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*Danida*

# Coconut Value Chain Manual



# **Coconut Value Chain Manual**



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**Disclaimer**

This manual is for advisory use only. Users of this manual should verify details that relate to their agro-climatic zones from their area agricultural extension officers. It is also advised that this training manual should be used in conjunction with the respective value chain handbook and other relevant resource materials.

# Foreword

The Micro Enterprises Support Programme Trust (MESPT) is a local development organization founded in 2002 through a partnership between the Government of Kenya (GoK), the European Union (EU), and later, the Royal Danish Government. MESPT's main goal is to eradicate poverty by supporting the growth of micro-enterprises, including agricultural production, agribusiness, and afro-processing. This support aims to foster social, economic, and environmentally sustainable growth by increasing access to financial and business development services, creating jobs, and promoting sustainable micro-enterprises. Our vision is to build a more prosperous society, and our mission is to provide sustainable business development and financial services to smallholder farmers and agri-MSMEs in Kenya.

For over two decades, our team of professionals has been at the forefront of developing cost-effective and scalable solutions that promote financial inclusion and support the growth of sustainable agribusinesses. We accomplish this by providing tailored financial solutions that meet the specific needs of various agricultural value chains, delivered through a wholesale lending model to financial service providers such as SACCOs, MFIs, and Farmer Cooperatives. These providers, in turn, extend loans to smallholder farmers and micro agricultural enterprises.

Our approach emphasizes delivering integrated financial and business development services to smallholder farmers and MSMEs in Kenya, helping them access finance, boost agricultural productivity, improve afro-processing and connect to markets. Over the years, we have worked closely with county governments, development agencies, donors, and investors to strengthen business development capacities in the agricultural sector, using a unique tripartite model that connects farmers, SMEs, and financial institutions.

Coconut is among key value chains that have been supported by MESPT over the years through various interventions in order to enhance commercialization. MESPT appreciates the importance of documenting best practices for the value chain in facilitating effective delivery of training for farm-ers and Agri-preneurs. Therefore, MESPT has facilitated the development of this manual alongside the value chain trainers' guide and other resource materials through Green Employment in Agricul-ture Programme (GEAP) with support from DANIDA.

This manual is expected to enhance effectiveness in delivery of trainings on Good Agricultural Practices and commercialization of the value chain. I am optimistic that this manual will be helpful to partners in the the value chain including county governments. I am grateful to DANIDA for the continued support to MESPT programmes. I am also thankful to the value chain experts who spear-headed compilation of this manual.

**Rebecca Amukhoye,**

**Chief Executive Officer, Micro-Enterprises Support Programme Trust**

## Preface

The Green Employment in Agriculture Programme is a 5 years' programme (2021 to 2025) funded by DANIDA and implemented by Micro-Enterprises Support Programme Trust (MESPT). GEAP seeks to contribute directly to Kenya's Vision 2030 and to one of Denmark-Kenya Strategic Framework on accelerated decent employment creation in MSMEs and improved competitiveness of targeted value chains in agriculture which will contribute to transforming the economy towards a greener and more inclusive growth.

GEAP programme targets 40,000 smallholder farmers and has been implemented in 12 counties namely, Kilifi, Kwale, Nakuru, Nyandarua, Siaya, Kisii, Kakamega, Bungoma, Trans Nzoia, Uasin Gishu, Makueni and Machakos. The programme facilitates increased commercialization, decent employment, and green transformation through targeted interventions in selected agriculture value chains that include, Cassava, Coconut, Dairy, Export Vegetables, Pineapple, Indigenous Poultry, Moringa, Pineapple, and Aquaculture.

MESPT through GEAP tasked multidisciplinary teams to develop resource materials tailored for extension service providers and farmers. This Coconut value chain manual is one of the series of the materials that were developed. MESPT further tasked value chain experts to develop a value chain trainers' guide for Coconut. This manual is to be used as a reference material for training on implementation of good agricultural practices, value addition and marketing for the value chain. Relevance of the content is based on needs identified among value chain players, actors and aligned to GEAP project objectives.

MESPT is grateful to the value chain experts who spearheaded the development and production of this manual. It is my hope that counties and other users will adopt and optimally use this resource so as to increase productivity and profitability while ensuring a greener and more inclusive growth.

**Doreen Kinoti  
Programme Manager, Green Employment in Agriculture Programme**

## Acknowledgements

The Green Employment in Agriculture Programme (GEAP) participating counties (Kilifi, Kwale, Nakuru, Nyandarua, Siaya, Kisii, Kakamega, Bungoma, Trans Nzoia, Uasin Gishu, Makueni and Machakos) are acknowledged for providing resource persons in compilation of the document. The technical support and expertise provided by Kenya Agricultural and Livestock Research Organisation in development of the document is appreciated. Thanks to the Royal Danish Government's Danish International Development Agency (DANIDA) for facilitating the development of this re-source material. Micro Enterprises Support Programme Trust (MESPT) is appreciated for co-ordinating the process of development and production of this document.

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# List of Abbreviations

<b>AEZ</b>	Agro-ecological zone
<b>AFA</b>	Agricultural Food Authority
<b>APVC</b>	Agriculture Product Value Chain
<b>ASAL</b>	Arid and Semi-Arid Land
<b>CA</b>	Conservation Agriculture
<b>CIG</b>	Common Interest Group
<b>CSA</b>	Climate Smart Agriculture
<b>CTT</b>	Core Team of Trainers
<b>DANIDA</b>	Danish International Development Agency
<b>GAP</b>	Good Agricultural Practices
<b>GEAP</b>	Green Employment in Agriculture Programme
<b>ha</b>	Hectare
<b>IDM</b>	Integrated Disease Management
<b>INRM</b>	Integrated Natural Resource Management
<b>IPM</b>	Integrated Pest Management
<b>ISFM</b>	Integrated Soil Fertility Management
<b>IWM</b>	Integrated Weed Management
<b>KALRO</b>	Kenya Agricultural and Livestock Research Organization
<b>kg</b>	Kilogram
<b>LF</b>	Lead Farmer
<b>MESPT</b>	Micro-Enterprises Support Programme Trust
<b>SPs</b>	Service providers
<b>VMG</b>	Vulnerable and Marginalized Group

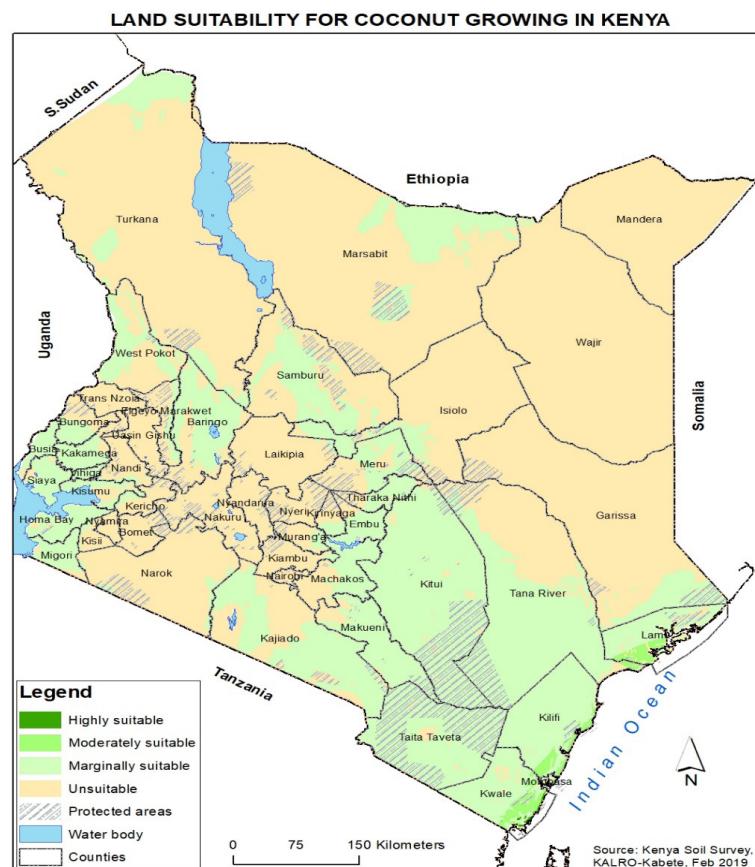
# **Coconut Value Chain Manual**



# Chapter I: Introduction

## 1.1 The Coconut plant

The coconut palm (*Cocos nucifera*) is monoecious, i.e., has male and female flowers on the same inflorescence, called a spadix, that develops within a woody sheath or spathe. The tree is composed of a crown of fronds borne on a single unbranched stem with aerial growth from a single growing point. A 40-year old palm typically attains a height of 20–22 m (66–72 ft.). The palm is a perennial tree crop that is widely cultivated in more than 86 tropical countries of the world with a total production of 54 billion nuts per year. The palm produces nuts throughout the year when climatic conditions are favorable and is one of the most important food security crops. The palm is also regarded as the tree of life owing to its wide range of over 120 products for domestic and international markets.



**Figure 1: Suitability map for coconut production in Kenya**

It was introduced to Kenya in the 16th Century by the Portuguese. Majority of the coconut trees are found in the Coastal Counties of Kwale, Mombasa, Kilifi, Tana River and Lamu. Taita Taveta, a Coastal highland County also has a small population of coconut trees; with the area under production continually increasing on yearly basis. Other areas with potential for coconut production include Busia and Homa Bay in the Lake Victoria region and Tharaka Nithi, Meru and Embu in Eastern region. The total area under coconut farming in Kenya is estimated to be 200,000 acres. The coconut palm is used both as a cash crop and food crop. The crop is also important because of its numerous health benefits. Coconut is one of the key economic drivers to over 150,000 households for business opportunities through its products and by-products. Currently, the crop's main product is wine which constitutes 60 % of the total subsector value.

The main challenges experienced in the coconut industry are mainly at production level, which include inadequate quality planting material, pests and diseases, aging trees, limited varieties, limited research, logging of coconut trees for provision of timber, limited knowledge on value addition, unstructured marketing systems and effects of climate change, among others. Among the major products and by-products that can be obtained from the coconut palm include Mature coconuts, Virgin coconut oil, Coconut cream and milk, Brooms, Door mats, Coir fibre, Coco peat, Copra oil, Desiccated coconut, Coir ropes, Vinegar, Coco syrup, Cocowood, Ornaments, Tender coconut water, Charcoal/ briquettes, Tooth picks, Toddy, Makuti.

## 1.2 Agro-climatic requirements

### **Soils**

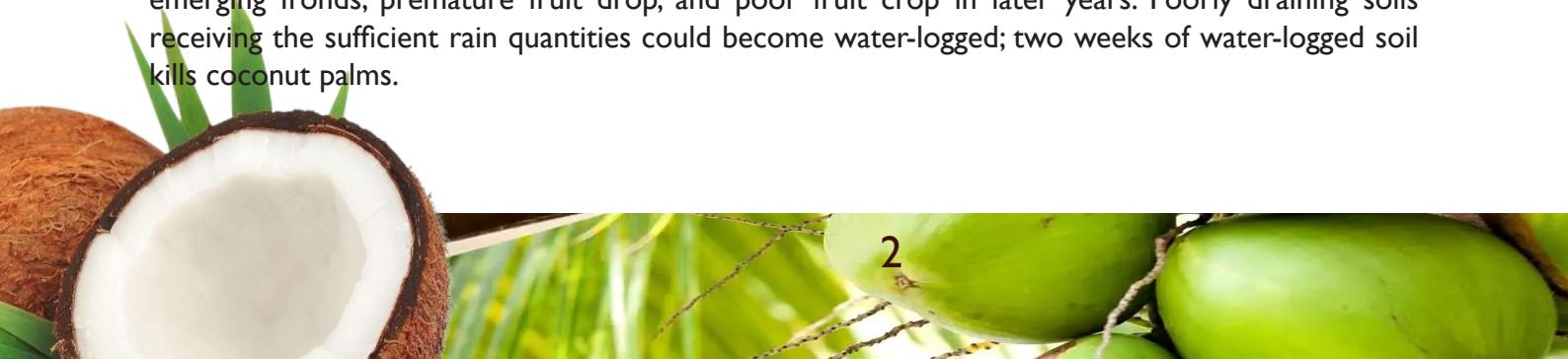
Coconut palms have the best competitive advantage on sandy shorelines. Their ability to grow in infertile and saline soils, tolerate short inundations of the roots in salt water, and thrive in a wide range of pH environments gives coconut palms this advantage. Coconut palms are naturally found on coarse sandy soils, but their ideal growth medium is well-drained fertile loam or clay soils. Ideal pH range is 5.5-7 although the palm can tolerate pH ranges from 4.5-8. The tree cannot tolerate waterlogging within its root zone.

### **Temperatures**

The palms requires a mean annual temperature of between 21-30 °C (mean max of hottest months 28-37 °C, mean minimum of coldest months 4-12 °C and coldest tolerated temperature of 0 °C (32 °F). Freezing will kill seedlings and young palms and prolonged exposure will kill older palms.

### **Rainfall**

The level of precipitation required is not less than 1000 mm, but the most preferred is 1500-2500 mm (60-100). Ideally, the precipitation should be evenly distributed throughout the year. A supply of ground water by seepage from upslope or a reachable water table could mitigate a lack of rainfall. Inadequate water supply is not well-tolerated and results in faster dropping of fronds, death of emerging fronds, premature fruit drop, and poor fruit crop in later years. Poorly draining soils receiving the sufficient rain quantities could become water-logged; two weeks of water-logged soil kills coconut palms.



### **Altitude**

Coconuts grow well in elevations ranging between 0-600 m above sea level; however, exceptions exist especially in Kenya where coconuts have been grown at higher altitudes.

### **Sunlight**

Coconuts can grow in shade but nut production will be adversely affected.

