Roses are delicate flowers and need the best care you could give

Treating the water with Chrysal RVB Clear enables the flowers to drink as much as they can. However, sometimes roses endure even harder conditions: temperature swings and traveling long distances. Common problems arising are dropping of buds, flowers and leaves, accelerated ripening, leaf yellowing and curved growth, which all are negative effects of ethylene.

Chrysal AVB
is a post-harvest conditioner for ethylene sensitive flowers such as roses. Research has shown that allowing your flowers to have a solution with Chrysal AVB as their first drink after harvest will help them better to endure these conditions. Therefore, Chrysal recommends to have your ethylene-sensitive flowers in Chrysal AVB (1ml/l) for four hours after harvest. Make sure to use clean buckets and clean water so you can reuse this solution.

Following this, overnight conditioning of your roses in RVB Clear (1ml/l). This way Chrysal AVB helps to improve the vase life of your roses, diminishes dropping of blooms, leaves and buds and improves opening. ***Your roses are getting the best care they can!***

Chrysal RVB Clear
Stimulates water uptake and improves quality.

Chrysal AVB
prevents dropping of buds and premature aging.

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United Selections joins list of flower farms using renewable energy

By MURIMI GITARI

Flower farms in Kenya have taken a new direction by venturing into renewable energy to tame the cost of production of flowers with the latest being United Selections based in Nakuru.

The rose breeder, with a slogan 'breeding a colorful future' will be rolling out a solar powered system after having contracted a Kenyan-based projector owner, Ecoligo Limited who will be transiting the entire power supply to renewable energy from electric.

United Selections joins a list of flower farms in Kenya that are currently using renewable energy with Oserian Development Company Limited having of late launched 3,000 solar panels this year that were to add 1megawatt power supply to its previous 2.5megawatt of geothermal power. The two integrated produce sufficient renewable energy for consumption by tenants and residents of the Two Lakes Industrial Park.

Oserian has invested a lot in geothermal energy to power its operations in the farm like transporting flowers using electric tugs/cars from the farm to the packhouse. This has led to reduction of fossil fuel that was used in the farm saving from Ksh 400,000 up to Ksh 30,000 and by cutting the cost of buying diesel fuel.

Tambuzi Flower Farm, based in Laikipia County is also one of the few farms in the country that also tapped into green solar energy by having installed a 60 kilowatt solar-power system in a bid to reduce carbon emissions. The company was also able to save up to 10,000 kilowatts per month in electricity bills.

Leveling ongoing in one of the farms United Selections is putting up a solar powered system that will hold a capacity of 110 kilowatts

Operations in flower farms require a 24-hour power supply from the national grid with the direct solar feed at Tambuzi reducing installation costs of batteries that are no longer in use.

Uhuru flowers installed a 72 kilowatts solar power plant cutting its spending on electricity by 50 percent from Ksh 600,000 every month. Their solar power plant that was installed in the year 2014 was used by the Kenya Flower Council as a case study on using solar technology in flower production

The United Selections project will be a photovoltaic system that will hold a capacity of 110 kilowatts and will be kicking off in August/September. This will help save the company the cost of electricity as it is with other farms using renewable energy and reducing carbon dioxide emissions that will go down by up to 113 tonnes of the gas annually.

The company strives to create a better environment for everyone by being sustainable in all their operations with the current one being transitioning to renewable energy.

Another company based in Ruriu, Red land roses saves about Ksh 450,000 every month on electricity costs and being able to tackle the menace of power losses by using solar energy in the farm which ensures seamless and uninterrupted business operations.

The interest in investing on renewable energy by flower farms has also seen new vendors of medium to large scale solar power developers shift to investing a lot to the new emerging market. This is becoming the greatest payoff of investment in solar energy to the country's floriculture industry ❐

Keitt Exporters: The home of Avocado Farmers

Keitt is establishing a modern packhouse, processing centre and a factory at Kenol, Thika, Muranga County to centralise consolidation of the fruit and related operations which will be ready for the next avocado season early 2020

Asif Amin Managing Director

Isaac Mwangi, the Production & Technical Director

Dipesh Devraj, Commercial and Operations Director

Mr Francis Gichuru, the Avocado Farms and Agronomy Manager, made a presentation on the right way of planting avocados

By MURIMI GITARI and ANTHONY MUTAI

With three commercial farms, thousands of contracted farmers and a new state of the art pack house in the offing, Keitt Exporters is set to mark its 20th anniversary in the fresh produce business as the home of avocado farming in East Africa.

While pundits think the current wave of expansion in avocado production in Kenya is likely to dumpen the fortunes of growers as large volumes are offloaded into the market, Keitt is looking for more farmers to join its club as it gears to increase exports and feed the factory.

With eyes trained in a better future buoyed by rising demand in the local and export markets, a surge in processing avocado oil as well as other byproducts, Keitt is establishing a modern packhouse, processing centre and a factory at Kenol, Thika, Muranga County to centralise consolidation of the fruit and related operations which will be ready for the next avocado season early 2020.

For the 19 years the firm has produced and exported vegetables and fruits it is fairly familiar with consumer dynamics and inndustry trends to inform the next phase of development. The portfolio includes mangoes, passion fruits and premium vegetables like sugar snaps, baby corn, chillis, snow pea, French beans, with avocado being a top product. The name Keitt was derived from the mangoes business which was a flagship variety for over two decades ago. The name was suggested by the Managing Director, Asif Amin, and the Production and

Technical Director Isaac Mwangi. "Avocado is our flagship business now and for the future', said Dipesh Devraj, Commercial and Operations Director of Keitt that is handling some 600 containers in a season by sea and a similar number by air.

Markets

Any sales to China? Not yet. But we are ready to send fresh fruit when the deal is renegotiated given that at the moment Kenya doesn't have the technology to process chilled avocados. Managing Director Asif Amin says quality and consistency in the supply of high quality, pest-free and disease-free produce is the goal of Keitt Exporters for customer retention, markets expansion and sustained business, the reason the company is continuously training growers and putting in systems to ensure they are certfied by regulators and inspectors.

When the Chinese toured Kenya to access the country's capacity to supply avocados, Keitt Exporters is among the nurseries, farms and packhouse identified by the Kenya Plant Health Inspectorate Service to host the delegation attesting the firm's leading position in the sector.

