PINEAPPLE GROWER'S MANUAL

Scientific name: *Ananas comosus* **Local Name: Swahili,** Nanasi

1.0 Introduction

Pineapple is a perennial herb that is grown for its juicy sweet fruit. It origin is traced back to the tropical regions of America. It belongs to *bromeliaceae f*amily.The stem is short stout with rosette of sword shaped leaves. The fruit is a terminal, cylindrical, compound structure at the apex of the stem and is formed by the fusion of the berrylike fruit lets that develop from the flowers. At its apex the fruit bears a compressed, leafy shoot called a crown.

1.1 Uses

It can be consumed fresh or processed and canned. Pineapple fruits are rich in sugar and provide good source of Vitamin. A, B, C and minerals like P, Ca, Mg, K and Fe. the fruit as well as the other plant parts like stem contain a proteolytic enzyme, bromelin, which helps the digestion process. This is used for tenderizing meat and in the leather tanning process. The fruit contains fairly good amount of fibers, which help in the bowel movement.

1.2 Varieties

Kenya's popular varieties include Smooth Cayenne, MD2, Red Spanish, Pwani hybrid and Queen.

Variety	Photo
Pwani hybrid	
Smooth Cayaenne	
Red Spanish	
MD2	

Figure 1: Pineapple varieties

1.4 Counties where grown

Homabay, Busia, Coastal region(Kilifi, Mombasa, Kwale, and Taita Taveta),Kiambu and Nyamira.

1.5 Ecological conditions:

Being a tropical crop, pineapple can grow best under the following conditions
Temperatures: between 23 – 32 o C.
Optimal PH: between 4.5-6.5.
Soil types: thrive best in well drained mildly acidic soils with high organic matter
Rainfall rates: range 1,143mm - 3,800mm.

2.0 Good Agricultural Practices (GAP)

Horticulture industry in Kenya is guided by a code of practice KS1758 which is a standard for flowers, vegetable, fruits, herbs and spices for both local and export market. The standard aims at ensuring food safety, environmental sustainability and social accountability by following good agricultural practices from production, processing, transportation and marketing of fresh produce.
The manual seeks to adopt climate smart technologies aimed at increasing production and productivity, enhancing resilience and reducing Green- house gases GHG emissions.

2.1 Crop establishment

Before establishing the crop enterprise crop planting calendar should be in prepared according to market requirements.

2.1.1 Land preparation

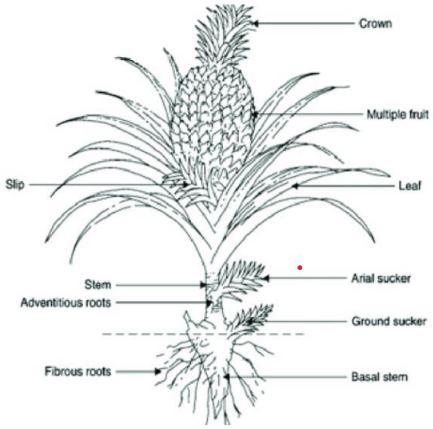
Land should be well prepared to a fine tilth and drainage structures put in place in areas prone to water logging.

2.1.2 Preparing planting materials

Propagation materials for pineapple are from crowns, slips, suckers and butts but commonly used are suckers and slips. It is important to source planting materials from a certified source.

Planting material are put under the shade for a day or two to cure before planting. Remove the dry scaly leaves at the base to expose the roots the planting material is treated with fungicide and insecticide to protect it against mealy bugs and heart rot.
The planting materials are graded according to sizes before planting to allow for uniformity during growth.

- Large suckers of 15 cm and above
- Small suckers of less than 15cm.
- Medium suckers are recommended to be used for purposes uniformity at maturity.



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2.1.3 Planting and Spacing

Double or single row can be used however, double row system of planting makes field management easier than single row planting and gives higher yields.
The heart of the planting material should be above soil level to avoid rotting. Water logging is not allowed around the plants.

Plant population per HA	Plant to plant within a row	Spacing -Row to row	Spacing-Bench to bench
35,000	35cm	60cm	90cm

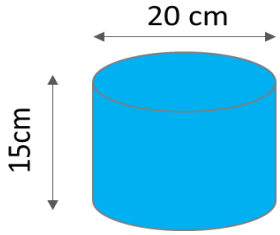

Fig 2: Planting hole for Pineapple

Fig 2: Planting spacing for Pineapple

2.2 Crop Management

2.2.1 Crop water requirement

Pineapple is a drought tolerant crop but irrigation can be applied when grown under adverse weather conditions to provide for uniform moisture for better growth and economic production.

2.2.2 Crop Nutrition

To sustain high growth rate and nutrient requirement, Nitrogen, potassium, phosphorus, calcium and magnesium are required by pineapple for in small quantities for the first five months but is increased up to two months before flowering.