## **1.3 Economic importance and production**

### ***Production status and economic importance***

Coconut production has seen a steady increase as a result of sensitization on replanting of quality coconut tree seedlings to replace the aged and senile trees as well as the empowerment of the farmers to embrace good agricultural practices

### **Seasonal nut production variations**

The tree produces nuts throughout the year, however harvesting is done three or four times annually depending on the rainfall amount received. There are two distinct coconut production seasons i.e. high and low. The high nut production season begins in October and ends in April while the low season is between May and September. Harvesting of immature nuts is one of the causes of scarcity of mature nuts in the industry. The indiscriminate harvesting lengthens the harvesting cycle and leads to wastage as the nuts harvested cannot be utilized for processing or seed material.

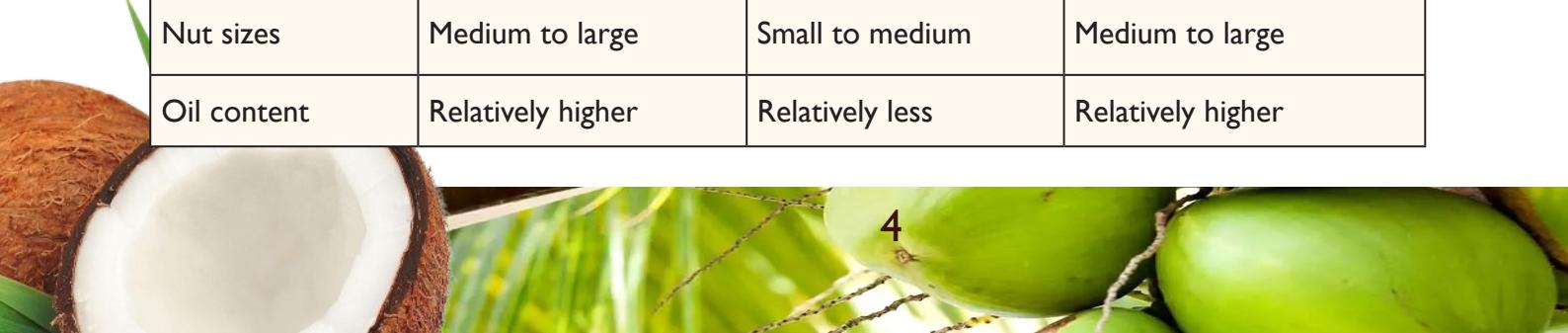
# Chapter 2: Planting Materials and Propagation

## 2.1 Coconut varieties in Kenya

Coconut is largely classified into 2 types: The East African Tall (EAT) and the Dwarf coconut. This classification is based on the most conspicuous difference between the two groups; the height of a mature tree. Recently, coconut hybrids were introduced as the third coconut variety in the country.

**Table 1: Attributes of the different coconut varieties**

Characteristic	East African Tall	Dwarf	Hybrid
Petiole and nut coloration	Green to brown	Bright colours of green, yellow, pink, orange.	Bright colours of green, yellow, pink, orange.
Number of leaves/fronds	12-18 leaves per year	20-22 leaves per year	20-22 leaves per year
Life span	Up to 80 years	Up to 40 years	Up to 50 years
Age at first bearing	5 – 7 years	3- 4 years	2.5 - 3 years
Economic life span	More than 50 years	Less than 50 years	Less than 50 years
Stem size and shape	Enlarged, mostly ball shaped at the base	Thin, with a cylindrical or tapering base	Enlarged, with a cylindrical or tapering base
Nut sizes	Medium to large	Small to medium	Medium to large
Oil content	Relatively higher	Relatively less	Relatively higher



Characteristic	East African Tall	Dwarf	Hybrid
Nut Yield in number	Up to 140 nuts per tree per year	Up to 200 nuts/tree/year	Up to 400 nuts/tree/year
Reaction to harsh weather, pests and diseases	Less sensitive	More sensitive	More sensitive

## 2.2 Coconut Propagation

Coconut is primarily propagated through seed. Attempts at clonal propagation and embryo culture have so far been employed in some countries. Establishment through seed propagation can take two ways:

**Direct Planting** - This is where quality seeds are planted in well dug planting holes from where they germinate and grow, without need for further transplanting. Trees established in this way don't suffer a possible transplanting shock, though it may make it difficult to manage them in case of drought and pest attack.

**Nursery establishment** - Seedlings can be raised in nurseries and managed until they attain the transplanting stage.

### Good/Desirable Coconut mother plant qualities

- Mature (30 years and above)
- High and stable yield – nuts, wine or tender coconut water (*madafu*)
- Big nut size;
- High growth vigor;
- Pests, disease and drought resistance/tolerance

f. Any other valuable traits as observed or described by the framer

### **Good/Desirable seed qualities**

- a. Mature: should dry up in the tree
- b. Free from pests/disease attack – skin should be smooth
- c. Big size, especially if the aim is to plant trees for nut production
- d. It should contain water inside



**Figure 2: Quality seed nuts for planting**

### **2.3 How to select good coconut planting seed**

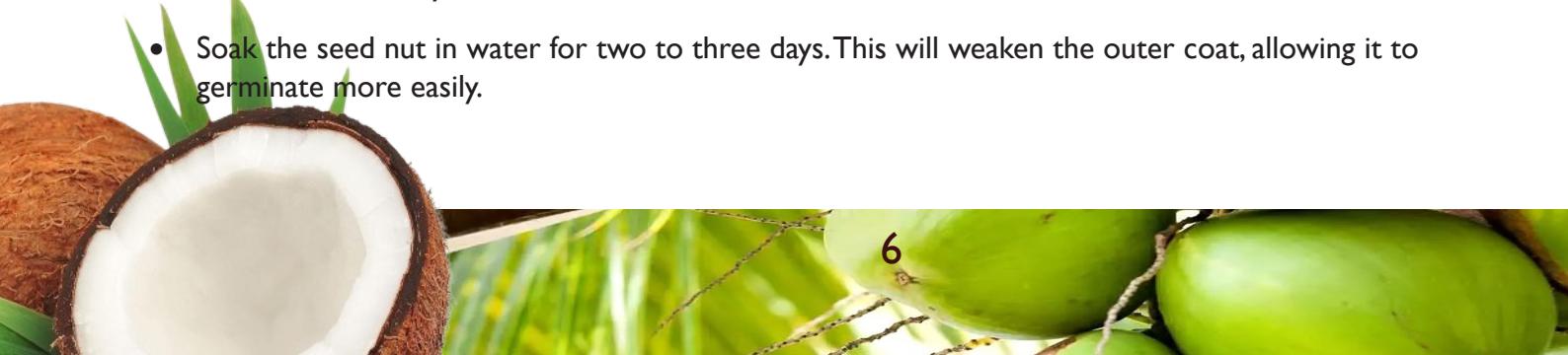
#### **Objective**

To ensure the propagation of only those nuts with good/ desired characteristics selected from the best trees available in the farms.

- The seeds are collected as soon as they have ripened (The American Horticulture Society, 65). In order to ensure the production of quality seedlings, there is need to carry out proper seed selection.
- Discoloration and a foul odor when the nut is cut is an indication that the seed is not fresh and, therefore, is less likely to germinate.

#### **Preparing the Seed for planting in the nursery**

- To hasten germination, slice the seed nut a bit and remove part of the husk on one end at the side of the three eyes.
- Soak the seed nut in water for two to three days. This will weaken the outer coat, allowing it to germinate more easily.



- When soaking, be sure to change the water daily to reduce incidences of pathogens
- For large quantities of seeds, they can be heaped together and covered with sisal gunny bags. Water is then applied by sprinkling until the gunny bags are completely soaked.



**Figure 3:A seed nut with one side cut to allow in water for faster germination**

## 2.4 Nursery Management

After obtaining quality seeds, the next step is to germinate them in a nursery to get seedlings for transplanting to the main seed bed. This process takes a minimum of six months.

### **Sowing the Seeds in the nursery bed**

In tropical environments, the seed nuts are sown outdoors. High humidity is essential for germination, therefore, constant mist should be provided to prevent the seed from drying.

### **Process of germinating the seed (Primary nursery)**

- Identify, demarcate the nursery area and plough it well
- Create trenches to bury the nuts at 1 foot apart from one another
- **Laying the nuts:** Place the nut end to end or side by side in the trench, with the broadest side of the nut at the bottom; and the front end (with eyes) lower such that the water wets the shoot.
- Another method of sowing the seed nut in the nursery is to place the seed with the end that had been attached to the tree pointing upward and the pointed end in the dug trench Cover the seed partially; bury with soil to about  $\frac{3}{4}$  of the nut being under soil.
- Mulch if need be and water the nursery frequently (at least twice a week)



**Figure 4: A seed nut nursery preparation and seed sowing**

## 2.5 Secondary nursery

Where germinated seedlings cannot be planted within 2 months' time, there is need to transfer them to a secondary nursery under well-spaced conditions. They are planted in holes of 1 foot depth at a spacing of 2 feet between lines, and 1 foot between seedlings within the line. Manure is needed. Seedlings can stay in the secondary nursery for a further 3 months before being ready for the farm. Potting can be done at this stage if required.



**Figure 4: Secondary nursery**



# Chapter 3: Crop Management

## 3.1 Preparation of planting holes

Prior to digging of holes, farm layout should be put in place by using pegs. Holes should be dug at 60 x 60 x 60 cm size, however, due to climate change larger sized holes of 90cm\*90cm\*90cm and 1m x 1m x 1m for low rainfall areas are recommended.

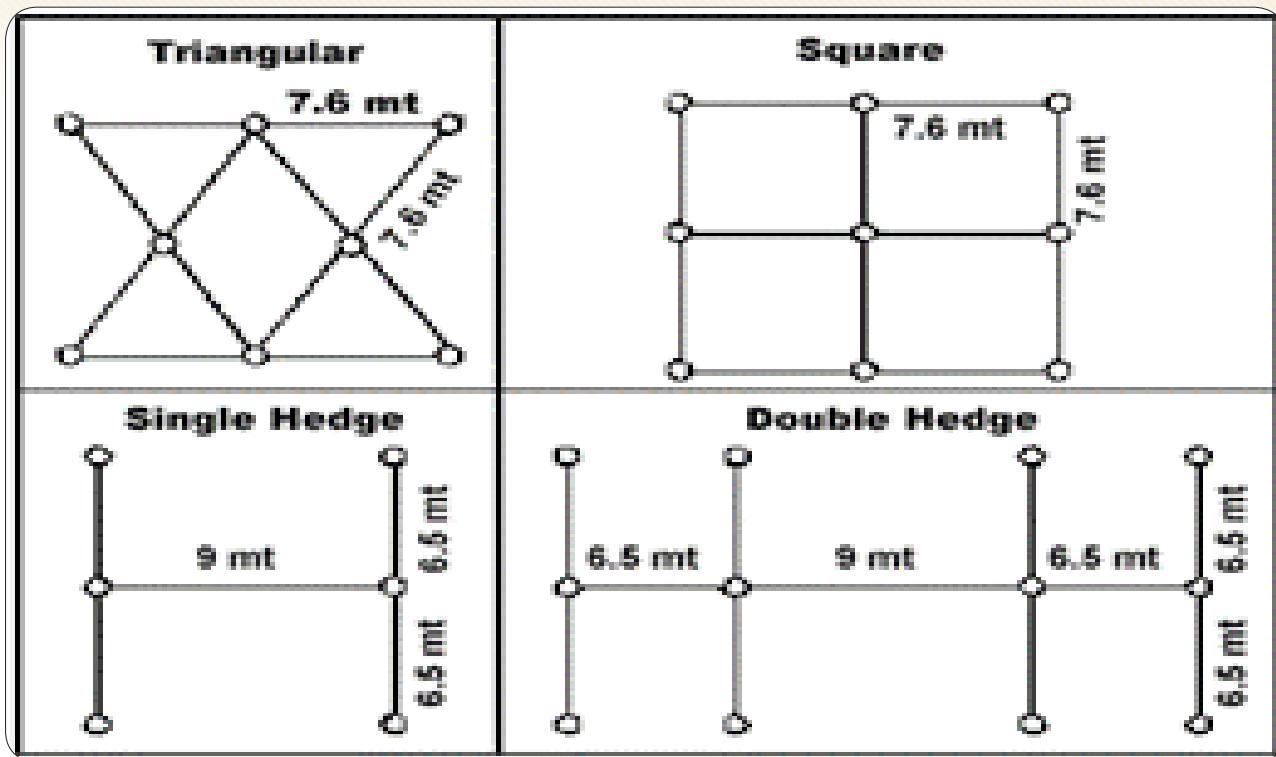


## 3.2 Spacing/Seed rate

Spacing depends upon the planting system and soil type in general the following spacings are recommended under different planting systems in sandy soils and other soil types. These spacings are however recommended for pure stand systems.

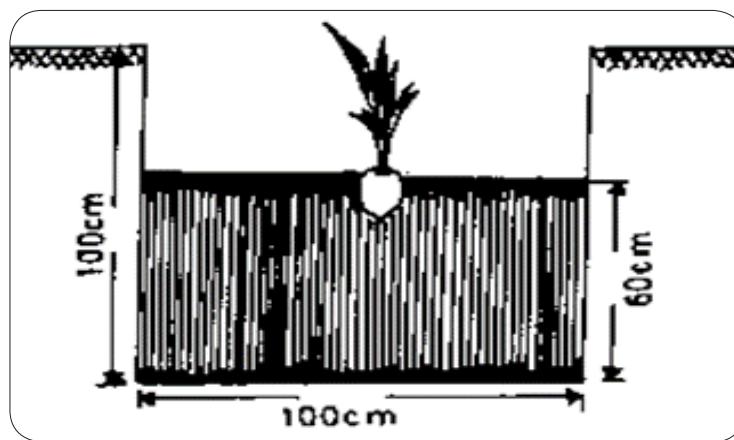
<b>Planting system</b>	<b>Spacing</b>
Triangular	7.6m
Square	7.6x7.6m, 8x8m, 9x9m
Single	6.5m in rows - 9m between rows.
Double Hedge	6.5 to 6.5m in rows - 9m between pairs of rows

This gives a pure stand plant population of 49, 64, 72 and 82 plants per acre for the EAT and Dwarf coconut respectively. In the farms where intercropping is desired, a wider spacing of 12m x 12m and 10m x 10m is recommended for the tall and dwarf varieties respectively



### Preparing for transplanting

- Before transplanting, the pits are filled up with top soil and two buckets of well decomposed farm yard manure.
- If there is chance for termites attack, apply a termiticide inside the small pit before planting.
- Then make a small pit inside the big pit at the centre, so as to accommodate the nut attached to the seedling



- Chop off all damaged roots on the seedling prior to planting. This enhances speed of establishment.