Currently the firm has an exclusive market with various partners and customers in Europe where they are selling the Kenya avocados. Other markets are Middle East, Russia, Turkey and Asia.

Keitt's confidence in the future of the avocado is informed by reports the market is growing globally for the fresh market and processing into oil. Statistics in Europe show consumers have moved from eating 400g per person to 7kgs. Locally, for the past 10 years appetitite for the avocado has increased as Kenyans make the fruit part of their daily meals either with breakfast, lunch or dinner. Some consumers report substituting margarine with avocado as breadspread, Kenya's traditional foods – Githeri and ugali are not considered complete without a slice of avocado! These and other consumer habits have fuelled an unprecedented demand for the fruit, and luckily, some varieties produce year-round therefore avocados are available all through. Increased demand in the fresh market, pharmaceuticals and cosmetic industries provide feasible growth and expansion in production.

Josphat Mutuku, the Embu farm supervisor demonstrates on the process of transplanting avocado seedlings

Production

With avocado farming being a game changer in the country and many famers switching to avocados, Keitt sources fruit from own production harvested at its three farms in Embu, Meru and Subukia (Nakuru) and tops up with produce from about 4,000 out growers active at any one given season spread across the nine growing regions in the country. The three farms avearge 750 acres with over 50,000 top quality grafted seedlings at one given time. It also offtakes produce from single large commercial farms. Smallscale producers are advised to form groups with a minimum membership of 30 growers who cumulatively can put 50 acreas under the fruit. The nine growing areas of avocados include Muranga, Nakuru, Uasin Gishu, Machakos, Kajiado Embu, Nyeri, Kiambu and Meru counties.

Keitt specializes in growing and exporting hass and fuerte varieties. In their Embu farm they grow hass variety, Meru farm hass and fuerte varieties while in Subukia farm they have only Fuerte. The company is advising farmers to grow fuerte variety as there is a very high competition in the hass market.

Keitt specializes in growing and exporting hass and fuerte varieties. In their Embu farm they grow hass variety, Meru farm hass and fuerte varieties while in Subukia farm they have only Fuerte

"The focus right now with many growers and exporters is on the hass variety that has flooded the market leaving a wide gap on fuerte that will be in demand in some years to come therefore there is need for farmers to start planting fuerte" Said Isaac Mwangi, Production & Technical Director.

Isaac Mwangi, the Production & Technical Director says the uptake of seedlings from their nurseries is an indication of the rapid expansion in production as existing farmers expand and new growers board the train. New farmers who purchase Keitt seedlings are encouraged and supported to join the firm's growing outgrowers club to benefit from a guaranteed market and technical support. 'We sell certified seedlings and our agronomists work with the farmers through the journey till harvest, providing regular guidance and support every step of the way to maximise production", said Mr Mwangi who added this includes harvesting timing. Their nurseries are in Embu, Meru and Subukia, with Embu as the model farm, where they take farmers for training on field days or arranged farm tours. The fruits that they get from these farmers who are their outgrowers do not mature at the same time being an advantage for them as they are able to get avocados at different times for the market. Where many farmers order for seedlings, they deliver at a collection point.

For Keitt Exporters avocado seedlings in Meru, Embu and Subukia contact Francis Gichuru: 0721359547, Isaac Mwangi 0722728691

Mr Mwangi notes that many farmers lack guidance in growing avocados, and not getting it right can lead to frustration. Produce rejection resulting from failure to follow laid down procedures and low tree productions are some of the challenges. "To avoid these and other challenges, we partner with our growers to offer the guidance and react to any emerging issues", he explained, emphasizing on the need to obtain certfied seedlings, conduct a soil analysis to identify the right fertilizer, apply the recommended fertilizer and water the tree. "Avocado requires water to do well, drip or jet sprinklers are good for watering', he said. Keitt's farms are all under irrigation while the firm works closely with CropNuts for soil and nutrition health.

Keitt Exporters team with the delegation of Tharaka Nithi farmers at the Embu farm

Many farmers lack guidance in growing avocados, and not getting it right can lead to frustration

Take good care of the soil for best results

A group of farmers and Keitt Exporters team during a farmer's day at their Embu farm

A healthy avocado tree has a taproot that can penetrate to one meter, with most of the feeder roots in the top 20cm of soil in the drip zone. Its roots are generally shallow and spread in the soil surface in search of water and nutrients. The taproot holds the tree firmly only releasing water when it is extremely dry. The branches tend to follow the roots towards the source of water therefore keep the bottom of the tree moist to maintain the tree within manageable spread, with a clear distance between plants and rows for sufficient lighting and feeding.

The feeder roots are very delicate. Root rot (Phytophthora) can develop very fast when damaged or waterlogged. It is important to determine, in advance, the fitness of soil for avocado production.

Soil profile pits should be dug throughout the farm, at least 1.5 m and a minimum of one pit per ha (more in hilly or non-homogenous areas). One should look at soil color, texture, hard pans, sitting water, structure, patches, concretions, gravels and stones. Soil samples should be analyzed for chemical and textural properties. Samples should include both the topsoil (0-20cm) and subsoil (20cm-1m). Drainage and soil depth can be increased by mounding the soils up.

Red / brown soils are preferable, yellow /grey/light brown soils are often prone to temporary or permanent water logging. Very dark or black soils tend to have too much clay or a large percentage of organic matter that may result in acidic conditions and aluminum toxicity.

The clay content in soil can be determined by conducting a soil texture analysis in the laboratory. Avocados do best in soils with 20-40% clay. In soils with a low clay content (<20%), the water holding capacity is generally much lower, requiring frequent irrigation otherwise the roots may suffer from temporary drought. Very heavy clay soils have high water retention and lower infiltration rates. These soils may become oversaturated during heavy rainfall or over irrigation which promotes root rot.

Keitt key message to farmers as production increases, don't just plant avocados. Obtain certfied seedlings and link yourself to a buyer. In the coming days we will need all the fruit for processing. But we don't buy fruits from anyone. We buy from contracted farmers.

Soil structure plays a big role in production and root health. Strongly developed block structures, soils that break into hard clods and soils that have large cracks when dry are unsuitable. Soils should only show small, fine cracks when the soil dries up.