2.2.3 Earthing up

This practice helps in promoting good anchorage to plant since they are prone to lopsided growth due to its shallow root system.

2.2.4 Removal of suckers, slips and crowns

De-sucking is done to allow for only one or two suckers for the ratoon crop, this is important since too many suckers/slips can weaken plant and hinder fruit development. Increased number of slips can delay fruit maturity.

2.2.5 Weed control

Pineapple field must be kept free from weeds to avoid competition for water, essential nutrients and space.
Methods of weed control used are;

- Mulching – plastic / organic mulch /stone mulch in some areas
- Hand weeding
- Chemical weeding

2.2.6 Pests and Diseases of Pineapple

Integrated crop management (ICM) is the best option for food safety. These practices include scouting of pests, field hygiene, proper spacing, physical methods, biological

methods like use of pheromone traps and others that will only give option of using Pest Protection Products as last option. The products must be registered for use on the crop in Kenya. (www.pcpb.go.ke/list-of-registered-products/

Pineapples rarely suffer from pests and diseases when good growth conditions are put in place. However, if conditions are not favourable pests and diseases can occur.

Table 1: Major Pests

Pests	Symptoms/Signs	Control
Mealybug (*Dysmicoccus brevipes)*  Photo: Kalro	Pink in color, up to 3 mm long, covered with a whitish waxy secretion, which develops into waxy filaments around the body. It is a vector of the Mealybug of Pineapple Wilt Virus. It is common on the roots of pineapple and large colonies develop on the stems just above ground level. May spread upwards to feed in the floral cavities, on both small and mature fruit, and on the crown leaves.	-Use of clean planting material. - Control ants to give a chance to natural enemies to keep mealybugs under control. -Heating pineapple crowns in a large water bath at 50°C for 30 minutes enables 100% plant survival and renders 100% of the plants free of pineapple wilt-associated virus. - Plant resistant varieties.
Scales (Dysmicoccus *bromeliea*) 	-A symptom of an attack is rust colored spots. -The insect is found beneath secretion, which serves as a shield. -In the case of this insect the scale or protective armor is made up partly of a waxy secretion of the insect and partly of molted skins. -Adult stage is quite well buried beneath the epidermis of the plant and hence there is necessity of	**-**Use of beneficial insects (parasitic wasp) **-**Use of methylated spirit and soap solution**.**

 Photo: Kalro	combating the pest in its early stages. -During periods of large populations, some scales become so abundant that an infested plant tissue is totally encrusted with insects.	

Table 2: Diseases and nutrient deficiencies

Disease/deficiency	Symptoms	Control
Pineapple Mealybug Wilt-associated closterovirus (PMWaV)  *https://www.mdpi.com/2311-7524/4/4/52*	-Yellowish-red to bright red at the leaf tips, that spreads down the leaf with time. -Soon other leaves turn colour and also show signs of wilting. -The inner heart leaves remain normal. -Stunted growth and produce small, under-grade and immature fruits during severe attack -The first effect of the disease usually appears in the roots, which stop growing, collapse and then rot; this results in leaves symptoms similar to the effect of drought. Mealybugs are the vectors.	-Use of clean planting material. -Heating pineapple crowns in a large water bath at 50°C for 30 minutes enables 100% plant survival and renders 100% of the plants free of pineapple wilt-associated virus. - Plant resistant varieties.
Top and Root rot (*Phytophthora cinamomi*)	- Leaf edges curve back and leaves are easily pulled out from the plant. -Stem and leaf become	-Avoid planting in water logged soils. -Ensure good drainage.

 https://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-106.pdf	soft, rotten and have an unpleasant smell. -The growing point of the stem has a cheese-like appearance. -It is common in young plants of 3-8 months. -Splashing rain, irrigation water and biting insects act as agents to spread disease.	-Improve soil by selective fruit rotations and application of organic compost material. Avoid overhead irrigation. -Control insect pests. -Dip planting materials in copper based fungicides before planting or use resistant plants. -Fungicides can be used to control any fungal complications.
Leaf spot {*phytophthora sp}*  https://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-106.pdf	-Initial infection appears at the apical end of the stem, at the base of the stem or at the roots -Stem shows brownish discoloration of the margins between healthy and diseased tissue. -The fungus survives in the soil -Brown spots appeared on the leaves. The disease is seriously only during low temperatures and overcast weather -It occurs frequently in moist, warm, climate. -Symptoms are in form of water-soaked lesions on the leaves {this disease incidence is more in areas with poor drainage} -The spots later enlarge in size and gradually dry	-Good soil drainage -Use of healthy planting material helps in minimizing the spread of the diseases -The plants recover when the weather warms up -Dipping of suckers recommended fungicide before planting has been advocated -Disinfection of nursery soil with recommended pesticides to kill the pathogens