- Plant the seedling inside this pit and fill up with soil, the remaining shallow hole of about half a foot is for water catchment around the stem in those areas of low rainfall. Press the soil well so as to avoid water stagnation.

### **Care of young palms in the plantation**

- The transplanted seedlings should be shaded and Irrigated adequately during the dry months to reduce water loss by the plant.
- Mulch can be applied to conserve soil moisture by use of dry grass, coconut leaves or husks, however, if the area has termites, the mulch should not come in to contact with the seedlings
- The fields should always be maintained weed free since weeds tend to compete with the palms for nutrients.

### **Mulching**

Place one layer of dried coconut husks or dry grass around the newly planted coconut seedlings from the base to a radius of 50 cm. In areas where there are incidences of termites, the husks should be drenched with a termiticide.



**Figure 5. Application of coconut husks as mulch around a young coconut seedling**

**Table 3: Fertilization Regimes**

Age of Palm	Nutrient dosage (g)	DAP	CAN	NPK
3 months	1/10 of full dose	200	110	200
1 year	1/3 of full dose	800	360	670
2 year	2/3 of full dose	1675	720	1340
Over 3 years	full dose	2000	1080	2000

### 3.3 Green Manure and Cover Crops application

This will help to increase the organic matter content of the soil and will also prevent soil erosion in coconut gardens. They also fix nitrogen into the soil.

The following Green manures / cover crops are recommended for cultivation in coconut gardens.

- Cowpeas
- Mucuna
- Dolichos
- Beans
- Green grams
- Gliricidia maculata

Sow the green manure / cover crops during April-May with the onset of rains and plough in and incorporate into the soil during August-September.

### 3.4 Care of old palms in the plantation

#### Weeding

Coconut trees, like other crops suffer competition from weeds, and progressively decline in yields.

- Coconut trees should be kept weed free at all times for better yields.
- Weeding twice a year is adequate for most environments of coconut growing.
- Generally, for the first 2 years of transplanting, a radius of 1m should be kept weed free. This should extend to 2m radius in subsequent years.
- Where possible, complete weeding of the farm is recommended.



**Figure 6. Complete farm weeding of a coconut plantation**

### **Manuring**

- Regular manuring from the first year of planting is essential to achieve higher productivity.
- Depending on the age of the coconut palms, 20 - 50kg organic manure should be applied per palm per year with the onset of the rains, when soil moisture content is high.
- Different forms of organic manures like compost, farm yard manure, bone meal, fish meal, blood meal, Neem cake, groundnut cake can be used.
- Broadcast the manure around every coconut tree base on a 2 meter radius then slightly plough it into the soil with a fork jembe.



**Figure 7. Applying and mixing soil with manure after weeding**

### **3.5 Mulching of mature coconut trees**

To improve water retention around the tree base, a layer of mulch can be applied around the plant in various ways.



**Figure 8. Application of coconut husks as mulch around a mature coconut plant**

#### **Husk Burial**

- Burying fresh or dried coconut husks around the palm is a very beneficial practice particularly for moisture retention especially in drought prone areas.
- The husk can be buried either in linear trenches taken 3 m away from the trunk between rows of palms or in circular trenches taken around the palm at a distance of 2 m from the trunk.
- The trenches may be dug at 0.5 m wide and at the same depth. Place the husks in layers with concave surfaces facing upwards and covered with soil.
- The beneficial effects of husk burial will last for about 5-7 years.

#### **Irrigation**

- It is a good practice to provide water to coconut trees in times of dry weather where this is possible.
- Observations have shown that coconut trees reduce flowering during the dry season and flower vigorously in the rainy season.
- Keeping the root zone moist all the time, where such is possible would be a positive way of improving coconut productivity.

### **Intercropping**

This refers to the planting of other crops in between coconut trees. Examples of intercrops include maize, cowpeas, sweet potato, green grams, beans, water melons, bananas, pineapples as well as fruit and leafy vegetables. For those plantations that have organically produced coconuts, the use of organic fertilizers and agro-chemicals for the control of pests and diseases is recommended.

#### **Benefits of intercropping:**

- Constant income for farmers especially in the young (unproductive) stages of coconut trees
- Where land is scarce the farmers maximize on the use of available land.
- Cover crops such as sweet potatoes and peas protect the soil from erosion.
- Leguminous inter-planted crops (e.g pigeon peas and beans) fix nitrogen into the soil for the benefit of coconut trees.
- Green manure and post-harvest crop residue improve soil structure and fertility.
- As the farmer weeds for the annual/seasonal crops, the coconut trees are also freed of weeds at no extra costs.

**Note:** Adopt a wider spacing when intending to intercrop with tree or non-shade plants.

### **3.6 Organic coconut production**

“Organic Agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on an ecological process, biodiversity and cycles adapted to local conditions rather than the use of inorganic inputs that have adverse effects. Organic Agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. In organic coconut production smallholder growers are organized into a group of producers (growers) with similar farming and production systems.

In that regard, the certified entity shall be the group as a whole. Based on international standards such as IFOAM, EU and USDA NOP, the group will undergo a certification process where the individual farms will be inspected for various aspects including the use of inorganic fertilizers and other agro-chemicals, use of labour, farmer living conditions, mechanisms put in place for the disposal of used containers of agro-chemicals among others. Once the certifying body is satisfied with the preparations put in place, the farmer group will be issued with a certificate of compliance for a period of one year. At the expiry of the period, another inspection will be undertaken before renewal of the certificate. The advantages of having the farms certified include selling of the products at a premium price, the products are safe for human consumption as well as ensuring a safe environment

Coconut pests and diseases are still one of the major factors contributing to low production in coconut plantations. In Kenya, most farms are pest infested and hardly can one find a pest free plantation. It is therefore advisable to know the types of pests and diseases that are of economic importance and their management options.

# Chapter 4 : Pests and Disease Management

## 4.1 Pests

The table below gives a list of the major coconut pests and their control practices.

Pests	Damage and Symptoms	Management
	<ul style="list-style-type: none"><li>• The pest feeds on unopened fronds, flower buds and the growing part (tip) of the stem</li><li>1. This results in V-shaped notches on leaves, holes on stem, and unopened flowers, stunted growth and death of especially young plants</li></ul>	<ul style="list-style-type: none"><li>• Farm hygiene - burn dead parts of plants</li><li>• scouting</li><li>• Physical removal of adult beetles from leaf bases.</li></ul>  <ul style="list-style-type: none"><li>• Fill affected leaf axils with sand.</li><li>• Chemical spray with Lamda cyhalothrin based chemical around the new leaf axils</li><li>• Use of hooks to kill the beetle</li></ul> 

Rhinoceros Beetle  
(*Oryctes monoceros*)

Pests	Damage and Symptoms	Management
 <b>Coconut mites</b> <i>(Aceria guerreronis)</i>	<ul style="list-style-type: none"> <li>The damaged nut and turns brown and scaly, young nuts may fall off.</li> <li>Those that survive are deformed; are small and with a thin layer of meat.</li> <li>Poor quality of husk fibre.</li> <li>Germination of affected nuts is usually low.</li> </ul> 	<ul style="list-style-type: none"> <li>Selection for resistance is the best measure; select seed nuts from trees that are not seriously affected.</li> <li>Proper supply of water reduces the damage.</li> <li>Proper fertility maintenance; some nutrients such as boron boost plant resistance to mites.</li> <li>Use of Neem based products</li> </ul>
 <b>Corred bug</b> <i>(Pseudotheraptus way)</i>	<p>This is an insect that sucks sap from young nuts and even cashew nuts. They can cause damage of 80-90% of the total crop. The nymphs and adults suck young nuts that are 1-5 months old leading to:</p> <ul style="list-style-type: none"> <li>Premature nut fall</li> <li>Badly scarred and gumming nuts</li> <li>Small nuts with less copra</li> <li>Poor husk quality</li> </ul> <p>Most serious coconut insect pest problem Rampant in East Africa including Kenya.</p>	 

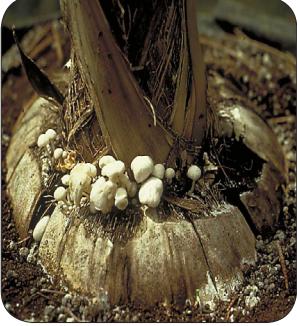
Pests	<b>Damage and Symptoms</b> <ul style="list-style-type: none"> <li>Feed on various parts of the crop both in the nursery or field.</li> <li>Young plants may die during germination.</li> <li>Old trees fall off or die, roots having been eaten off More damage is during the dry season</li> </ul>   <p>Termites (<i>Coptotermes formosanus</i>)</p>	<b>Management</b>

Pests	Damage and Symptoms	Management
	<ul style="list-style-type: none"> <li>Mealybug infestations of above-the ground plant parts start with the appearance of crawlers (the first- instar nymphs) on the underside of the leaves on terminal shoots, stems and other plant parts.</li> <li>Heavy mealybug attack appears as white, waxy masses of mealybugs on stems, nuts and along the veins on the underside of leaves. Heavy infestations usually result in coating of adjacent stems, leaves and nuts with honeydew and sooty mould.</li> <li>Severely infested plants may wilt due to sap depletion; leaves turn yellow, gradually dry and ultimately fall off. Feeding on nuts results in discolored, bumpy, and scarred nuts, with low market value, or unacceptable for the fresh fruit market.</li> </ul> <p> Mealybugs</p>	<ul style="list-style-type: none"> <li>Conserve natural enemies. Mealybugs are usually controlled by a wide range of natural enemies.</li> <li>However, use of pesticides may kill these natural enemies leading to mealybug outbreaks.</li> </ul>
	<p>African palm weevils (<i>Rhynchophorus phoenicis</i>)</p> 	<p>The primary means of control for African palm weevil is preventative, using cultural and sanitary methods.</p> <ul style="list-style-type: none"> <li>The damaged tissues turn necrotic and decay. Sometimes the grubs feed on the growing point killing the palm. Grubs are whitish-yellow, legless, and oval in shape; their head is reddish brown, and is armed with strong mandibles.</li> <li>Fully-grown grubs are 5 cm long. The pupal stage is passed within a cocoon of vegetal debris made by the grub at the end of its development. The African palm weevil usually damages young palms, yet may also, in exceptional cases, cause damage to mature crops.</li> </ul>

Pests	Damage and Symptoms	Management
	<ul style="list-style-type: none"> <li>A number of scales feed on leaves and fruits of coconut palms. The most damaging is the coconut scale.</li> <li>Eggs are protected underneath the scale or shell of the mother insect until they hatch.</li> </ul>	<ol style="list-style-type: none"> <li>Hatched young scales leave the maternal scale, take up a position and start feeding.</li> <li>They do not move afterwards. They are found mainly on the undersides of the leaves, but frond stalks, flower clusters and young nuts can also be attacked.</li> <li>A severe infestation forms a continuous crust over flower spikes, young nuts and the lower surface of leaves. The leaves become yellow and eventually die. The crown dies leading to collapse of the infested plant. Attacks of young nuts cause shriveling of nuts leading to premature nut falls.</li> </ol> <ul style="list-style-type: none"> <li>Conserve natural enemies. They usually keep scales under control. Ladybird beetles and parasitic wasps are particularly effective in controlling the coconut scale.</li> <li>Avoid or restrict movement of infested plants in areas where the coconut scale is not a problem, to avoid spread of the scale.</li> <li>Destroy infested plants and plant parts. This may help to eradicate scales from new areas. However, this scale is difficult to eradicate due to its wide host range.</li> <li>Provide good growing conditions for the palms. Healthy palms in well-drained soils are seldom seriously infested.</li> </ul> <ul style="list-style-type: none"> <li>Mostly young coconut trees of up to 10-15 years are vulnerable to damage.</li> <li>Scales may infest palms throughout the year, but damage is usually more severe during the dry season. Neglected plantations are particularly susceptible</li> </ul>