Avocados can grow in soils from pH 5-7, with an optimum PH of 6.2 t0 6.5. A complete soil analysis, done in good time well in advance of planting is essential. Lime is added to acidic soil to increase the soil PH to 6.5. Dolomitic lime is part substituted for calcitic lime if magnesium is deficient. If phosphorous is deficient it should be added along with the lime and mixed thoroughly into the soil prior to planting. If the soil is too alkaline, the PH may be reduced by adding Sulphur and keeping the soil moist for 6-12 months.

Calcium is a critical nutrient in avocado production. Soil levels need to be higher enough to suppress root rot. Plant levels are important for the nutrient content and storability of the fruit.

Farmers' day out

During a visit by a group of farmers from Tharaka Nithi County at Keitt Exporters Embu farm, Mr Francis Gichuru, the Avocado Farms and Agronomy Manager, made a presentation on the right way of planting avocados. He advised the attentive growers on the importance of obtaining seedlings from known sources for assurance of type quality and maturity. "Don't buy seedlings from the roadside because they are cheap. Chances of not knowing what type you are planting are high and so is the possibility of its not thriving into a mature productive plant", he advised to laughter from his audience who later confessed to have suffered the fate. Seedlings, he added must stay in the nursery for not less than one year to withstand the shock of transplanting and be clean of root pathogens.

Transplant by digging a hole of 2X2 ft. The soil dug out is mixed with manure at a ratio of two wheel barrows of soil to one debe of manure and returned to the hole without compacting the mixture. The seedling is placed in a raised bed to control waterlogging which causes root fungi. Good spacing of 4X6 between rows is recommended due to shallow spreading nature of the avocado feeder roots to create sufficient spacing for feeding and light for the leaves.

He added that avocado trees are maintained by watering them once or twice in a week provided mulching is done.

"When planting ensure the soil is not compacted and do not provide any kind of nutrients to the seedlings other than manure," he said. The first fertilizer application should be Nitrogen, Phosphorus and Potassium (NPK) at a ratio of 3:1:3 applied after four months which should last for up to one year before the next application.

Avocado farms and Agronomy manager Mr Francis Gichuru with the delegation of farmers from Tharaka Nithi County at the Embu farm

Afterf 18 months, apply Zinc and Boron by way of spraying or applying on the ground to provide sugars to the plant and help in pollen germination respectively. Avocado trees in Kenya flower in August and farmers are advised to feed the plant four months earlier. The young avocado tree is whitewashed to reflect sunlight and prevent damage. It is critical not to dilute the solution too much.

With common fruit fly and False Coddling Moth being the main pests in avocados and major threats, Mr. Gichuru reports there are very simple ways of tackling the predators. Pheromone traps are effective in knowing the ratio of males to females and type of pests in their farms.

One of the farmers, Gitari M'Rachi, noted with concern how they have been growing avocados the wrong way and with the brief training they received, they are now going to do it the right way with expectations of reaping higher yields.

"We have been mistreating the avocado trees and now with this kind of information we now aim to embark on a journey of transforming our orchards ," Mr. Gitari said amid applause from his peers.

The delegation of farmers showed great interest going by the questions raised. They engaged the technical team at great length and requested Keitt Exporters team to visit their farms to sensitize them and other farmers more on production as they also organize themselves for another tour which will attract more growers from the county, with assurance of signing supplier contracts if they are organized and ready for training in Good Agricultural Practices.

The Keitt team together with the directors of the company hold regular field days and spend the day with farmers – this is an old traditional concept from tobacco farmers in Zimbabwe who meet together and see the good, the bad and also exchange ideas on the fields as they walk the talk – a new concept introduced by Keitt management says Dipesh Devraj the firms Operations & Commercial Director. We also have regular specialist growers from Israel hosted by Keitt to visit our farmer's fields at the cost of Keitt – this is an imitative we drive so all of us can benefit on increasing our yields.

The County Government official Wilberforce Muriungi said the relevant departments would mobilise the necessary support to ensure Tharaka Nithi can tap the huge potential in avocado for increased farmer incomes ❐

Avocado production in Kenya

By Dr. Hezekhiah Agwara (BIF)
Ian Kopar (ACRE AFRICA)
Stella Ndirangu (ACRE AFRICA)

Immature fruits aborted before maturity. The fruit abortion can be linked to self pollination or poor nutrition for the tree

The equatorial climate in Kenya is favourable for avocado production. The country enjoys a competitive advantage over leading global producers (Mexico, Chile, Spain, and Israel) because the main harvesting season extends much later into the year when the leading producers are offseason. In the past few years, avocado production in Kenya has been increasing rapidly due to increasing demand in major export markets, better market organisation, and better prices for the fruit. This has led to the categorisation of avocado as the fourth most important cash crop, representing 17% of Kenya's exports.

Avocado is produced in several agro-ecological zones in Kenya, with major concentrations in the highlands regions – Murang'a, Meru, Embu, Kisii, Nyamira, Nyeri and Kiambu. Production is considered for local consumption and export. Kenya has been ranked as one of the highest avocado exporters in the world – number two in Africa in 2018. The major varieties produced in Kenya include are Fuerte, Nabal and Puebla, with Hass and Pinkerton fast emerging. The main varieties grown for export are Fuerte, Hass, and Pinkerton, which constitute about 30% of total production, while the rest are Puebla, Duke, Nabal and G6 for domestic consumption. Production cycle typically begins in October, followed by a dry spell in January to end February, and then the long rainy season from March to May; harvesting starts from April and continues into September, depending on the region and variety.

Avocado agronomic practices

Establishing an avocado orchard: Theory versus Practice: Let us get it right from the onset!

Although avocado can grow in multiple locations, it is important for farmers to understand that there is a difference in the scientific or theoretical and the practical procedures to follow in establishing an avocado orchard. For example, in theory, farmers in Nandi can purchase avocado seedlings from KALRO in Thika. However, in practice, the seedlings from Thika are acclimatised (or are used to) the climatic conditions in Thika and Central Kenya not those in Nandi.

