieve a quality crop. Having realised this, we took upon ourselves to have beehives within our orchards and specifically developed standards in determining how many hives we require in a given area, says Mr. Zackary Giku, the Packhouse manager at Kakuzi in-charge of avocado packing operations.



The avocado flower is adapted to visitation by most flying insects as is evident by its open morphology and the easy access to the nectar. Hence, flies, wasps, honey bees, stingless bees, bumblebees and other insects become potential pollinators of the avocado flower. At Kakuzi, bees are widely used to pollinate avocados in orchards. Currently, Kakuzi has about 700 hectares of mature avocados and working with three hives per hectare, with each hive giving an average of 2kg of honey. To improve on production, the management is training bee operators and also having the correct bee forage species within the orchards.

It is estimated that Kenya produces about 11,000 tonnes of honey and 1-3 tonnes of beeswax annually, translating to about 20 percent of the country's potential. The low production is attributed to lack of appropriate technologies, poor beekeeping practices, low uptake of improved technologies, poor policy guidelines and marketing skills. To mitigate this, Kakuzi has partnered with Kakuzi Hills community to establish the Kakuzi Hills Self-Help Group, a beekeeping initiative meant to diversify the community's income. Through the group, a total of 175 beehives have been supplied to members.

The program is supporting the Kakuzi Hills community with financing, technical support, and marketing of honey to establish a sustainable beekeeping project. The community has shown a desire to work with Kakuzi and the company looks to a continued meaningful engagement.



Kenya produces 11,000 tonnes of honey annually.



Kenya produces 1 - 3 tonnes of beeswax annually.



175 beehives have been supplied to Kakuzi Hills Self-Help group members.





Regenerative agriculture for sustainable farming

Regenerative agriculture involves farming practices that rejuvenate soil health.

Kakuzi has been practicing and promoting regenerative agriculture by ensuring use of water sustainably, introducing pollinators in the orchards and promoting tree planting in schools and the community. The company has taken a bold step towards soil restoration through increase of organic content to improve fertility. Through this, Kakuzi has been able to conserve and restore soil organic matter by protecting

the habitats of micro and macro-organisms, improving on soil water conservation and erosion resistance.

“Soil becomes degraded when you lose the organic matter, and here at Kakuzi, the system of land use we practice focuses on long-term viability of the soil,” says Mr Zachary Giku, the Packhouse Manager at Kakuzi, in charge of avocado packing operations.

The adoption of regenerative agriculture is based on reduced tillage, maintenance of a better balance, and



We have moved from exposed soil to the issue of cover crops. As you walk around, you will see that one of the things that we are working towards is that as we plant the first tree in a new area, then we also grow the cover crop so that land can remain covered. In the old orchards, what we are trying to do is minimise mechanical systems like when weeding we don't want to keep disturbing soil and that's why we are establishing as much ground cover to even suppress the weeds,” says Mr. Giku.

continuously nourishing the soil with permanent plant cover. Mr Giku says unlike in conventional agriculture where there is no systematic production of cover crops between two productions, the continuous presence of plant cover crops helps the agricultural ecosystem to produce a maximum amount of biomass. This is increasing the organic matter of the soil, favouring soil fertilising properties. Permanent cover crops improve soil physical, chemical, and biological properties, hence rejuvenating soil health.

According to experts, crop rotation reduces pest pressure and balances the soil's ecosystem, while diversification of plant species helps control pathogens, insects and weed pressure thus limiting the use of insecticides and pesticides. At Kakuzi, chippings of avocado pruning and leaves are used as mulch contributing to soil health and help to retain moisture. Dams and filtration traps have been created for future water use, while avocado and macadamia orchards act as a carbon sink, creating a healthy natural environment – biodiversity is improved and the hydrological cycle is completed.

Nitrogen fixation

For plants to grow, they need nitrogen, but this nitrogen has to be converted into a form that can be absorbed by the plant. Lack of nitrogen is regarded as one of the greatest limitations on plant growth, and yet plants are bathed in it because the atmosphere is 78 percent nitrogen. Most plants cannot use nitrogen in this form as it is considered inert. It has to be converted into other forms such as nitrate, ammonia, ammonium, and amino acids for plants to utilise.

In conventional agriculture, most of these plant available forms of nitrogen are obtained through synthetic nitrogen fertilisers.

Through the biological process, micro-organisms in the soil turn nitrogen in the air into plant available forms, a process called nitrogen fixation. Experts say this is done by a symbiotic organisms such as Rhizobium bacteria in legumes

and free-living nitrogen-fixers. This process is strongly associated with the amount of soil organic matter. Stable soil organic matter has carbon to nitrogen ratios of 11:1 to 9:1. Experts affirm that soil organic matter is the greatest store of soil nitrogen and most of this nitrogen is plant available.