## 4.2 Diseases

Disease	Symptoms	Management
 <p><b>Bole rot</b>  <i>(Marasmielus infescocophilus)</i></p> <p>The disease is caused by the Basidiomycete (<i>M a r a s m i e l l u s cocophilus</i>) and it mostly affects the young palms of the tall variety that are less than 8 years old. The disease has caused some substantial deaths to coconut palms in the coastal regions of Kenya and Tanzania.</p>	<ul style="list-style-type: none"> <li>The first symptoms which are noticed on 8 or more years old palms are a frond wilt and a crown rot, followed by a primary bole rot.</li> <li>Highest mortality is among seedlings and young palms up to 8 years old. Where the disease occurs sporophores are sometimes common on exposed roots, dead seedlings and the soil surface where diseased palms have been removed.</li> <li>The fungus appears to be a persistent colonizer of coconut debris in the soil.</li> <li>Mycelial cultures from infected bole tissues and from sporophores are highly pathogenic to seedlings, and slowly invade older tissue.</li> <li><i>M. cocophilus</i> reaches the inner bole tissues only through the roots, as they get wounded during weeding and during uprooting of seedlings in the nurseries.</li> <li>Seedlings may become infected through roots damaged during transplanting from nurseries to the field.</li> </ul>	<ul style="list-style-type: none"> <li>Destroy affected trees by burning.</li> <li>International movement of coconut germplasm should follow the technical guidelines recommended by FAO/ IBPGR (Frison and Putter, 1994). The guidelines state among other things that seed nuts should not be transferred directly from countries in East Africa where <i>M. cocophilus</i> infections are known to occur, to areas not affected by the pathogen.</li> </ul> <p><b>Cultural practices</b></p> <p>Suggested control measures are:</p> <ol style="list-style-type: none"> <li>(1) selection of seedlings in nurseries and subsequent transplanting should be done as early as possible</li> <li>(2) During transportation, handle the seedlings carefully, prune and disinfect damaged roots.</li> <li>(3) Avoid obtaining seedlings from affected areas.</li> <li>(4) Carry out periodic soil sterilization of nurseries</li> <li>(5) Avoid cultivation in between palms, where disease is present.</li> </ol>

Disease	Symptoms	Management
 Lethal Yellowing Disease (Phytoplasma)	<ul style="list-style-type: none"> <li>Premature nut fall, starting with the oldest nuts.</li> <li>Blackening of youngest opened inflorescence after nut fall.</li> <li>Yellowing of the old leaves rapidly spreading upwards.</li> <li>Affected leaves often hang down forming a skirt around the trunk for several days before falling.</li> <li>Death of the plant</li> </ul>	<ul style="list-style-type: none"> <li>No known control measures.</li> <li>Use genetically resistant ecotypes ("Malayan Yellow Dwarf") and hybrids ("Malayan Yellow Dwarf" x "Panama Tall"). This is the only practical long-term solution to lethal yellowing.</li> <li>Avoid movement of planting materials from affected areas, and cut down and destroy affected trees.</li> </ul>
 Bud rot ( <i>Phytophthora palmivora</i> )	<ul style="list-style-type: none"> <li>Bud rot (also called heart rot) caused by the fungus <i>Phytophthora palmivora</i>.</li> <li>The fungus enters into the plant by infecting tender host tissues (leaves, buds or young nuts).</li> <li>Affected leaves turn yellow and later brown.</li> <li>The heart leaf becomes chlorotic, wilts and collapses.</li> <li>The disease may spread to older, adjacent leaves and spathes, producing a dead centre with a portion of living leaves.</li> <li>Light brown to yellow, oily, sunken lesions may be found on leaf bases, stipules or pinnae.</li> <li>Internally, the tissues beneath the bud are discolored pink to purple with a dark brown border.</li> <li>Affected leaves progressively drop.</li> <li>Infected nuts show brown to black necrotic areas with a yellow border developing on the surface; internally, they have a mottled appearance.</li> <li>Young nuts are highly susceptible and fail to mature, they then fall off the tree; older infected nuts ripen normally.</li> </ul>	<ul style="list-style-type: none"> <li>Remove and destroy infected debris and infected coconut trees. This helps to reduce spread.</li> <li>Do not irrigate nurseries at dusk or at night to avoid prolonged periods of free moisture.</li> <li>Plant resistant varieties. Malaysian dwarf varieties, such as "Malayan Yellow Dwarf", "Bali" "Tall", "Malayan Yellow Dwarf" x "Palu Tall" hybrids, and other varieties originating in South-East Asia, show resistance.</li> </ul>

Disease	Symptoms	Management
Stem Bleeding 	<ul style="list-style-type: none"> <li>Exudation of reddish brown liquid through cracks developing on the stem.</li> <li>Decaying of tissues at bleeding point</li> <li>Vigor and yield declining.</li> <li>Development of big holes inside the trunk</li> </ul>	<ul style="list-style-type: none"> <li>Chisel affected tissue and dress the wound with 5% Calixin (5ml in 100ml water). Apply coal tar after 2 days. Burn off chiseled pieces.</li> <li>Avoid any mechanical injury to the stem.</li> <li>To avoid spread of disease on to upper portion of trunk, root feeding with 5% calixin may be adopted 3 times a year - April-May, September-October and January-February.</li> <li>Along with 50kg organic manure, apply 5kg Neem cake containing the antagonistic fungi, Trichoderma culture to the basin during September.</li> <li>Provide adequate irrigation during summer and drainage during rainy season.</li> <li>Apply recommended doses of organic manures and chemical fertilizers.</li> <li>Coconut stem boring insects like Xyleborus, Diocalandra should be controlled by applying Carbaryl 50% WP on the trunk @ 3g per litre water</li> </ul>

# Chapter 5: Green Technologies and Mechanization

Green Technologies (GT) refers to those friendly technologies that reduce environmental damage and contribute to both poverty reduction and sustainable agricultural development. In coconut farming, the green technologies that are employed include the following: zero tillage, organic farming, use of green manures and cover crops, husk burial, irrigation and integrated pest management as described below:

## 5.1 Irrigation

Soil moisture very often limits coconut production in those areas where long spell of dry weather prevail or where the rainfall is scanty and ill-distributed. So irrigate the palms during dry months in basins around the palm. The irrigation requirement varies according to the soil type and climatic condition. Generally, an adult palm requires 60 to 80 litres of water once in seven days. Irrigate in basins of 1.8m radius and 10-20 cm depth. In coastal sandy soils, sea water can be used for irrigating adult palms. However, do not irrigate seedlings and very young palms up to 2 years with sea water. In irrigated gardens, interruption of irrigation would lead to serious set-back in yield and general condition of palms. Hence, once started irrigation should be continued regularly and systematically. Drip irrigation is the best suited method of irrigation for coconut. It saves water, labour and energy.

## 5.2 Inter-cultivation

### Husk Burial

Burying fresh or dried coconut husks around the palm is a very beneficial practice particularly for moisture retention especially in drought prone areas. The husk can be buried either in linear trenches taken 3 m away from the trunk between rows of palms or in circular trenches taken around the palm at a distance of 2 m from the trunk. The trenches may be dug at 0.5 m wide and at the same depth. The husks are to be placed in layers with concave surface facing upwards and covered with soil. The beneficial effects of husk burial will last for about 5-7 years.

### Green Manure and Cover Crops

The green manures and cover crops help to increase the organic matter content of the soil and also help to prevent soil erosion in coconut gardens. The following Green manure / cover crops are recommended for cultivation in coconut gardens.



Figure 9. Green manures and cover crops

Mucuna

Cowpeas

Dolichos lablab

Gliricidia maculata

The green manures on the other hand are made from sown cover crops that are sown during the onset of the long rains and then ploughed to be incorporated in the soil during the short rains season.

### **Zero tillage**

No-till farming (also known as zero tillage or direct drilling) is an agricultural technique for growing crops or pastures without disturbing the soil through tillage. No-till farming decreases the amount of soil erosion that tillage causes in certain soils, especially in sandy and dry soils on sloping terrain. Other possible benefits include an increase in the amount of water that infiltrates into the soil, soil retention of organic matter, and nutrient cycling. These methods may increase the amount and variety of life in and on the soil. While conventional no-tillage systems use herbicides to control weeds, organic systems use a combination of strategies, such as planting cover crops as mulch to suppress weeds. There are three basic methods of no-till farming. "Sod seeding" is when crops are sown with seeding machinery into a sod produced by applying herbicides on a cover crop (killing that vegetation). "Direct seeding" is when crops are sown through the residue of previous crop. "Surface seeding" or "direct seeding" is when crops are left on the surface of the soil; on flat lands, this requires no machinery and minimal labor. Tillage is dominant in agriculture today, but no-till methods may have success in some contexts. In some cases minimum tillage or "low-till" methods combine till and no-till methods. For example, some approaches may use shallow cultivation (i.e. using a disc harrow) but no plowing or use strip tillage.



**Figure 10. An example of Zero tillage practice**

### **Organic farming**

The main aim of organic Coconut farming is the production of quality products that contain no chemical residues and maintain soil fertility. These are achieved by growing suitable intercrops under Coconut on rotation, recycling palm residues, appropriate tillage, and water management practices.

Management of weeds and pests is done by encouraging a biological control through a balanced host-predator relationship augmentation of beneficial insect population and the mechanical removal of weeds and pests affected plant parts.



**Figure 11. An organically produced coconut plant**

**An organic production system is designed to:**

- Enhance biological diversity within the whole system
- Increase soil biological activity
- Maintain long term soil fertility
- Promote the healthy use of soil, water and air as well as minimize all forms of pollution that result from agricultural practices
- Handle agricultural products with emphasis on careful processing methods to keep the organic integrity of the product at all stages.
- Organic farming is based on the enhancement of the soil structure and soil fertility and the implementation of diversified crop rotation systems.

### **5.3 Mechanization of Coconut Production Activities**

#### **Power tiller**

A Power tiller is a low powered two-wheeled agricultural implement, also referred to as a walking tractor 8-16hp that can be fitted with a rotary tiller, disk harrow, mouldboard plough, trailer, water pump or chisel at alternate times for easing farm operations. It can complete one hectare per day by one operator in about two hours though the machine could do more with a different operator. This will vary depending on the climatic conditions, soil types, soil moisture content, operator stamina and experience. Fuel consumption is about 15 litres per ha. Though these results may vary with the technical ability of the operator.



**Figure 12.A hand operated power tiller**

The power tiller has the ability to solve the following challenges:

- Slow and tedious processes of seedbed preparation, in a commercialized coconut plantation
- Difficult to prepare a uniform fine tilth seedbed manually
- Delayed operation lead to late planting
- High cost of manual labour

The equipment has multiple uses and other advantages. A Power Tiller can be used in seedbed preparation, sowing seed, planting seed, spraying fertilizer, herbicide and even irrigation. In addition, can also be used for transporting produce. A power Tiller is ideal where the land size is small. Farm sizes less than one hectare may limit maneuverability of conventional tractors and manual labour is costly and slow, hence the need for a power tiller.

#### **Wheeled Tractor**

A small sized, 4 wheeled tractor is a low powered agricultural implement of 40-55hp that can be fitted with a rotary tiller, disk harrow, mouldboard plough, trailer, water pump or chisel at alternate times for easing farm operations. It can complete 4 hectares per day by one operator but can have two operators to run another 8 hours of 4 hectares coming to 8 per day. This will vary depending on the climatic conditions, soil types, soil moisture content and operator experience. Fuel consumption is about 15 litres per ha. Though these results may vary with the technical ability of the operator.



**Figure 13.A four wheeled tractor**

The tractor has multiple uses and other advantages. A four wheeled tractor can be used in seedbed preparation, sowing seed, planting seed, spraying fertilizer, herbicide and even irrigation. In addition, it can also be used for slashing through a power take off device and transporting produce. Farm sizes less than one hectare may limit maneuverability of conventional tractors and manual labour is costly and slow.

#### **Mouldboard Plough**

A mouldboard plough is an agricultural implement and is generally considered to be the important tillage implement. Mouldboard ploughs are available for power tiller and tractor operation. A mouldboard plough does four jobs namely a) cutting the furrow slice, b) lifting the furrow slice. c) inverting the furrow slice and d) pulverizing the furrow slice. Ploughing accounts for more traction energy than any other field operation.



**Figure 14.A mouldboard plough**

When well-adjusted, the plough automatically seeks the desired depth. It is Versatility. The various models have different features that enable high efficiency in preparation of the land. Weed Control. Pest Control. Improved Soil Health.

### **Harrow**

It is an implement consisting of a heavy frame set with teeth or tines which is dragged over ploughed land to break up clods, remove weeds, and cover seed and is a cultivating tool set with used primarily for breaking up and smoothing the soil in preparation of a seedbed for small sized grain planting.



**Figure 15. A disc harrow**

### **Why use a harrow in coconut plantations?**

- Creation of a crumbly layer for planting is tedious.
- It is not possible to manually protect the soil surface from rapid drying.
- Improving both the air and water penetrability into soil manually can be too expensive if manually undertaken.
- Manual operation will reduce microbiological processes in the soil
- Manual land harrowing Improving of nutrient availability to plants.

### **Tractor operated Soil Auger**

With the high and increasing cost of manual labour, manual hole digging for transplanting coconut seedlings increases the cost. It is also a slow and tedious process. At the same time it is difficult to prepare a uniformly spaced holes. Delayed operations lead to late planting. The hole digger is a PTO driven machine that digs holes in rows on equal distances mechanically and economically. It also can be used for hole making for electric poles and farm hedges. It is best suited for tree plantation. It can

dig about 90cm deep hole even diameter in just 30 seconds. By detaching augers, it can be used as a small crane.



**Figure 16.Tractor operated hole digger**

The auger digs a definite hole diameters and depths as desired. Users spend a short time to make the holes. The machine spends low amounts of fuel. It is easy to use, and can be used to a much greater depth, as the hole can be dug as deep as the entire length of the shaft. It mechanically removes soil from holes. The machine forms a much neater hole, with a well-defined circumference. Holes can be made at pre-defined places by driving the compact tractor. Size of the hole is determined by the size of the auger used.

#### **Motorised Sprayer**

The sprayer is used to address the slow and tedious processes of manual spraying of coconut plants especially the young plants. The height of the tree requires a long projectile spray; since coconut has a high number of pests that invade leaf, flowers and nut.



**Figure 17.A motorised sprayer**

A motorized **sprayer** is a device used to spray a liquid, where sprayers are commonly used for projection of water, weed killers, crop performance materials, pest maintenance chemicals, as well as manufacturing and production line ingredients. In agriculture, a sprayer is a piece of equipment that is used to apply herbicides, pesticides, and fertilizers on agricultural crops. Sprayers are man-portable units typically backpacks with spray guns. They are used to control weeds that can harbour insects by use of herbicides, insect pests that can cause diseases by the use of insecticides as well as pesticides. Control of fungal diseases by the use of fungicides. Application of micronutrients on the plants, boron including as well as foliar fertilizers.