As a farmer, there are critical requirements that MUST be considered before you can venture into profitable avocado production. These include:

Climatic range

It is important that a farmer only establishes an orchard if their land falls within suitable climatic range. The avocado tree does well in all altitude ranges, from sea level to 2500 metres above sea level. Some cultivars, such as Simmonds, Booth 7, and Booth 8, prefer low altitudes of 90-800 m; Hass and Nabal are more versatile, 800-2100 m, and Fuerte and Puebla are restricted to 1500-2500 m. altitude is important because the avocado tree prefers temperatures of 15-30°C, with high humidity, and can withstand as high as 33°C.

Avocado tree prefers well distributed annual rainfall of 900-2000 mm. For optimum productivity, trees must be exposed to a period of stress (dry season) for about 2 months followed by rain to induce flowering. Sufficiently high moisture content and light showers at the time of flowering and fruit set ensure good yield; off-season flowering and

fruiting can be induced by stressing the tree and then watering. Avocado tree has a relatively shallow root system; thus, where irrigation is necessary, water should be applied frequently but in light applications (not more than 50 mm at a time). The tree is also sensitive to strong winds, which may lead to breakage of branches, drop of flowers and fruits, and uprooting of the tree. Moreover, hot dry winds may cause desiccation of flower buds or abrasions.

Erratic weather patterns experienced in recent years have adversely affected fruit yields and farm operations.

Soil Type

Avocado prefers deep well-drained soils with adequate organic matter for water retention and a pH range between 5.5 to 6.5. Waterlogged soils are not ideal for avocado production as such soils create an ideal environment for the development of root-rot disease caused by the fungus Phytophthora cinnamomi, which is usually associated with lack of aeration. Furthermore, the tree has very low tolerance to salinity. It is therefore important that farmers involve accredited government institutions, such as KALRO, and private companies, such as SoilCare Limited, to carry out regular soil tests to ascertain the properties of their orchards. Soil testing is a crucial factor in crop production and helps farmers identifying mineral nutrient deficiencies for appropriate remedy. Annual application of organic and inorganic fertilizers, lime, and foliar feed is critical for avocado tree yield and pest/disease control.

Source of Seedling and Grafting

Grafting is common in avocado seedling propagation. It is done to improve survival, increase genetic diversity, and growth vigour. The scion should be dominant and match the size of the rootstock.

Rootstock

A rootstock is a stem with a well-developed root system, to which a bud from another plant is grafted. In avocado production, the desired rootstock varieties in Kenya include Fuerte, Puebla, and Duke. It is, however, important to note that it is desirable to source rootstock varieties from similar agro-ecological zones as the location of the orchard for ease of climatic adaptation. If the varieties listed above are not available, you can select a rootstock from a local avocado tree that grows well within your area. Avocado orchards are not uniform either in tree behaviour or in productivity. They are probably the most non-uniform of all fruit trees. The technical explanation for such a phenomenon is the rootstock variability resulting from seed heterozygosity (Gene diversity).

Factors to consider when selecting the rootstock:

Should be from a similar agro-ecological zone (the same way a maize farmer 1. in Nandi cannot plant maize varieties from Makueni but can plant varieties from Kitale, then the avocado rootstock planted in Nandi should also come from an area with similar climatic characteristics)

2. Should be from a tree that has a history of healthy and multiple fruits production (if you use a rootstock from a tree that produces very little fruits, then even after grafting, the basic production characteristic will remain low)

Scion

The scion is a young shoot, branch or bud that is taken from one plant to be grafted onto the rootstock of another plant. Farmers should endeavour to get quality scions for grafting, as this will develop into the productive crown of future avocado tree. This should be sourced from healthy and high yielding mother plant that is true to type and with a history of producing high-quality fruits.

Factors to consider when choosing a quality scion:

Should be from a tree that has already started producing fruits (this means it has mature reproductive hormones). As a result, after grafting, the scion will form into a shoot that contains mature reproductive hormones and will be able to start flowering and producing fruits within 3-5 years. (If the scion is sourced from a young tree that has never flowered, then the newly grafted tree will take 7 or more years to bear the first flowers and fruit.)

Should be from a healthy tree – if the scion is procured from a diseased tree, it will carry on the disease and could cause an infection of other existing avocado trees in the area.

It is therefore imperative that the farmers consider the above critical pre-requisites while selecting or sourcing seedlings from accredited nurseries. There is a high possibility that the vendors may not be conversant with the characteristics of the different ecological zones from which the farmers come from.

In cases where they do, the nurseries may not be having varieties suited for all the different ecological zones ❐

What do I do if I have already bought seedlings or established my orchard without following

these steps?

Ian Kopar, an Agronomist at ACRE Africa advises the following:

Avocado farming is a long-term investment (30-40 years) that a farmer would wish to get right from the onset. It is recommended that you consult an Agronomist to visit your farm to provide on-site technical

Planting

The ideal spacing for avocados is 9 m x 9 m, which would give a plant population of 120 trees per hectare (2.47 acres). However, spacing depends on the variety and agroclimatic conditions; in intensively managed orchards, Hass can be planted at 5 m x 7 m and Fuerte at 6 m x 7 m intervals.

The planting holes should be 60 cm x 60 cm x 60 cm in length, width and depth. Seedlings should be planted in raised soil (mounds) to prevent water collecting at the base that can cause fungal infections. Fungal infections at a young stage permanently compromise long term yields and may shorten the productive life of trees (from 30-40 to 8-10 years).

Pollination

For optimum pollination and yield, it is also important that the farmers do not plant only one variety of avocado within the orchard. This is important because different varieties of avocado have different flowering patterns (Type A and B), agro-ecological requirements, and bearing patterns (consistent versus alternate). Self-pollination leads to heavy flower and fruit abortion – hence poor yield. Type A (e.g., Hass, Pinkerton, and Puebla) and Type B (e.g., Fuerte and Nabal) varieties flower at different times of the year and flowers open at different times of the day and days of the week. Type A female flowers are receptive to pollen in the morning and male blooms shed pollen in the afternoon; Type B flowers are receptive to pollen in the afternoon and their male blooms shed pollen in the morning. This means that optimal yield occurs with cross pollination between Type A and Type B flowers; therefore, mixing varieties in the orchard would enhance cross-pollination, which results in higher and consistent tree yield. In addition, keeping bees within an orchard would be an added advantage as bees are the main pollinators of avocado.