Use of Rhodes grass as a cover crop in Kakuzi has increased soil organic matter, improved soil structure, enhanced nutrient cycling, aided in weed suppression, provided a habitat for beneficial insects and pollinators, and build on farm resilience to climate changes. The grass is used for forage and hay.

Mr. Giku notes that from a nutrition perspective, to produce one tonne of avocados, one requires 7.5kg of nitrogen. He adds that, for sustainable farming, if you remove the 7.5kg then you need to replace it with the same, since you want the soil to remain at the same level of fertility. "A single percent of organic matter will give you an equivalent of 30kg of nitrogen fertiliser per annum," he says.

Experts say biological nitrogen fixation is the major source of plant-available nitrogen in natural soil systems, pointing out that regenerative agriculture is the way to go and should be embraced by all farmers since soils will become unproductive if their health is not rejuvenated.



Farm to table:

Tracing produce from the orchards to the plate

Fresh unprocessed food has a lot of advantages to the body. It is loaded with essential nutrients, helps manage high blood sugar as it is low on sugar and keeps the heart healthy. Kakuzi takes it a step further when it comes to their produce; they make sure that the consumer can trace the food on their plate all the way back to the farm. Kakuzi believes in the “Farm to Fork” concept, with traceability at its core. Traceability is key as it aids in accurate withdrawal of unsafe food from the market when need be. The information collected during the process makes it easier and faster to identify the affected food. It also helps mitigate risks to consumers and saves time and money. With special reference to food, Kakuzi mostly deals with agricultural products. The company traces the movement of its products and ingredients through steps in the organisational chain, from the farm to the consumer, and vice versa. With its

mission in mind, which is to consistently produce quality products, the company prides itself on traceability. Practicing traceability shows that Kakuzi is ethically responsible as the firm assures customers of quality and safe food.

The strategy is important for Kakuzi’s processes, continual improvements and compliance to statutory and regulatory requirements as well as customer requirements. Smart suppliers who want to survive in the long term, prompted the company’s entry into the global market and competition. Traceability began with Kakuzi’s defined focus and vision which is to be the global leader, preferred producer and supplier of quality agricultural products. The company strives for longevity and that is why it wants to be the global supplier of choice.

Keeping this in mind, the organisation only supplies products that it can trace. For example, it only processes and supplies products such as macadamia that come from its own farms/ orchards. Kakuzi has three orchard divisions: northern, central and southern. These are further divided into estates: Northern-North Kikito, Kikiti, Mission, Central-Kaguru, Kinyagi, Southern-Kasioni and Kakuzi. Since the estates are within Kakuzi’s control, it is easy to collect and keep sufficient relevant data. Additionally, traceability is easily communicated to the consumer. This starts by documenting and linking production, processing, distribution chain and ingredients. The company uses package labelling and issues package lists and Certificates of Authenticity (COA), which contain unique production codes of every package it sells to consumers. A consumer only needs to quote the unique code and Kakuzi will trace the product from their fork back to the farm.

But how does traceability benefit the farmer? The farmer, the primary producer, will have a way to swiftly respond and recall products if need be. Advantages of traceability are that tracking produce through the supply chain reduces costs and duration associated with recalls or contaminated products. Traceability also enhances Kakuzi and the farmer’s image, and instills consumer confidence in the products purchased. Farmers can also track production and reduce contamination (or diseases) or produce spoilage, as they use the information to identify relevant hazards before the affected products reach the market. Farmers also use the information they obtain through traceability to plan integrated pest control and also get an opportunity to communicate with their consumers.





Tackling global warming through reduced carbon footprints

The world has been grappling with global warming as a result of carbon emissions due to industrialization and related human activity.

Various studies by scientists have shown that the planet is in serious jeopardy unless urgent remedial measures are deployed. The effects of global warming have been evident around the world. These include rising seas, disruption of weather patterns, drought, depletion of fresh water and extreme weather activities such as hurricanes.

Through various conventions such as the Earth Summit and the Kyoto Protocol, the United Nations has come up with resolutions and programmes aimed at reducing carbon emissions to below 2°C per year.

Such efforts include concepts such as the carbon offsetting initiative that brings countries together to respond to climate change. Through this concept, countries come on board to engage in commercial trading of carbon credit reductions in a common market.

While the carbon trading and offsetting has been rolled out in most of Europe and parts of Asia, in Africa, only South Africa has established a market under the UN guidelines. In Kenya, however, some companies such as Kakuzi PLC are already engaging in carbon foot prints and trading in the global market through the company's group, Camilia of UK.

Mr David Migot, the engineering department in-charge at Kakuzi PLC, explains that carbon footprints are measured in equivalent tons of CO2 during the period of the year and can be associated with an individual, organisation or a product among others.