Pests reduce yields up to 70% and are a major menace in agricultural production. Before coconuts form a canopy, broad leafed weeds compete with coconut seedling for nutrients and light greatly reducing their yield. Manual sprayers are labour intensive and spraying labour is too expensive. It has lower pressure reducing its efficiency. Motorized sprayers therefore come in handy.

### **Coconut harvesting stick**

Manual coconut harvesting by climbing the tree is slower, untimely and risky. It also results in high cost of labour since food and water is used as fuel. At the same time manual labour in terms of coconut harvesters is diminishing since the expert climbers are becoming old.



**Figure 18. Coconut harvesting stick**

The coconut harvesting sticks are used to harvest coconut bunches by making some cuts onto the bunch by means of a metallic sickle that is attached at the end of the adjustable stick. It can also be used to prune old coconut leaves/fronds. The harvesting stick can harvest nuts from trees that are as high as 30m tall. In that regard, the harvesting stick has the following advantages:

- It works faster
- It can reach far end bunches
- Does not use fuel and hence is cheaper
- Discourages child labour
- Easier to operate
- Cost effective

### **Coconut tree climbing gear**

The coconut harvesting climbing gear are used to help climbers harvest coconut bunches in tall coconut trees faster and safer than when manual climbing is done. This saves time and more trees can be harvested in a day as compared to manual harvesting.



**Figure 19. Coconut tree climbing gear**

### **Coconut harvesting Robot**

The coconut harvesting robots are used to help harvest coconut bunches in tall coconut trees faster and safer without having a climber physically climbing the tree. This saves time and more trees can be harvested in a day as compared to manual harvesting.



**Figure 20. Coconut harvesting robot**

### **Tractor mounted telescopic hoist**

The coconut harvesting by use of tractor mounted telescopic hoist help harvest coconut bunches in tall coconut trees faster and safer without having a climber physically climbing the tree. This saves time and more trees can be harvested in a day as compared to manual harvesting.



**Figure 21.Tractor mounted telescopic hoist**

### **Coconut de-husking machine**

The coconut de-husking by use of the electric de-husking machine helps in de-husking many coconuts faster and safer thereby making more nuts available for further processing. This makes more nuts to be processed in a day as compared to manual de-husking (250-2500 per hour).



**Figure 21. Coconut de-husking machine**

### **Electric coconut grating equipment**

The normal method used for coconut grating is slower, untimely and tiresome. Grated nut produced is prone to contamination and at the same time increases drudgery by the operator. The coconut grating by use of the electric grating equipment helps in grating many coconuts faster and safer thereby making more grated coconut available for further processing. This makes more nuts to be processed in a day as compared to the local method of grating coconuts.



**Figure 22. Electric coconut grating equipment**

Coconuts are harvested at two different stages of development, depending on the intended use. Coconuts intended to be consumed fresh for the water content and jelly-like meat should be harvested when the fruits have reached full size, but at an immature stage with soft inner white meat (endosperm). On the other hand, fruits intended to be harvested for copra and further processed into oil should be harvested at a mature stage, when the inner white meat has thickened and hardened. Several different indices can be used to determine coconut maturity. These include time from flowering, fruit size, external appearance, and amount and texture of the meat. Coconuts that are intended for provision of water coconuts should be harvested soon after the fruit has reached full size, but while it is still immature. This coincides with maximum water content and occurs about 7 months after flowering. In immature coconuts, the skin surface around the cap on the top of the fruit is typically whitish-yellow. Also, the short stem above the individual coconuts that originally contained the male flowers will have partially dried up.

The mature coconuts (twelve months old nuts) are harvested at the interval of 30-45 days for seed as well as copra making and culinary purposes. For household use the nuts should be kept in a vertical direction. However, for tender nut purposes 7 to 8 months old nuts are harvested. The nuts can be harvested using coconut climbers. Nuts which are 11 months old give fiber of good quality which is suitable for coir fiber. In case of tall variety, the nuts harvested for seed purpose can be stored for 2 to 3 months period before sowing, whereas in case of dwarfs and hybrids, nuts should be sown within a period of 10 –15 days of harvest.

On an average, we can have eight harvests, though the coconut palm produces inflorescence every month. For oil extraction, nuts are generally sun dried for copra making. In this case there is a chance of dirt accumulation followed by oil quality deterioration, nuts can be dried in various types of driers available (Kiln, electric and solar driers) and also sun drying. Good quality copra can be obtained in short time by using these driers. Moisture content in copra for final use should be around 5-6%. Store the copra in polythene tar coated gunny bags. The oil yield of copra under rain fed condition will be around 1.7 to 2 tons/ha.

#### **5.4 Post-harvest handling of coconuts**

Only fully matured nuts should be harvested if the purpose is for copra making or the processing of other value added products. For collection of seed nuts/tender coconuts, the bunches should be harvested and brought down by using ropes to prevent the damage of nuts. In case of copra, it should be dried to 6% moisture by sun drying or by using copra driers. The storage period of copra can be increased up to 6 months by storing the copra in polythene tar coated gunny bags. For household storage the nuts may be kept in vertical position.

**De-husking:** Manual de-husking with the help of an iron rod driven to the ground is strenuous and skill oriented. Presently mechanical devices are used for de-husking.

**Copra Processing:** The optimum moisture content in copra is 5-6 percent. Sun drying, smoke drying, kiln drying and indirect hot air drying are commonly used drying methods.

**(i) Sun Drying:** Traditional system of copra drying is by spreading the cups (Split open coconut) on any open surface for sun drying. It takes about 8 days for sun drying. The deposition of dirt and dust on wet meat during sun drying results in deterioration of copra quality. Further, cloudy weather and low atmospheric temperature also reduce the quality of copra.

**(ii) Solar Dryer:** Use of a closed type solar dryer avoids the quality deterioration of copra due to deposition of dirt. Drying time is reduced to 3-4 days. A batch type of solar cabinet dryer with a capacity of 100 nuts developed at CPCRI takes only 3 days for drying.

**(iii) Indirect Drying:**

This is done by use of the following methods:

**Small Holder Copra Dryer:** An indirect copra dryer of 400 nuts per batch capacity (using agricultural waste as fuel) developed at CPCRI is gaining popularity among coconut growers. The dryer requires only 3 sq. m for housing and could be carried by 2-3 persons. The drying time required per batch is 36 hours spread over 4 days. Kerala Agro Industries Corporation (KAICU) is manufacturing this type of dryer.

**Large Holders Copra Dryer:** Large size copra dryer, the capacity of 3500-4000 nuts is developed at CPCRI. The unit is suitable for large holding and copra processing societies.

**Smoke Free Copra Dryer for Medium Holding:** CPCRI has developed this with a capacity of 1000 nuts per batch. This can dry coconut in 24 hours. It has got unique furnace where in the fuel used is only shell.

**Electrical Copra Dryer:** CPCRI has developed an electrically operated dryer with forced hot air circulation. Its capacity 1000 nuts per batch with a drying time of 28 hrs.

**(iv) Ball Copra:** Ball copra is of superfine quality and commands a premium price in the market. It is prepared by storing fully mature nuts for 10-12 months, when kernel will get detached from the shell. A special developed dryer is used to prepare ball copra in shorter time by giving different heat treatments.

**(v) Copra Grading:** The copra is graded in the order of its market value. The grading is mainly based on moisture content, foreign matter and black copra. The maximum limits for them are 10 per cent, 2 per cent and 5 per cent respectively.

#### **Other common coconut value added products**

##### **Virgin coconut oil**

The shortage of edible oils in the country has led to massive importation of edible oils by the government to the tune of KES 25 billion annually thereby leading to a reduction of the foreign exchange earnings. The virgin coconut oil is edible oil obtained from fresh, mature endosperm (kernel-meat) of coconut processed by either mechanical or natural means, with or without the use of heat and no chemical refining, bleaching or de-odorizing. It is called "virgin" because the oil obtained is pure, raw and maintains all the natural constituents, aroma and antioxidants.



**Figure 23. Virgin coconut oil**

Processing of virgin coconut oil avails high quality edible oil for household, medicinal and industrial use. This makes use of locally available resource and saves on foreign exchange used to import edible oils

### **Grated coconut**

Inadequate quality grated coconut products in the market have led to the importation of grated coconuts from other countries thereby leading to a reduction in the county's foreign exchange. At the same time the imported grated coconut products become unaffordable to the local citizens. Grated coconut is processed by grating the mature coconut by means of a coconut grating tool or a motorized equipment and thereafter drying it to 13% moisture content. The grated and dried nut is packaged in different sizes and sold. For use, the grated coconut is dissolved in warm water to obtain coconut milk that is used in cooking foods



**Figure 24. Grated coconut**

Grated coconut is one of the high value products from coconut that fetch better prices in the market and is simple to process. There is high demand for grated coconut in the market especially in the urban areas where residents require products that are ready to use.

### **Coconut milk and coconut cream**

Coconut milk is a sweet, milky white liquid obtained by grating the meat of mature coconut kernel and thereafter adding water twice the volume of grated coconut to produce milk. Coconut milk is used to make desserts and sauces, soups, tea and general cooking. Coconut milk is packed in packages of different sizes and preserved for long storage and for sale. Concentrated coconut milk is called coconut cream.



**Figure 25. Coconut milk and coconut cream**

Coconut milk is a high value product from coconut that fetches better prices in the market and is simple to process. There is high demand for coconut milk in the market especially in the urban areas where residents require products that are ready to use.

#### **Coconut flour**

The coconut flour is prepared by drying and grinding the residue which remains after expelling the coconut milk. The flour so obtained contains 7-8% protein, 3-5% moisture and 17% fat. It can be used as an ingredient in weight control foods because of its high fibre content. Coconut flour can also be used in baked goods, soups, stews and burgers.



**Figure 26. Coconut flour**

Processing of coconut flour avails high value product from coconut. There is high demand for coconut flour in rural and urban centres.

### **Tender coconut water (Madafu)**

This is the water of tender coconut, technically the liquid endosperm. Tender coconut water is at its optimum level of acceptability and economic viability for commercial use when nuts are 6-7 months of maturity. It offers many health benefits in addition to being a refreshing drink. It involves harvesting of the immature nuts and removing the husks. Thereafter the shell is cut using a sharp and stainless knife and the water is either extracted from the nut and emptied in a clean container or is drunk from the nut using a straw.



**Figure 27.Tender coconut water (Madafu)**

Processing and packaging of tender coconut water offers a special market niche that has not been exploited fully. There is high demand for tender coconut water since it is a natural refreshing drink with medicinal values.

### **Snow ball tender coconut**

Snow ball tender coconut is the tender coconut without the husk, shell and testa, which is a ball in shape and white in colour. This white ball contains tender coconut water, which can be consumed by just inserting a straw through the top white tender kernel. In this process, coconuts of 8-month maturity are more suitable for making snow ball tender coconut. Since snowball tender coconut can be individually packaged and refrigerated, the shelf-life of this product is prolonged and, therefore, this ready-to-serve product is becoming popular.



**Figure 28. Snowball tender coconut**

Snow balls made from tender coconuts are very rare commodities that have a niche market and fetch better prices.

### **Tender coconut kernel products**

These are kernels of tender coconut. It is a good source of carbohydrates and fibre. Processed young tender coconut kernel could be in the form of sweetened dehydrated young coconut kernel in syrup or dried chips. These young coconut kernel products are ideal for dessert or snack food.



**Figure 29.Tender coconut kernel products**

The fresh kernels left after the use of tender nut water is in many cases not put into effective use though it has high nutritional quality. Processing of the tender kernel products increases the value of the tender coconut.

### **Mature coconut water**

This is a soft drink produced from the coconut water of mature nuts. The process involves collection of water, pasteurization, filtration and bottling. The water from the mature nuts is nutritious and has medicinal values.



**Figure 30.Mature coconut water**

Processing of water from mature coconuts increases the value of the coconut in terms of income generation. There is high demand for coconut water.

### **Palm wine / Toddy (*mnazi*)**

Palm wine also called Toddy or simply Toddy (locally called *mnazi*) is an alcoholic beverage prepared from mature coconut water through spontaneous fermentation. Coconut toddy is a natural drink that is obtained from the inflorescent of the coconut flower just before spadix (sheets) splits open. The inflorescent is cut at the end and the sap that oozes forms the toddy. Freshly harvested toddy can be taken as wine after meals. However, when it undergoes fermentation, it turns into alcohol.



**Figure 31. Coconut toddy**

### **Coconut vinegar**

Vinegar is made from fermented coconut water by fermentation and inoculation with acetic acid bacteria in vinegar generators. Coconut vinegar is used extensively as a preservative and flavoring agents in pickles, salads, sauces and many other condiments.



**Figure 32. Coconut vinegar**

The utilization of coconut water which is considered a waste material in copra making or in desiccated coconut factories gives added income to rural families in the coconut farming communities

### **Coconut fibre**

This is coir fibre processed from coconut husks. Coconut husks pose environmental dangers and processing into fibre eliminates this danger. Coconut fibre is also an alternative use of husks apart from using them as source of firewood. Processing of the husks into coconut fibre creates cottage industries for income generation.



**Figure 33. Coconut fibre**

### **Coconut fibre rope**

This is mainly a rope that is weaved from coir fibre. Coconut husks pose environmental dangers and processing into coco fibre rope reduces this danger. Coco fibre rope is also an alternative use of husks apart from using them as source of firewood. Processing of the husks into coco fibre ropes creates cottage industries for income generation. Coir fibre ropes cannot easily rot.