Intercropping

Land sizes for agricultural production in Kenya are becoming smaller and smaller causing farmers to intercrop for economic and food access during the first 3-4 years before the tree starts bearing fruits. Farmers should NOT intercrop avocados with crops that are alternative hosts to its common pests and diseases. Since pests and diseases can also be specific to locations, farmers are advised to consult their local extension officers for intercropping advice. Farmers should engage off-takers to provide guidelines on approved agrochemicals and fertilizers so that the fruit conforms to market and regulatory standards.

Crop protection

Pests and disease management is a major challenge to growers; particularly avocado anthracnose disease, fruit flies, and weeds. The use of agrochemicals in avocado is limited and whenever applied, farmers access them through local agrovet shops that are supplied by major agrochemical companies. Integrated pest management (IPM) practices are recommended for optimal crop protection and compliance with maximum chemical residue levels (MRLs).

Harvesting

Harvesting practices are key determinants of yield and quality of avocado fruit. It is critical that farmers invest in proper harvesting practices and technology. However, due to the high demand and competition for the fruit, picking immature fruit by unscrupulous farmers and brokers is common, which leads to poor quality fruit and high rates of rejection by the market. For market channels where the fruit is purchased 'on the tree,' off takers engage their own pickers to ensure quality is not compromised.

An example of interventions to get it right

From the agronomic information discussed above, avocado

On-farm grafting of seedlings by Kuga Seedlings Farmers Group in Kiamachimbi, Nyeri County

BIF also facilitated ACRE Africa to conduct a feasibility study on climate risk management solutions for the avocado value chain.

production requires extensive technical support to get it right from the onset. One of the key differences between a healthy productive orchard and premature cessation of production by the eighth year is the quality of seedlings and planting technology. Recently, farmers have taken up avocado production without the requisite technical and extension support only to be disappointed when the expected returns do not materialise. BIF identified these knowledge and technology gaps as key to avocado development and has been collaborating with Nyeri County Government to improve the capacity of extension services and farmers organisations to support avocado farming and marketing through training and organisation support.

BIF also facilitated ACRE Africa to conduct a feasibility study on climate risk management solutions for the avocado value chain. This was aimed at addressing increasing vulnerability to climate variations, and stems from the finding that financial institutions are willing to lend to the value chain but only if there are risk management solutions available. The study conducted an assessment to identify the key agronomic and weather risks affecting avocado production in Kenya for purposes of developing suitable risk management solutions.

Experience from this interventions so far shows that because it is a relatively new crop, even to Agriculture Extension Officers (AEOs), farmers have limited understanding of the best ways and places to source seedlings, characteristics of good quality seedlings, suitable varieties and the need to adequately mix varieties for optimal production, planting methods (variety-specific spacing and planting in mounds), proper tree and orchard management, and the effect of soil health and weather patterns on tree growth and fruit bearing. Moreover, the advice provided to farmers is oftentimes inaccurate. For example, farmers are being advised to cut down Fuerte and Pinkerton trees to plant Hass, which is considered more valuable, yet the major export markets are indifferent to these varieties; in fact, major exporters have indicated they equally prefer the three, if not more Fuerte.

Training, educating and advising the AEOs, Lead Farmers and farmers organisations has shown that most knowledge and technology gaps can be bridged relatively quickly and at affordable cost. The AEOs and Lead Farmers quickly picked up from the training provided to lead the education of farmers. In addition, better market structuring through better organisation of farmers and linkages with off takers has been shown to increase the value of produce and farmers' incentives to invest in their avocado trees. The climate study developed weather models and produced advisories for dissemination, and also drafted a prototype index insurance product to be tested for the value chain. It confirmed that climatic patterns are critical determinants of avocado yield and output.

Agro-Weather Advisories: Using weather forecasts from Kenya Meteorology, satellite weather data trend analysis and agronomic data, ACRE Africa developed agro-weather advisories tailored for each value chain and specific locations. The advisories were developed using the weather forecasts for specific locations in relation to the agronomic stages of the trees. The advisories were then transmitted to farmers and other value chain stakeholders through text messages to form decision support systems.

Index Insurance: ACRE Africa has crafted a prototype weather index insurance, which will proceed to product development phase. The insurance product development process will take time due to the challenges in yield data and the presence of multiple middlemen (brokers) within the value chain processes. ACRE Africa anticipates that a tested index cover will be ready by 2020 for piloting, with the hope that it will enable more financial service providers to support avocado farmers more comfortably to increase production ❐

From a Lab Technician to organic avocado grower in Murang'a County

Robert Mburu Murega, an organic avocado grower, who took an early retirement after seeing the potential in avocado farming

By MURIMI GITARI

He probably never knew that he would one day be recognized and get awarded not only as the best avocado farmer but one who has ventured into organic farming of this green gold.

Robert Mburu Murega, a 66 year old retired Lab technician who worked in the ministry of Education took his early retire after seeing the potential of making more income from avocado farming. He had planted fuerte varieties that were the only grafted avocados in the early 80s when he was still a civil servant that would give him enough money.

In the year 2003, Mr. Mburu decide to quit his job to invest in farming where he added more avocado trees that he had already had in his farm.

Located a few meters form Kihumbuini shopping center in Kihumbuini sub-county in Muranga County, Mburu's farm has a total of 1,800 avocado trees of the hass variety after cutting all the fuerte and grafting them with hass.

"I decided to cut the fuerte variety and graft with hass due to the black spot deficiency in fuerte and the low prices they were giving at the time,"Mr. Mburu tells HortiNews after paying him a visit in his 8 acre farm. "I started with 100 hass trees after seeing the potential in them when I visited a farm at Kandara in Muranga County giving me a total sense of the variety where I grafted my fuerte and within six months started bearing 10-15 fruits," he adds.

From the year 2006, Mr. Mburu started planting plants not less than 200 seedlings that he makes from his nursery which is in his farm and fully cerified by the certification bodies in Kenya. He also sells the seedlings to farmers who come to buy from him and during our visit he had grafted 1,000 seedlings to a farmer who is yet to pick at a cost 0f Ksh 25o per seedling.

He started making his harvest in the year 2009 from the old grafted trees and the new ones by making an harvest of 40, 000 piceses of avocados from the old ones while the new ones would give him 20, 000 seedlings in a season.