"As a group, we are legally required to comply with carbon foot print reporting which we do annually. After doing carbon analysis, we submit our report to Camilia. At Camilia, the report is merged with others from our other groups to make one report," Mr Migot explains.

Kenya is expected to establish a carbon market by the end of the current financial year with funds having been factored in the 2021/2022 budget. In carbon trade, a country or polluter having more emissions of carbon is able to purchase the right to emit more. A country with low emissions sells the right to emit carbon to other countries or entities. This way, countries or polluting entities emitting more carbon emission satisfy their carbon emission requirements. This method has been found as the most cost effective in carbon reduction.

Mr Migot says that carbon reduction measures have immense and direct impact on a company's financial health. Following the UN guidelines, Kakuzi PLC has been able to analyse its energy requirements to introduce efficiencies in production systems.



The United Nations has come up with resolutions and programmes aimed at reducing carbon emissions to below 2°C per year.

"Energy is a huge component of production. Following the guidelines, we are able identify areas where we can cut down on the use of energy and reduce cost of production," he adds. For instance, the company uses a lot of water for irrigation. The water is pumped from place to place using diesel engines. The company has introduced meters to measure soil moisture to avoid unnecessary irrigation thereby cutting back on the use of fuel. Where possible, the company uses gravity to deliver water to the fields.

"When we you introduce these efficiencies into the system, you are able to grow your crops competitively and increase profit margins," says Mr Migot.

Kakuzi recognizes that it cannot tackle environmental issues in isolation. It has therefore brought on board host communities in its conservation efforts.

“Like ourselves, our neighbours are farmers and we share common concerns regarding the environmental impact on rainfall and weather patterns. It is critical that we get adequate rain at the right time otherwise we will engage in more irrigation which fuels emissions and deplete water supplies,” the engineer observes.

To constructively engage the community, Kakuzi PLC has at its disposal the Water Act of 2009 that provides for the establishment of water users associations.

Through the associations, the firm has been instrumental in sensitizing communities on the fact that global warming is a problem that needs to be addressed by everyone.

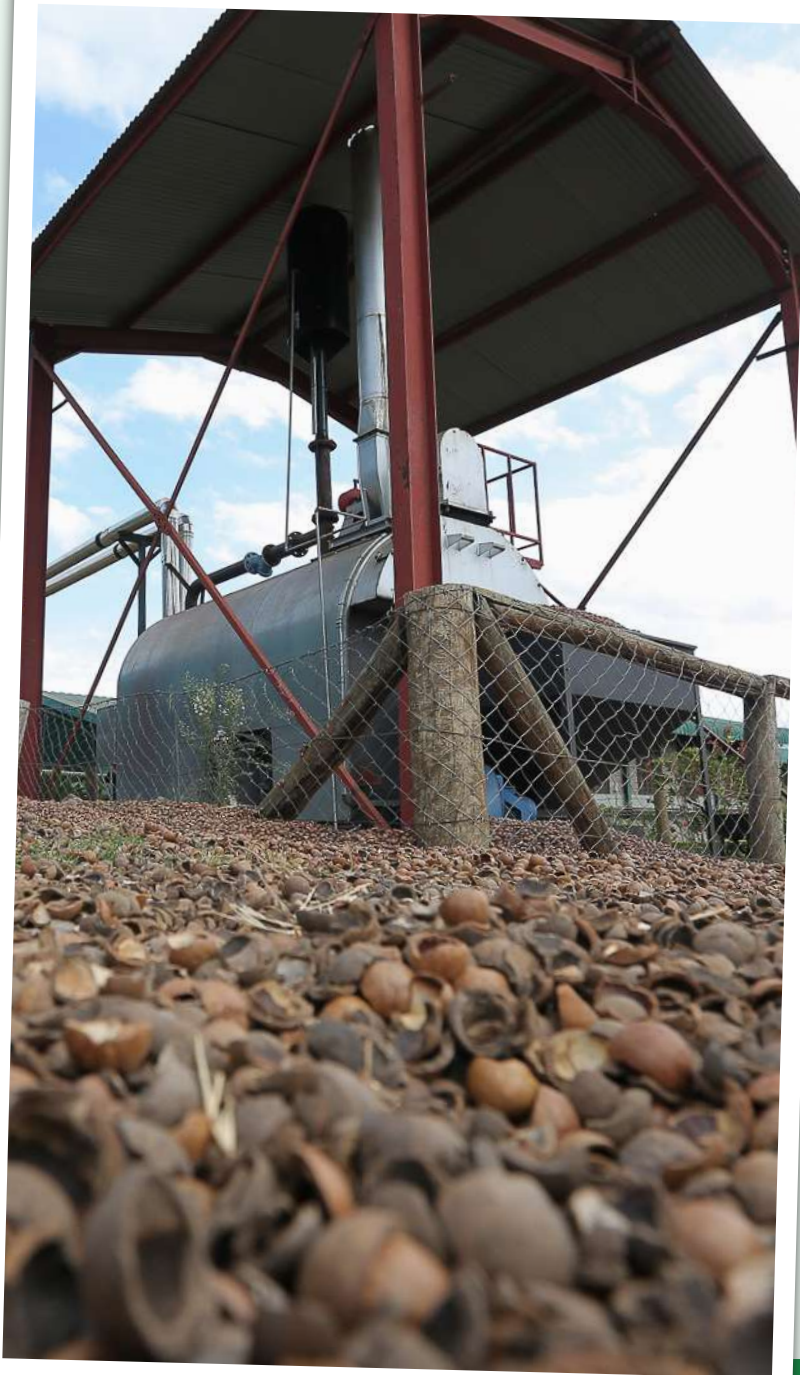
“Through barazas, we have been drawing attention to the adverse effects of global warming. We draw linkages between global warming and disruptive weather patterns, water scarcity and food insecurity,” says Mr Migot.