**Figure 34. Coconut fibre rope**

### **Door mat from coconut fibre**

This is mat processed from coir fibre. Coconut husks pose environmental dangers and processing into coco fibre rope reduces this danger. Coco fibre rope is also an alternative use of husks apart from using them as source of firewood. Processing of the husks into coco fibre ropes creates cottage industries for income generation. Coir fibre mats are durable as they cannot easily rot.



**Figure 34. Coconut fibre door mats**

### **Coco peat**

Coco peat is a multipurpose soil less growing media that provides new opportunities for Potting Mix Suppliers, seedling nurseries, hydroponic growers and golf green constructors. Coco peat is also used as a bedding in animal farms and pet houses to absorb animal waste so the farm is kept clean and dry.



**Figure 36. Coco peat**

Coconut husks pose environmental dangers and processing into coco peat eliminates this danger. Processing of the husks into coco peats creates cottage industries for income generation. The horticultural industry in Kenya currently imports over 1000 tons per annum of coco peat and the demand appears to be growing.

#### **Coconut shell ear ring**

Coconut shells pose environmental dangers and processing into ear rings minimizes this danger. Coconut shell earring is also an alternative use of shells apart from using them as source of firewood. Processing of the coconut shell into earrings creates cottage industries for income generation and hence increases the value of the coconut.



**Figure 37. Coconut shell ear rings**

#### **Coconut shell hair clip**

Coconut shells pose environmental dangers and processing into hair clips minimizes this danger. Coconut shell hair clips is also an alternative use of husks apart from using them as source of firewood. Processing of the coconut shell into hair clips creates cottage industries for income generation.



**Figure 38. Coconut shell hair clip**

### **Coconut shell bangles**

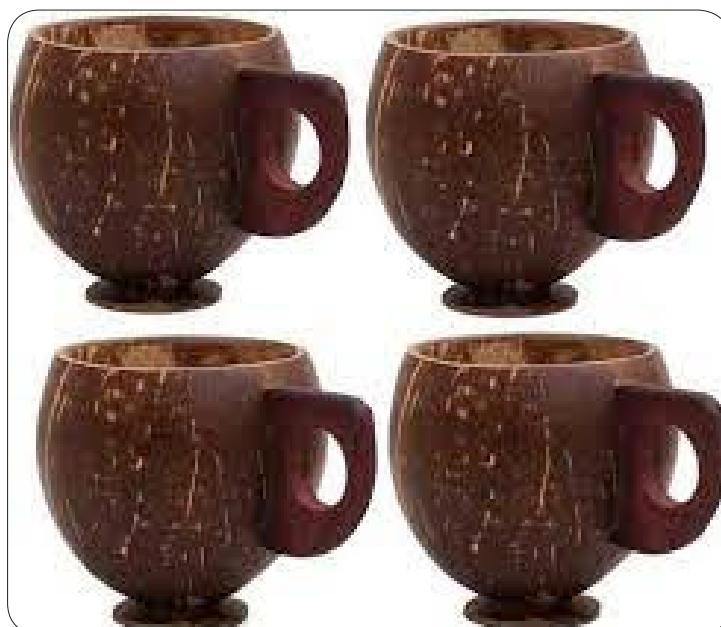
Coconut shell bangles is also an alternative use of husks apart from using them as source of firewood. Processing of the coconut shell into bangles creates cottage industries for income generation.



**Figure 39. Coconut shell bangles**

### **Coconut shell cups**

Cups can also be processed from coconut shells. Processing of the coconut shell into cups creates cottage industries for income generation



**Figure 40. Coconut shell cups**

### **Coconut shell belt**

Coconut shell belts is also an alternative use of shell apart from using them as source of firewood. Processing of the coconut shell into belts creates cottage industries for income generation



**Figure 41. Coconut shell belts**

### **Coconut shell doll**

Coconut shell doll is also an alternative use of husks apart from using them as source of firewood. Processing of the coconut shell into dolls creates cottage industries for income generation

### **Coconut shell charcoal / activated carbon**

Coconut shell charcoal is manufactured by burning the shell of fully matured nuts in a limited supply of air sufficient for carbonization, but not for complete destruction. The output of burning in the traditional pith method is just below 30% of the original 100% of the shells.



**Figure 42. Coconut shell charcoal**

Making coconut shell / activated carbon makes use of the shells and addresses the shortage of charcoal. The heat generated while burning the coconut shell is used for drying copra.

#### ***Copra cake as livestock feed***

The main coconut by-product of the copra oil extraction is the copra meal. Depending on the oil extraction method, the oil residue in the marketed product ranges from 1% to 22%. The terms “copra cake” and “copra meal” sometimes refer respectively to the mechanically extracted and the solvent extracted product. However, the names are often interchangeable. Copra cake is fed to cattle as a protein supplement for increased milk yield.



**Figure 43. Coconut copra cake**

# Chapter 7: Business Opportunities In the Value Chain

## 7.1 Business Opportunity

Businesses opportunity exists where and when sellers of goods and services interact in one way or another with buyers for profit gains. It may be existing/being practiced or potential (existing but not explored yet).Value chain business and/or market opportunities are the circumstances in which the specific value chain nodes exist and are therefore influenced by time and geographic/space variation.

## 7.2 Factors to consider/Types of Business Opportunities

Business opportunities are diverse. They include among others the following;

- Low competition due to the commodity characteristics (natural superior attributes and utility diversity)
- Potential for expansion/growth
- Emerging Markets
- Potential for strategic alliance
- A growing population which translates to an increasing demand
- Changing trends in market demand (demand for processed and/or certification of goods)
- Internet/On-line marketing (enabling wider networking)
- Existence of free Knowledge hubs (including knowledge on business planning)
- Existence of financial enablers

### Investment Profiling for the Value Chain

Business Opportunity	Opportunity Drivers	Investment Requirements	Challenges
Establishing of registered nurseries for provision of planting material	High demand for clean and quality planting material	Land and water	Certification conditions including and cost
Production of tissue culture seedlings	Demand for uniform clean planting materials	Tissue culture laboratory	<ul style="list-style-type: none"><li>• High cost of investment</li></ul>

<b>Business Opportunity</b>	<b>Opportunity Drivers</b>	<b>Investment Requirements</b>	<b>Challenges</b>
Production of the whole nut for the wide utility range of its products and byproducts.	Wide range of utilization of the nut and its byproducts	Land and working capital	<ul style="list-style-type: none"> <li>Prolonged drought due to changing climatic patterns</li> <li>Limited access to clean/superior planting material</li> </ul>
Aggregation of the whole nut and other products and byproducts (toddy, copra, brooms, husks, coconut-shell....) and delivery to buyers/consumers and cottage processors	Demand for high volumes of the coconut products(the nut, toddy, <i>makuti</i> and brooms among others)	Land, collection shades, sorting and grading facilities	Production units are scattered and yield small and un-economical quantities
Cottage processing of coconut products and byproducts ( <i>oils, desiccated coconut, coconut milk, coconut cake, coconut flour, briquettes, door-mats, coir, ornaments, tooth-picks, and other confectionaries such as "kashata"</i> )	High demand for processed products and byproducts	<ul style="list-style-type: none"> <li>Processing equipment</li> <li>Standards' specification</li> </ul>	<ul style="list-style-type: none"> <li>Seasonality</li> <li>Cost of equipment</li> <li>Reinforcement of the standards</li> </ul>

### 7.3 Coconut Value Chain Business Opportunities

#### **The Whole NutMarket (local and/or export)**

The whole nut is the most common product for the coconut enterprise with a readily available local market and sometimes an export market. Both local and export market opportunities are influenced by seasonal trends as well as proximity of the market place to the point/s of production.

Below is a variable costs outlay for raising one acre under coconut at a spacing 7 x 7 metres at the ninth (9<sup>th</sup>) year of production when it has attained the average yield of 120 nuts annually.

#### **Whole Nut Business:**

Establishing a coconut orchard requires an initial investment for establishing the coconut tree. This investment takes care of primary ploughing of one acre, purchase of seedlings, digging of planting holes, purchase and application of manure at the time of planting. After planting. Thereafter, other costs of investment relate to weeding of the crop from the first year through to its first fruit bearing age which is at five (5) years.

### Initial Investment Outlay/Costs (KES/acre):

Input variable	Unit Cost (KES)	Quantity	Amount (KES)
Bush clearing	10,000.00	1 acre	10,000.00
Ploughing	3,000.00	Once	3,000.00
Cost of seed	100.00	80 seedlings	8,000.00
Cost of digging planting holes	30.00	80 holes	2,400.00
Cost of manure	1.00	6,400 Kg	6,400.00
Cost of manure application	400.00	4 Man-days	1,600.00
Cost of planting (labor)	20.00	80 seedlings	1,600.00
Cost of mulching	50.00	80 trees	4,000.00
<b>Total Direct Investment</b>			<b>37,000.00</b>

**Note:** The coconut value chain is known for many products of economic importance. Some of these products such as fronds and *makuti* are harvested even before the stated optimal production age of nine (9) years. Based on this scenario, the profitability of the value chain follows a secular pattern such that an economic advantage of one product feeds to another product and sums up to multiple receipts.

### 7.4 Gross margin Analysis

Determining the gross margin of an enterprise requires that the variable costs streams are outlined for every business opportunity alongside the total revenue from the same enterprise. A gross margin is simply the difference between the total revenue (TR) accrued and the variable costs (TVC) or costs that vary with the scale of the enterprise ( $GM=TR-TVC$ ).

#### Variable Costs Outlay at the optimal production age (9<sup>th</sup> year)

Input Variables (Cost items)	Unit Cost (KES)	Quantity	Total Amount (KES)
Fertilizer *	70.00	160 Kg (2kg per tree)	11,200.00
Fertilizer application	400.00	5 Man days	2,000.00
Weeding	4,000.00	2 times	8,000.00
Mulching **	50.00	80 trees *	4,000.00
Harvesting *** (120 nuts per tree)	2.00	9,600 nuts	19,200.00
Marketing costs – Storage/Handling on farm	1.00	9,600 nuts	9,600.00
<b>Total variable Costs</b>			<b>54,000.00</b>

Input Variables (Cost items)	Unit Cost (KES)	Quantity	Total Amount (KES)
<b>Revenue (gross income)</b>	12.00	9,600	<b>115,200.00</b>
<b>Gross margin (gross profit) = Total revenue – Total variable costs</b>			<b>61,200.00</b>

#### Legend:

- i) The costs' outlay has been done from year nine when production is expected to have stabilized
- ii) \* = It is recommended that NPK fertilizer be applied once annually
- iii) \*\*= spacing for a pure stand was used with a defined spacing of 7 x 7 metres giving 80 trees per acre
- iv) \*\*\*= Nut yield/ Production per tree is based on optimal management.
- v) Mulching is done using coconut husks around the base of the coconut tree once every three years

**Notes:** Average cost of production per whole nut = Total variable cost divide by number of fruits produced:  
 $91,200 \div 9,600 = \text{Ksh } 9.50$

When determining gross margins for other Coconut products, the specific item costs and income will change depending on the product and prevailing prices.

#### Collective Marketing

One way of introducing and enhancing collective marketing is through establishment of or strengthening of Producer organizations (POs). These will establish collection centres and provide an opportunity for youth, women and men to participate in collection of coconut products and byproducts such as the whole nut, fronds, coconut husks, coconut shell and brooms. This is an avenue for the opportunity for friendly competition on quality issues for the products and by-products. Central collection points also provide a platform for grading and standardization of the products and by-products for competitive advantage of the value chain.

# CHAPTER 8: GENDER EQUALITY, HUMAN RIGHTS AND SOCIAL INCLUSION

## 8.1 Background

Studies conducted during implementation of the various value chains identified gender and human rights related challenges to participation. Women reported that cultural issues affected their rights to own land preventing their involvement in value chain activities as they could not make decisions on what to plant since all agricultural activities are dependent on land as a factor of production.

Gender roles ,triple roles for women -Reproductive. Productive and community management for women while Men's role is productive, and community politics were also sited as a hindrance to women's involvement in value chains .

Cultural practices like wife cleansing and inheritance, especially in some counties, denied widows an opportunity to participate in the value chain activities. Decision making at the household level relating to value chain selection were mostly done by men, though in some instances, women also participated in the process. But where men had migrated to towns, women were the sole decision makers on selection of value chain(s).in some counties, men dominated in decision making concerning value addition, grading, marketing, savings, access to agricultural and marketing information, as well as access to credit and training. Women and youth could not initiate any agriculture-based Income Generating Activities (IGAs) without permission from the husbands/fathers or the elderly men in the family due to cultural beliefs and patriarchy.

High illiteracy levels and low skills especially among women left them vulnerable in terms of technical matters in the value chain activities. Several farmer groups believed both English and Kiswahili languages be adopted during training, Trainers were said to use a lot of English when training and it confused the farmers making language and methodologies used a barrier.

Lack of markets: Exploitation by intermediaries affected the prices of most of the value chain produce. It was suggested that market linkages with potential external buyers be established and strengthened.

Gender and extension services - Extension services were provided to the farmers through group training and through telephone calls by private extension officers and county government extension officers. The youth indicated that the extension training courses were done early during the day when they had reported for other activities such as attending other fishponds, harvesting excluding them from the services. Women also complained that the time at which the extension trainings are done did not favour them as they are attending to domestic chores or farm activities denying them the opportunity to gain experience.

Youth attributed their inadequate participation in value chain production activities to lack of land ownership since the parents (fathers) were not willing to give them land on a permanent basis. As a result, there was serious conflict between the young men and their fathers in counties in some counties. The fathers felt that the sons (youth) were irresponsible people who would sell the land upon being given, and the money spent on drinking alcohol. This would render the entire family landless.

**Widowhood – Women** in all the sampled counties were targeted because of their status as widows, and the fight for family land and other capital assets always starts immediately after the husband died. Being a widow left them vulnerable to other families or even community members who want their land and other assets. In some cases, family members secretly alter particulars of ownership documents such as title deeds to the disadvantage of widowed women.