'I do organic farming in my farm as it Is cheap due to the fact that I do not depend on pesticides or fertilizers but rather use compost manure that I make in my farm," Mr. Mburu says. He does not use any machinery in his farms as he has traps that he uses to counter fruit flies and False Scolding Moth FCM which are the most threatening pests in avocado farming.

"These traps are the best when it comes to monitoring the pests in your farm as they will help you know if the farm is highly infested by pests or not, you are able to do daily recordings in a pest control file of the pests that in your farm by the means of the traps," he explains. The recordings do not occur to those that use pesticides in their farms as they might not know what pests they have killed after spraying.

All the traps in the farm are numbered and contain phenomenon inside that attracts the pests where once they get inside they are trapped by getting stuck to a gummy paper and put inside the traps. When the farm is highly infested, Mr. Mburu keeps the traps all over and within a couple of days there will be few or no pests in his farm. FCM traps are kept overnight as the pests invade the fruits at night when they are very small in size.

He says that organic farming is very sensitive as one has to keep guard to the farm to ensure there are no strange things within the farm. He has a pit consisting of charcoal and concrete mixture where he throws away any kind of strange liquid that he finds in the avocado farm. The farm is well organized by having separated farm house, offices, cow sheds and the farm.

Mr. Mburu depends on rain water to water his plants and does not use any kind of irrigation.

An avocado tree at Robert Mburu's farm in Muranga County grown using compost manure only with no use of pesticides or fertilizers and depends only on rain water

His pruning stars in the first year after planting the seedlings while he prunes the mature trees after every harvest he makes. This is for the management of the plants where they will be able to get enough lighting and to control overcrowding. After pruning he applies liquid copper and white emulsion to the pruned plants that help control fungal infection.

He has put 40 fruit fly traps in the farm and 10 FCM traps. The farm has golden tree varieties that are believed to grow quickly and produce avocados early. There are also giant trees that produce about 4,500 pieces in every season with each piece estimated to go at a price of KS 15 though he sells his avocados in boxes.

The retired lab technician who served he government for only ten years applies the manure he makes to his plants in the months of July and August when there are no fruits to harvest. He gets more manure from the Maasai community to add to what he makes which is believed to be much nutritious to crops.

He currently sells his produce to Mavuno Orgnics, Kandia and Sunripe exporters but he is in the process of getting certified where he will be exporting directly from the month of September.

Mr. Mburu is certified by Eco-cert from Madagascar but based in France to practice organic avocado growing and Afri-cert, a Kenyan certifying body that is global.

When asked about the new China market, he overwhelmly supports it as it will bring a lot of benefit to the Kenyan avocados as there will be no further rejects again. This means that, with the exportation of peeled and frozen fruits, both fully grown avocados that are considered as rejects will also find their way to the export market together with the export ones.

Muranga county alone, exports 10 containers a day with farmers having planted more than 5 million avocado trees this year as the market continues to expand ❐

Mofarm: One of Kenya's leading green gold exporters

Mofarm Co- Director Maggdaline Kamau (center), Lydiah Muthoni, Packhouse Technical Advisor (right) and Clarisie Wambui, the Packhouse Manager displaying some of the avocados Mofarm exports

By MURIMI GITARI

It is a sunny afternoon when we catch up with Lydiah Muthoni who is the Packhouse Technical Advisor, at Mofarm Fresh Fruits Exporters, a company that won an award for the best medium scale exporters. After a warm welcome at the company's packhouse, located in Utawala, off Ring road, she takes us around the packhouse as she explains every step involved in preparation of exportation from receiving the green gold from farmers up to packaging and then shipping.

"We have a team that receives and offloads the avocados from trucks where they are later washed as they are taken to a sorting line machine that sorts the size of the avocados, helps remove unnecessary materials like leaves and twigs that comes along with them," she says. The company exports both hass and fuerte varieties with hass having a high demand in Europe while the demand for fuerte is in Middle East and Egypt.

Lydiah introduces us to Mrs Magdaline Kamau, one of the Directors of the company who is also the founder of the company. She is in her early 30s and after some brief introductions, she says she is ready to tell her success story on the birth and growth of Mofarm.

"We started Mofarm, initially known as Molo Farm in 2008 when I as at the age of 23 and my husband was at 26," Mrs Kamau starts narrating the journey of their success that has also been met by a quite number of challenges especially when they operations of exporting begun but were able to scoop them all. She says they named the company Molo Farm as they were living in Molo but later changed the name to Mofarm after releasing the first name was registered under another company.

They were motivated by an avocado farmer in Molo who had several avocado trees on his farm that he was selling to an exporting company that he was working for. They realized how it would be good for them to have such a company where they will approach such farmers to get their avocados and export for them.

"The farmer had so many avocado trees and many of the avocados went to waste as there were very limited companies that specialized in exportation of the fruits. At that time we were very young with my husband

but we decided to try it out by having our own company that will specialize in exportation only," the Director says.

She says they had no much money to start the business and they approached a packaging company where they struck a deal of getting their avocados packaged.

"When we started the business, we lost our very first container losing millions of money prompting us to almost quit," she adds. Their first vessel was supposed to go to Dubai but it found its way to Saudi Arabia. Mrs Kamau describes the situation as the most devastating one having it in mind they were new to the business with very high expectations of making money.

Other challenges the company has been experiencing since establishment according to the Director is getting orders that comes along with very stringent rules of quality specifications that they cannot be able to meet. There are buyers who want the produce without any kind of spots. Anthracnose is a disease affecting avocados bringing the spots thus being a major threat to the industry currently.

The Director who is also in charge of International marketing and exhibitions for the company and says they have so far been exporting in Europe, Middle East especially the hass avocados.

"The company has grown to a full limited liability and we have over 35 employees that we have employed to help in operations and we intend to add more workers as we await relocating to our new home that the company has put up to expand the business," Mrs. Kamau explains.

The company contracts small scale avocado farmers where they them with trainings on emerging farming trends though agronomists. The farmers also get inputs on credit or subsidized prices from the company after settling on an agreement.

Avocados being cleaned by a machine that grades them according to their sizes at the company's packhouse

"We work closely with these farmers to ensure we get the best quality avocados free from diseases, pests and any kind of deformity," Ms Muthoni, the Packhouse Technical Advisor who is also in charge of local marketing says.