Kakuzi PLC has brought together other water users associations in the region to craft measures to nurture the environment. Such measures include planting suitable tree species and the protection of water sources and catchment areas. The associations also protect riparian areas and engage in prevention of soil erosion.

“We also encourage communities to turn to organic farming to reduce deployment of chemical fertilizers and pesticides which are in themselves sources of emissions at the application and manufacturing level,” he says.

Mr Migot is confident that once the carbon market is established in Kenya, they can easily get together as a community to trade because of the reduction measures they have in place and the evident positive impact.





Managing waste from macadamia processing

As the early morning mist lifts away, the leaves of the lush green macadamia trees rustle softly in the gentle wind. From the treetops, birds resident in the sprawling plantation sing away complementing the tranquility of the crisply cold morning.

Besides the green beauty of the macadamia trees that blends seamlessly with the natural environment, growing macadamia is one of the activities that keeps the production wheel of Kakuzi humming along each day. On average, the company production line processes three tonnes of macadamia for both local and export markets. The catch is that 70% of macadamia is waste meaning that for the three tonnes processed for the market each day, seven tonnes of waste is produced.

This has inspired the company to devise innovative and sustainable measures of waste management appropriately themed as “world without waste”.

According to the assistant general manager, Mr Mathias Muinde, the farm generates three types of waste. There is the organic waste that is generated by the company’s staff in the residential villages. The company provides housing for most of its permanent staff.

“This is mostly organic waste from the kitchens. To absorb this waste, we have the kitchen garden initiative where we encourage staff to grow various crops in their compounds. The waste from the kitchens is composted for this purpose,” says Mr Muinde.



The catch is that 70% of macadamia is waste meaning that for the three tonnes processed for the market each day, seven tonnes of waste is produced.

In addition to reducing waste, use of organic manure by employees in their kitchen gardens ensures that they have access to various vegetables that enrich their nutritional needs. This in turn translates to a healthier and robust workforce.

The second type of waste includes non-biodegradable materials such as metal, rubber and plastic. This waste also includes empty bags of fertilizers and crop spray containers.

This kind of waste requires specialized disposal methods off site. It is therefore moved to central collection points where it is removed for disposal by a contracted National Environmental Management Authority (NEMA) certified company.

The third category of waste comes from the processing of macadamia which comes in three levels.

The first level is de-husking where the green outer covering of the nut is removed. The green covering constitutes 50% of the entire product thereby generating the largest volume of waste.

The company is able to turn 100% of the husks into compost manure that is channeled into its orchards and fields where other crops are grown. This helps to enrich soil content. It also reduces the need to use chemical fertilizers cutting down on cost of production.

“After de-husking, we move to the next level that involves cracking the shells. We use the shells as fuel to run our boilers and sell any excess to local users with similar drying facilities,” says Mr Muinde.

Globally, cost of energy has been identified as a major impediment to production and consequently economic growth. The use of macadamia shells as alternative fuel helps the company cut down on cost of overall use of energy and at the same time competitively sustain production.

The final level of waste from macadamia processing is water that is discharged from the factories. This is fed to a bio-digester which is at the head of a natural purification process.

The bio-digester breaks down liquid and semi-solid waste before it is released into a system of constructed wetlands and ponds. In this system, pollutants become nutrients for microorganism which pass them up the food chain.

“In the ponds and pathways, both chemical and biological breakdowns take place. We have bacteria that predate on

whatever is in the waste. Then we have various plants that hydroponically feed on waste water taking in about 15% of the pollutants,” he explains.

The plants also transmit oxygen downwards from the leaves to the root zone. This helps in increasing water levels and enhances the activity of aerobic bacteria. At the end of this natural process, the waste water is released into the environment in a purer and safer form.



The plants that hydroponically feed on waste also transmit oxygen downwards from the leaves to the root zone.