People with disabilities often experience discrimination in their everyday life. Discrimination describes a situation where an individual is disadvantaged in some way because of a ‘protected characteristic.’ Discrimination takes place in different forms. It can be direct or indirect, manifest in the form of harassment, or there can be direct instructions to discriminate. Direct discrimination is based on negative attitudes, prejudice, and/or discriminatory legislation. Indirect discrimination, for example, can be caused by physical barriers, such as stairs as the only means to get to vital locations, or using media. For example, people who are visually impaired or have difficulties hearing cannot use media without assistance.

Most of the respondents requested special training on gender mainstreaming and gender-based violence and human rights, hence this manual. The findings came from the report below and gender analysis of selected value chains conducted by the Gender Youth and Social Inclusion Advisor, MESPT in August 2024 (G.V. Masinde and C.K. Wambu, PhD November, 2021 Final draft report A Gender Equality and Human Rights Approach for The Green Employment in Agriculture Programme (GEAP), MESPT)

### 8.1.1 Definition and key concepts

**Sex:** It identifies the biological differences between men and women. Kenya recognized and counted intersex persons during the census in 2019.

**Intersex:** Intersexuality is an overarching term that refers to human bodies that fall outside the strict male and female binary. The term refers to the many variations—often present at birth—that can affect a person’s reproductive or sexual anatomy, which may involve genitalia, hormones, reproductive organs, and chromosomes.

For example, these variations might include being born with “female” anatomy on the outside, such as a vaginal opening, but having “male” sexual organs on the inside. - [Intersex: What It Means, How It's Identified](#) accessed on 14/11/2024



Figure 1:Kenya recognizes three genders [Two genders? No, we should recognize the three in Kenya | Nation](#) accessed on 14/11/2024.

**Gender** : Refers to the socio-cultural differences and relations between men and women that are learned, changeable over time, and have wide variations both within and between societies and cultures. The concept of gender also includes expectations held about the characteristics, attitudes and behavior of women and men (femininity and masculinity).

**Gender equality:** This is a human right that is enshrined in several declarations and conventions, including the legally binding Convention on the Elimination of All Forms of Discrimination against Women (CEDAW).

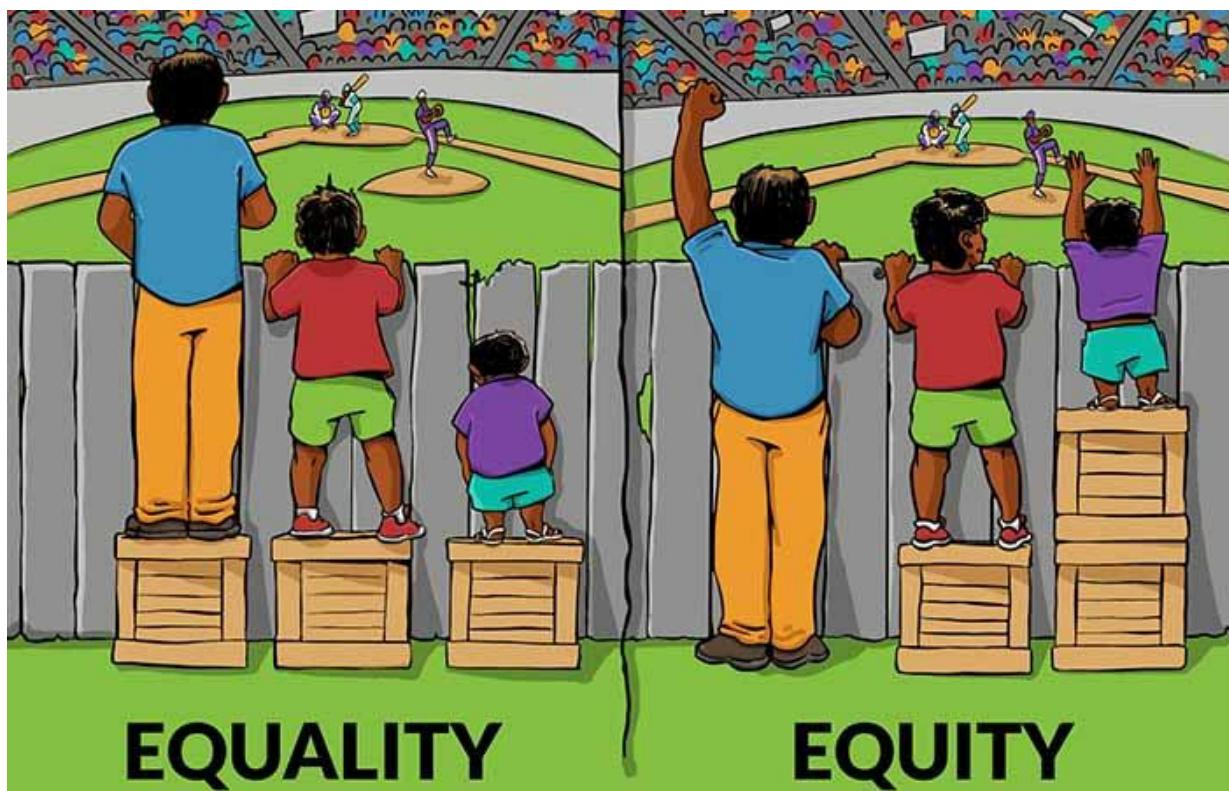


Figure 2 *Equality and Equity* illustrated [All You Need To Know About Gender Equity](#) Accessed on 14/11/2024

**Equality** does not mean that women and men are the same but that women's and men's rights, responsibilities and opportunities should not depend on whether they are born male or female. Gender equality implies that the interests, needs and priorities of both women and men are taken into consideration, recognizing the diversity of diverse groups of women and men(UN General Assembly, 1979). The centrality of **gender equality** to development is its establishment as a goal (goal 5) of the Sustainable Development Goals (SDGs) and included as a target in other SDGs.

**Gender Equity:** This is about fairness and being sensitive to the peculiarities of individuals, socio-economic groups, or communities. It is about equality of outcome or result of an intervention. Gender equity involves considering the different social, cultural, and economic situations of women, men, girls, and boys right from the design of an intervention through implementation to monitoring and evaluation.

**Gender sensitivity:** The ability to recognize the differences in terms of roles, contributions, needs and experiences of both women and men, and create a conducive environment for effective application of their specific knowledge, skills, and experiences in meeting their prioritized needs.

## Gender Integration Continuum

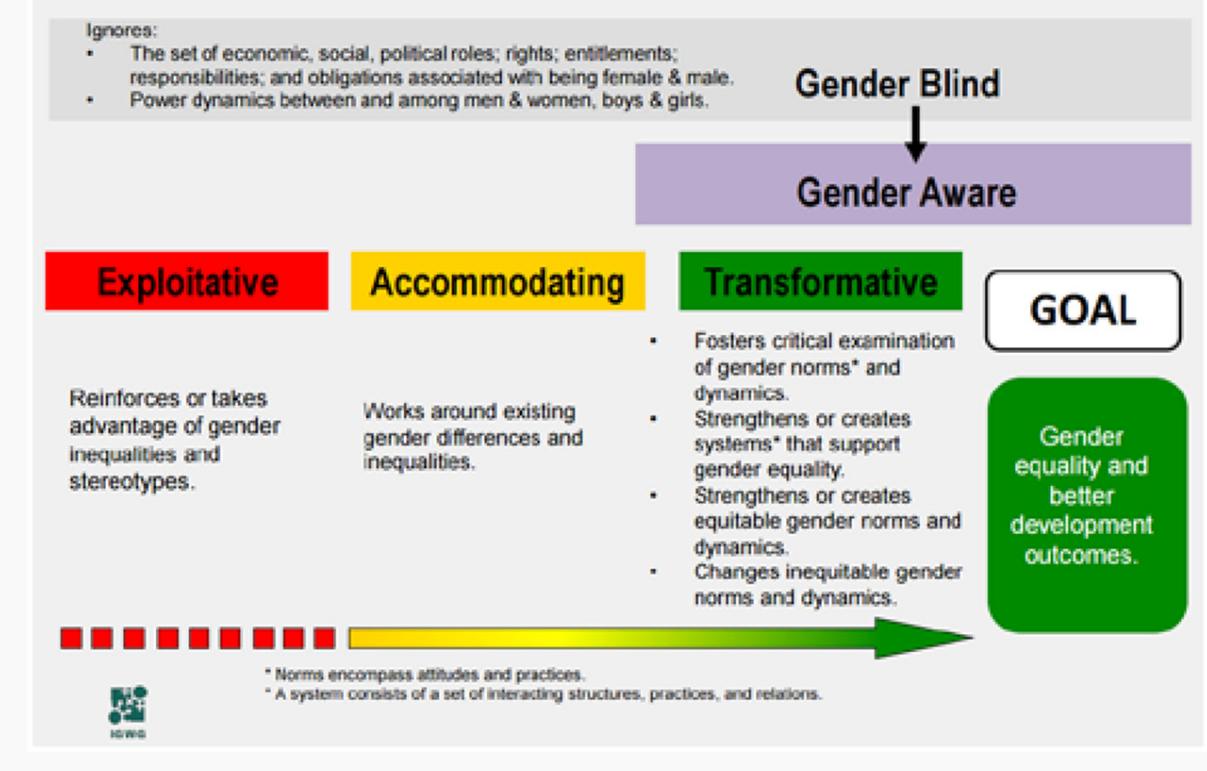


Figure 3: Gender Integration Continuum [About IGWG | IGWG](#) accessed on 14/11/2024

**Gender aware:** Recognizing or being aware of the existence of gender and gender differences in society; recognizing that men and women are positioned differently; that they have different experiences, different needs and interests, different strengths, and skills, and that these need to be considered while planning for any intervention.

**Gender responsiveness:** This describes the policies, programmes and projects that focus on transforming existing gender disparities to create a more balanced relationship between women and men in terms of power and decision-making as well as access to and control over productive resources. Gender responsiveness is key in meeting strategic gender needs(strategic gender needs are the needs women identify because of their subordinate position in society.These needs are long-term and relate to the empowerment of women. Strategic gender needs for women might include land rights, more decision-making power, equal pay, and greater access to credit. Addressing these needs allows people to have control over their lives beyond socially defined restrictive roles)

Practical gender needs are defined as: Needs that respond to immediate necessities such as adequate living conditions, water provision, health care, and employment. Gender-specific needs that do not challenge gender roles, such as access to healthcare, water availability, and employment opportunities.

### Gender transformative

Addressing gender imbalances, changing gendered power relations, and actively building equitable social norms and structures. An organization is aware that women and men do not have equal opportunities in the household, at community level or at work.They may, for example, create equal working conditions for women and men, recognizing that special means may be required to increase the number of women in management positions or to achieve an environment free from gender-

based violence (GBV). Gender transformative approaches are characterized by explicitly centering gender norms and are thus common for interventions that have the primary goal of addressing gender issues and transforming gender relations to promote equality.

Transformative Gender Programming includes policies and programs that seek to transform gender relations to promote equality and achieve program objectives. This approach attempts to promote gender equality by:

1. fostering critical examination of inequalities and gender roles, norms, and dynamics,
2. recognizing and strengthening positive norms that support equality and an enabling environment,
3. promoting the relative position of women, girls, and marginalized groups, and transforming the underlying social structures, policies and broadly held social norms that perpetuate gender inequalities.
4. Most importantly, program/policy planners and managers should follow two gender integration principles:
  - First, under no circumstances should programs/policies adopt an exploitative approach since one of the fundamental principles of development is to “do no harm.”
  - Second, the overall objective of gender integration is to move toward gender transformative programs/policies, thus gradually challenging existing gender inequities and promoting positive changes in gender roles, norms, and power dynamics.

**Empowerment:** Is about improving women's and men's status to enhance their decision making-capacity at all levels. It refers to the process in which women and men reflect upon their reality and question the reasons for their situation in society. It includes developing alternative options and taking opportunities to address existing inequalities. It enables them to live their lives to the fullest of their capabilities and their own choices in respect of their rights as human beings.

**Gender Mainstreaming:** **Gender equality** can be achieved by a strategy of mainstreaming which is defined by the United Nations, as ‘...the process of assessing the implications for women and men of any planned action, including legislation, policies, or programmes, in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic, and societal spheres so that women and men benefit equally, and inequality is not perpetuated. The goal is to achieve gender equality.’

Gender mainstreaming aims to ensure that women and men, particularly those who are disadvantaged, equally participate in and benefit from the activities of a given organization, and that all implemented projects and programmes consider women's and men's concerns and experiences as an integral dimension of their cycles. This intervention ensures that existing democratic relations are protected, at the same time preventing the further perpetuation of inequalities and the creation of new ones.

### **8.1.2 The Business case for gender mainstreaming**

**Gender mainstreaming** in Agri-enterprises is not only a matter of social equity but also makes strong business sense. Here are some key points that highlight the business case for gender mainstreaming in this sector:

**Increased Productivity:** Women make up a sizable portion of the agricultural workforce. By providing them with equal access to resources such as land, credit, and training, productivity can be significantly increased. Studies have shown that closing the gender gap in agriculture could increase yields on women's farms by 20-30%

**Enhanced Innovation:** Diverse teams bring varied perspectives, leading to more innovative solutions. Women often bring unique insights into agricultural practices and market needs, which can drive innovation and improve business outcomes.

**Market Expansion:** Women are key players in local markets and value chains. By empowering women, Agri-enterprises can tap into new markets and consumer bases, enhancing their market reach and profitability.

**Improved Financial Performance:** Companies that invest in gender equality tend to perform better financially. Gender-diverse companies are more likely to have higher returns on equity and better financial performance overall.