Due to market demand and the stringent rules put the farmers are supervised in ensuring they adhere to the standards and to sound environmental farming practices. All farms that supply Mofarm with avocados are Global Gap, Organic and Field to Fork accredited and certified. Global Gap certification takes a period of 6 months while the organic one takes up to 3 years.

They have external auditors who go to the farms to check if farmers have met the set standards by the certifying bodies and adhere to agricultural practicing procedures. Mofarm works with both individual and group farmers who must have not less than ten stems per individual in every group. The groups must also have committee consisting of a chairperson, secretary and a treasurer. Every farmer is provided with a trace code that helps in tracing of where he avocados came from in case of any issues that would arise after the farmer supplies the produce to the company.

The cost of training farmers is expensive but the company has been sponsored by various organizations in training them. International Trade Centre, AFFA, KEPHIS, Export Promotion Council and USAID are some of the sponsors partnering with Mofarm in offering trainings to the groups.

There are 8 groups in Muranga, one in Meru and another in Machakos counties supplying Mofarm with avocados as they intend to diversify in other 31 counties that grow the green gold. Some counties have got cotton and rocky soils that not best fit for the growth of avocados.

The company buys directly from these groups or farmers so as to do

Readily packed avocados for exports by sea freight at the company's packhouse located at Utawala in Nairobi

away with middlemen who exploit farmers.

"It is our responsibility to give our clients consistent quality to enhance their value as we aim to grow on a solid base of trust and total dedication to the fresh produce industry which has also been showcased by President Uhuru Kenyatta when he struck a deal with the Chinese government and when he visited Malaysia early this year that led to the lifting of the ban on fresh produce," the Packhouse Technical Advisor says. The company has so far made shipment of avocados to Malaysia after the ban was lifted.

Mofarm preserves avocados in cold temperatures of 50C emphasized by temperature recorders after they are packaged and during transportation. Before shipping, they are also precooled at the same temperatures for six hours to ensure they do not go bad during their transportation. This helps in pro-longing their shell life. Containers used to transport them have gen-set or cooling facilities for cooling purposes with shipment expected to take about 28 days when being transported to Europe.

Mofarm has not yet started exporting to China even after the Asian continent opened its market for Kenya's fresh produce due to the sanitary and phyto-sanitary measures put by the Chinese government.

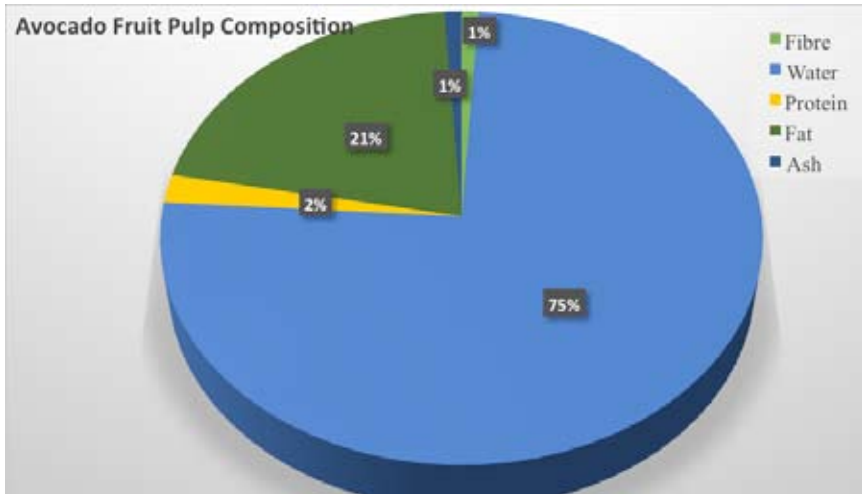
"These measures or rules put by China are an eye opener or wakeup call to us as they will help us add value to our avocados and here at Mofarm plans are underway to start exporting peeled and frozen avocados," Mrs Muthoni explains. She says China is trying to show that Kenya has untapped potentials that can come in existence by doing away with traditional way of doing things and using technology. Exporting peeled and frozen avocados will be convenient and will bring lots of money as compared to exporting raw ones according to Lydiah. She says that a 40 foot reefer or container carries 20 pallets of boxes with each holding 120 boxes of 10kgs. There are also pallets that hold 288 boxes of 4kgs meaning a 40 foot container can be loaded with 5,760 boxes of avocados. The space consumed by the raw waste materials of the avocados which include the seed and the peeled waste can accommodate more avocados when peeled and frozen thus bringing more money.

The company has already acquired a new sorting machine that comes along with facilities of peeling avocados as they get prepared for the China market and value addition to the green gold. The machine which is at the port of Mombasa awaiting clearance will be installed at their new premises in expansion of business by an Israel expert whom they will cater for all his expenses during the period of installation. They also have plans of extracting oil from avocados that will be used as cosmetic and for cooking.

Other than exportation of avocados, the company also exports mangoes, coconuts, thorn melon, baby corns, cashew nuts, vegetables, chillies, pineapples and butter nuts.

As we part short with the director and the technical advisor, they are all full of ambitions of growing the company from strength to strength in becoming Kenya's best avocado exporter the most value adding company to avocados and with all of this, to be the first company to export frozen and peeled avocados by meeting the set standards by the Chinese government ❐

High avocado fruit quality is key to competitiveness in the market place



Ripe avocado fruit pulp composition, adapted from Fats and Oils Handbook, 1998

By Dr. Jane Ambuko

Avocado has become increasingly important in Kenya as the leading export fruit which account for 74% of the export revenue from fruits. It is now considered as the 'green gold' – both for farmers and traders (especially exporters). Although most of the avocado producers target the lucrative export market, the domestic market is expanding gradually as consumers become more aware of the health and nutritional benefits of the 'super fruit'.

The fruit is a rich source of health promoting nutrients and compounds including minerals, vitamins E and C, and βcarotene (pro-vitamin A), proteins, carbohydrates, fats and fiber (Fig 1.). It is noteworthy that avocado fruit contains approximately 2.5% protein which is significantly higher (2 – 10 times) than most fleshy fruits and vegetables. The fruit also contains a high oil content (10 – 20%), most of which is contained in the fleshy part of the fruit. It is also noteworthy that avocado contains more of the good fat – the monounsaturated fatty acids.