	up	
Black rot (*Ceratocystis paradoxa*)  https://apps.lucidcentral.org/	-White leaf spots are yellow to brown and several cm long. - Later they dry to become papery and straw colored. -Black rot is a post-harvest disease occurring only on injured pineapple fruit. -Only freshly cut or injured tissue is infected, and a soft black rot with dark colored mycelium develops.	-Use crop management practices that promote germination and rooting. -In disease prone areas, if possible, plant varieties that are quick to germinate. Varieties that are slow to germinate should be treated in hot water (50°C for two hours). -Avoid extremely wet or dry soil conditions. -Do not plant freshly cut pineapples unless dried out -Avoid wounds to tissue and remove infected pineapple plants. -Improve soil drainage and avoid planting during wet weather.

2.3 Harvesting

2.3.1 Maturity indices

Timing is key in pineapple production and the stage of harvesting is determined by market destination and specification. Colour turns golden and gives a sweet aroma. The leaves at the Centre of the crown pull out easily when fruits are mature.

2.3.2 Harvesting method

Ready fruits are cut with a sharp knife severing the fruit stalk with a clean cut retaining 5-7cm of the stalk. Under large plantation, special machines are used to harvest ready fruits.

For fresh market the crown is left attached on the fruits while for processing/canning crown is trimmed off.

2.3.3 Expected yields

Plant population of 35,000 gives a yield of 70 tonnes per hectare.

2.4 Post-harvest handling activities

Post -harvest practices should be done to ensure that quality is maintained during storage shipping and retailing.

2.4.1 Sorting

Sorting is done to removed damaged, diseased and deformed after which they are cleaned.

2.4.2 Post –harvest treatment

Harvested fruits are dipped or sprayed with recommended fungicide to control black rot which is a major post -harvest problem. Waxing is done to reduce browning due to chilling injury and water loss.

2.4.3 Grading

This is done to stimulate the quality standards of the customer appeal and raise profit, the following are considered;

- Fruits must be mature and firm.
- Fruits are clean free from surface debris and strains.
- Fruits should have no wounds, scratches / bruises and should be pests /disease free.
- Size of the crown and ratio of crown to fruit length should be according to market specification.

2.4.4 Packaging

Fresh pineapples are hand packed in fiberboard boxes for shipping. These boxes are either 20kgs with capacity of 9 -12 fruits or 10kgs holding 5-6 fruits. Fruits are packed flat to avoid compression damage to the crown.

2.4.5 Transportation

Ventilation is important aspects during transportation and the produce should also be protected from direct sunlight. It's recommended to transport during cool period of the day. Transport in closed trucks as per the Crops (Horticultural crops) Regulation 2020.

3.0 Gross Margin Analysis (1 Ha) as at 2024

Item	**Unit**	**Quantity**	**Cost/Unit**	**Total Amount in (Ksh)**			
				Initial crop	**1st Ratoon**	**2nd Ratoon**	**3rd Ratoon**
Gross Income	Ksh	70,000.00	20.00	**1,400,000.00**	**1,000,000.00**	**900,000.00**	**800,000.00**
Production cost							
Land preparation	Ksh	1	10,000.00	10,000.00	-	-	-
Digging holes(labour)	Mds	15	4,000.00	4,000.00	-	-	-
Manure	Tons	30	1,000.00	30,000.00	40,000.00	45,000.00	50,000.00
Seedlings	No.	14,000	10.00	140,000.00	-	-	-
Fertilizer TSP	Kgs	75	60.00	4,500.00	-	-	-
Weeding(labour)	Mds	20	500.00	10,000.00	8,000.00	6,000.00	5,000.00
Top dressing	Kgs	150	120.00	18,000.00	20,000.00	25,000.00	27,500.00
Insecticide	ltrs	4	1,200.00	4,800.00	6,000.00	7,500.00	9,000.00
Fungicide	Kgs	3	2,000.00	6,000.00	8,000.00	10,000.00	12,000.00
Spraying(labour)	Mds	8	500.00	4,000.00	4,000.00	4,000.00	4,000.00
Harvesting- labour	Mds	20	500.00	10, ,000.00	10,000.00	10,000.00	7,500.00
Crates	NO	200	11.00	2,200.00	2,200.00	2,200.00	1,100.00
Packaging materials	Pcs	70	150.00	3,450.00	2,400.00	2,250.00	1,950.00
Precooling		3	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Transport	Tons	70	1,000.00	70,000.00	50,000.00	45,000.00	40,000.00
Total production cost				**318,950.00**	**163,600.00.**	**156,950.00**	**160,050.00**
Gross margin(Gross income-Total production cost)				**1,081050.00**	**836,400.00**	**741,050.00**	**639,950.00**

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