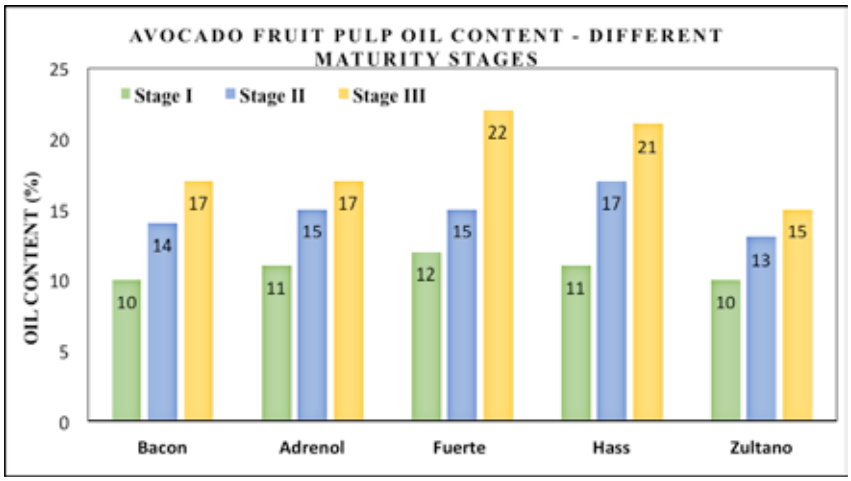
Of the many components in avocado fruit, its oil content is a critical quality attribute which affects market acceptance both for industrial and culinary use. Oil content is also used as an index of maturity in avocado fruit.

The use of avocado oil has been predominantly in the cosmetic industry, mainly because of its stability and high content of vitamin E which is a key ingredient in beauty products. However due to consumer awareness about the health benefits of the super fruit, avocado is gaining even greater importance in culinary use.

What factors affect the oil content and therefore quality of avocado fruit?

Among the many other factors that affect the oil content and quality of avocado fruit, variety, crop production/orchard management practices, agro-ecological conditions and harvest maturity are key. Oil content varies with variety – some varieties contain more oil than others. The dominant varieties in the Kenyan export market (Fuerte and Hass) have an oil content ranging from 14 – 20% depending on production conditions and harvest maturity. Oil content in other common varieties such as Bacon, Puebla, Duke, Adrenol, Pinketon, Zultano ranges from 10 to 18%.

Like other fruits the quality of avocado fruit is affected by preharvest production factors including crop husbandry practices. These include water and nutrient management, pest and disease management and other orchard management practices. Therefore best fruit production and orchard management practices must



be employed to ensure optimal fruit growth and development which subsequently affect fruit quality at harvest.

The agro-ecological conditions have an effect on avocado fruit growth and development and significantly affect the oil content. Kenya has diverse agro-ecological zones ranging from sub-humid to semi-arid. Due its wide adaptation, avocado fruit is produced in most of the agro-ecological zones in Kenya hence potential variation in quality of the fruits from the different AEZs. Unpublished studies (Boen, 2019) show that Hass avocado fruit produced in the less humid (dry) AEZs have higher oil content compared to those from the more humid (high potential) AEZs in Kenya. This means that even when avocado fruits possess similar physical attributes such as size and peel color, they may vary significantly in internal quality attributes including the oil content.

The same studies also showed that harvest maturity has a significant effect on avocado fruit quality attributes including oil content. Oil content was shown to increase gradually from <5% at 120 days after bloom (early harvest) to >13% at 180 days after bloom (late harvest).

The high demand for avocado fruit, especially in the export market often pushes farmers to harvest the fruits early in the season (often prematurely) to meet their contractual obligations. Knowledge of the maturity indices for various avocado varieties so as to guide farmers on when to harvest the fruit without compromising the quality is important.

Immature harvest not only affects the oil content but also negatively affect the eating and keeping quality of the fruit. Fruits that are harvested too early (prematurely) have low pulp dry matter, watery texture, poor flavor, shrivel during ripening and don't ripen evenly. These attributes have negatively impacted traders and consumers perception of avocado fruit from Kenya.

As the global demand for avocado fruit continues to increase, more farmers (not only in Kenya) will increase production to take advantage of the market opportunities. For the avocado fruits from Kenya to compete favorably in the global market, efforts must be made to ensure that the factors that affect fruit quality are addressed.

There are various postharvest technologies and practices that can be applied to preserve quality after harvest. These include technologies for cold chain management, ethylene management, waxing to minimize gaseous exchange and water loss among others. However these technologies can only preserve the existent quality after the fruit is harvested. Therefore efforts must be made to ensure optimal quality at harvest and harvesting the fruit at the right stage of maturity. For Kenya's avocado fruits to compete favorably in the market place (domestic and global), there is need for concerted efforts and interventions from various stakeholders including farmers, traders, policy makers and researchers ❐

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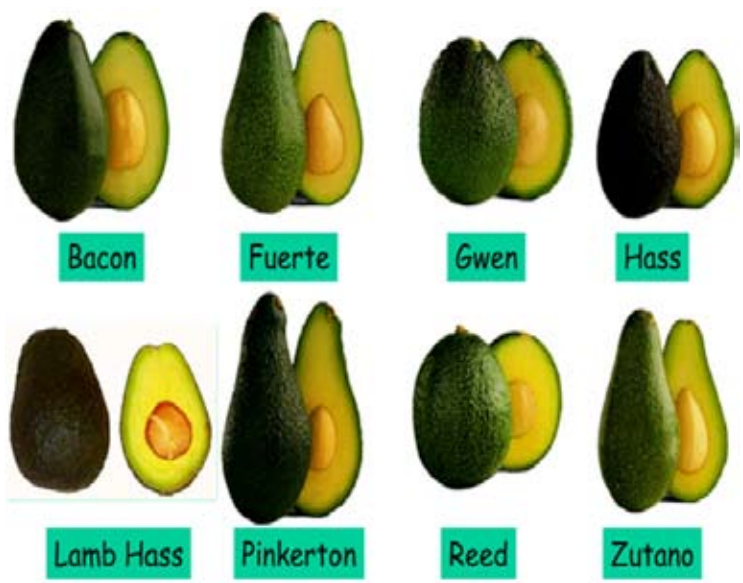

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