**Risk Mitigation:** Gender mainstreaming can help mitigate risks associated with labor shortages and community relations. Empowering women can lead to more stable and resilient communities, which in turn supports sustainable business operations.

**Compliance and Reputation:** Increasingly, investors and consumers are looking for companies that adhere to social responsibility standards. Gender mainstreaming can enhance a company's reputation and compliance with international standards, attracting more investment and customer loyalty.

By integrating gender mainstreaming into their operations, Agri-enterprises can not only contribute to social equity but also enhance their competitiveness and sustainability.

### **8.1.3 Steps to mainstream Gender**

Gender mainstreaming in Agri-enterprises involves several strategic steps to ensure that gender considerations are integrated into all aspects of the business. Here are some specific strategies:

- 1. Conduct Gender Analysis:** Start with a thorough gender analysis to understand the distinct roles, needs, and challenges faced by men and women in the agricultural sector. This analysis should inform all stages of project planning and implementation.
- 2. Develop Gender-Responsive Policies:** Create policies that promote gender equality and address specific barriers faced by women and youth. This includes policies on equal access to resources, decision-making, and opportunities for training and development.
- 3. Capacity Building:** Provide training and capacity-building programs for both men and women to enhance their skills and knowledge. This can include technical training, leadership development, and financial literacy.
- 4. Gender-Responsive Budgeting:** Allocate budget specifically for gender mainstreaming activities. This ensures that there are sufficient resources to support gender equality initiatives.
- 5. Participatory Planning:** Involve both men and women in the planning and decision-making processes. This ensures that the perspectives and needs of both genders are considered and addressed.

- Monitoring and Evaluation:** Establish gender-sensitive indicators and regularly monitor and evaluate the impact of gender mainstreaming activities. This helps in assessing progress and making necessary adjustments.
- Promote Women's Leadership:** Encourage and support women to take on leadership roles within the enterprise. This can be achieved through mentorship programs, leadership training, and creating an enabling environment for women leaders.
- Address Social Norms:** Work on changing discriminatory social norms and practices that hinder gender equality. This can be done through community engagement, gender transformative approaches including Gender action learning systems(GALS), community conversations, model families, among others that seek to address root causes of discrimination.

## 8.2 HUMAN RIGHTS

**Human Rights:** These are rights inherent to all human beings, independent of nationality, place of residence, sex, national or ethnic origin, race, religion, language, or any other status. All human beings are equally entitled to human rights without discrimination. These include the right to life, equality before the law, the right to work, social security, education, and the right to development. These rights are all interrelated, interdependent and indivisible(Access the comprehensive text here [30 articles on the 30 Articles of the Universal Declaration of Human Rights | OHCHR](#)

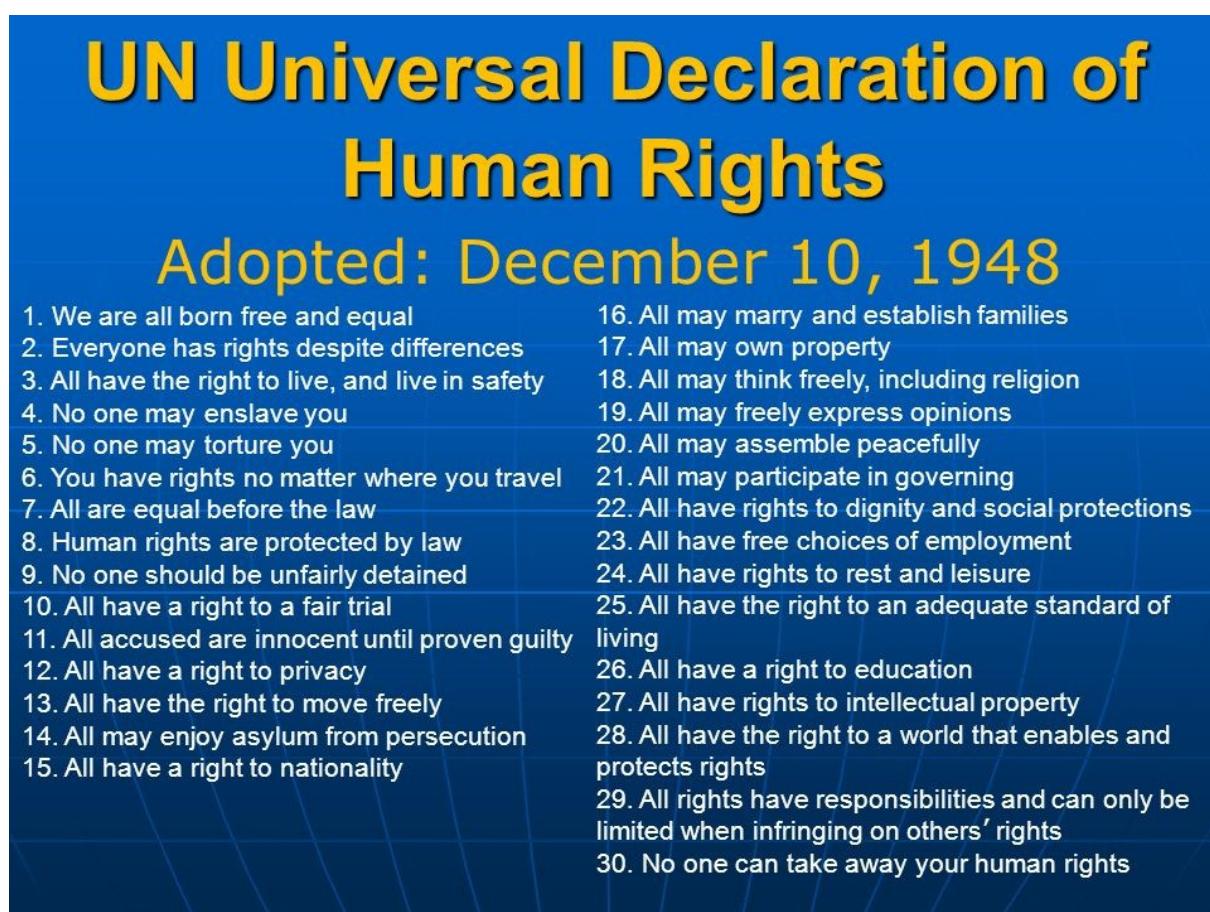


Figure 4: 30 articles of Human rights <https://rvalibrary.org/shelf-respect/law-library/national-human-rights-month/> Accessed on 14/11/2024

Children rights are also enshrined in the convention on the rights of the child(1989). Kenya enacted this into a children's act 2022.



## CONVENTION ON THE RIGHTS OF THE CHILD

[convention-rights-child-text-child-friendly-version.pdf](http://convention-rights-child-text-child-friendly-version.pdf) accessed on 13/11/2024.

Access the full text here [file](#)

**A human rights-based approach (HRBA):** This is a conceptual framework based on international human rights standards and directed towards promoting and protecting human rights. HRBA seeks to analyze the inequalities which lie at the heart of development problems and redress discriminatory practices and unjust distributions of power that impede development progress.

**HRBA** is concerned with empowering people to know and claim their rights and increasing the ability and accountability of individuals and institutions who are responsible for respecting, protecting, and fulfilling rights. The HRBA approach aims to eliminate or at least diminish the impediments of existing exclusion and discrimination within the implementation of any programme or project. HRBA gives equal attention to both achieving development goals and to the processes that are chosen to

achieve these goals. So, within HRBA, the processes that enable the participation and inclusion of all stakeholders are important.

## 8.2.1 ABOUT HRBA AND PANT PRINCIPLES

The HRBA builds on the norms and principles outlined in the Universal Declaration of Human Rights, and the subsequent legally binding UN treaties, which form the basis for all development cooperation. Application of the HRBA contributes to effective development cooperation processes and sustainable development outcomes. It challenges unequal power relations and social exclusion that deny people their human rights and often keep them in poverty and oppression. Microenterprise support Programme Trust (MESPT) is committed to the HRBA in all interventions.

HRBA places people living in poverty and oppression (rights holders) at the center. It is about:

- Empowering rights-holders to enable them to take action to address their situation and to claim their rights individually and collectively.
- Developing capacities and interests of duty-bearers to fulfil their obligations to respect, protect and fulfil human rights.

PANT is a tool that guides staff on the practical application of the HRBA.

It has four elements:

**Participation :** Do all stakeholders engage actively, in a way which allows rights-holders to contribute meaningfully and influence processes and outcomes?

Everyone has a right to freely participate in decision making that affects them and their environment. People of power have an obligation to offer meaningful participation and consultations to people affected. Everyone has the right to organize and hold opinions without any interference, and to seek, receive and impart information and ideas through any media regardless of frontiers. Promoting participation is essential for the outcome of projects and programmes. It is stated in international treaties that women, men, girls, and boys have a right to participate in decision-making that affects them. Social and cultural roles that are prescribed women and men have impact on their possibilities of choices, economic independence, access to natural resources, access to land tenure, access to clean and safe water, and decisiveness on housing, education, and livelihood.

**Guiding questions are:**

- Are fair and effective platforms for public-private dialogue in place, and do they give space to representatives of women and men with less power and status?
- Are measures taken to include and enhance the capacity of those with less knowledge and power so that they can participate meaningfully in the consultative processes? For example, do all stakeholders have sufficient and accessible information on the issues being addressed? Are they invited to truly participatory processes? Are barriers removed, e.g., no expensive travelling, not during busy seasons, not inaccessible for women or persons with disabilities?
- Are stakeholders actively engaged at all stages of the programming process?
- Do initiatives make space for vulnerable people to take actions of their own choosing to manage perceived risks? This is especially important in ‘transformative’ efforts that encourage profound changes in livelihood systems in response to climate change or market upheavals.
- **Accountability :** Who are the duty bearers on various levels, and do they have sufficient capacity and interest to be accountable to rights holders?

- The state has an obligation to respect, fulfil and protect the rights of its population. It entails a functional regulatory system for climate and environmental issues, labour law, land systems ; concrete plans for disaster risk reduction and response; rule of law including a justice system providing legal aid to poor and marginalized people and their organisations; and functional and accessible complaints mechanisms. Emphasizing the accountability of all actors (both state and non-state), whose actions impact the environment and natural resources, is a central element of HRBA. Asserting human rights without supporting effective and precise frameworks to hold duty bearers accountable is of little practical use. Strengthening the governance of natural resource management and securing natural resources tenure while also taking rights of local people, women and men, ethnic minorities, nomadic or other marginalized groups into account, can
- minimize corruption.
- have positive effects on conflict management.
- be a key step towards alleviating tensions in society and consolidating peace in post-conflict societies.
- **Guiding questions are:**
- Are the duty bearers and other actors with power identified?
- Does the initiative contribute to ensuring that public and private sector actors have systems in place to monitor and disclose social and environmental impacts according to national and international standards?
- Do monitoring and evaluation arrangements involve civil society organisations representing the concerned population?
- Are there consequences (legal, financial, or moral) for non-compliance with human rights objectives and principles?
- Has the contribution established accessible and effective mechanisms for redress and complaints?
- Does the contribution facilitate access to networks, organisations and other sources of information that may assist duty bearers to enhance their accountability and rights holders to claim their rights?

**Non-discrimination :**Are rights holders and the root causes of their lack of human rights identified and considered, particularly those most subjected to discrimination, marginalization, and vulnerability?

All women, men, girls, and boys are, without any discrimination, entitled to equal access to ecosystem services , market systems and natural resources as well as resilience for a standard of living adequate for their health and well-being. Discrimination may be expressed in law (explicit discrimination) and hence be part of official policy such as lack of land rights; or it may be found in practice and behavior (implicit discrimination)such as where a remote group cannot access water services because drinking wells provided by the state are too far away.

**Key questions are:**

- Are vulnerable groups specifically identified and targeted?
- Is there a proper analysis of the consequences of the contribution for these women, men, girls, and boys?
- Is there a plan for their inclusion and benefit including disaggregated data and indicators?
- Are tariffs and fees also adjusted to accommodate poor and marginalized groups?
- Are land and property rights addressed to ensure that women, minorities, and poor people are protected or compensated?
- Are the livelihoods supported resilient to risks related to climate and market volatility and uncertainty, and therefore relevant for vulnerable populations that cannot afford to shoulder uncertain risks?

**Transparency** :What measures are put in place to ensure that all stakeholders can access relevant information and knowledge regarding the contribution?

**Transparency** All people have the right to obtain information in an accessible and timely manner, e.g., about pollution levels, water quality, environmental health risks, exploitation plans, land use plans and disaster preparedness plans. Granting sufficient and accessible information to affected women and men in planning and policy making processes is of key importance to their ability to influence and monitor developments. It is also important to consider local traditions, survival strategies and indigenous people's dependence on natural resources, and ensuring that separate views are documented. It is also essential to consider access to natural resources for people living in poverty and that a long-term sustainable development can be promoted, to avoid future opposition and conflicts.

**Guiding questions are:**

- Are the plans and goals of the contribution made public and explicit in an accessible manner to all stakeholders concerned, including the most marginalized groups so that they understand benefits and risks?
- Will affected women, men, girls, and boys receive sufficient, timely and accessible information, including separate views on the plans, and will they be able to take meaningful part in and influence the process?
- Will access to information regarding the local risk situation be improved and will early warning systems be developed so that the ability of vulnerable groups to protect themselves and quickly recover after disasters is strengthened?
- Does the initiative contribute to capacities and commitments for greater transparency in policies and practice affecting land and natural resource tenure, particularly in new forms of land acquisitions and concessions?

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ANNEX I



## **BANANA VALUE CHAIN TRAINING WORKSHOP FOR XXXX**

**TRAINING VENUE: XXX**

**DATES: XXX**

## **SAMPLE PROGRAMME**

## **ANNEX II: List of participants who validated this value chain manual**

<b>S/NO</b>	<b>NAME</b>	<b>INSTITUTION</b>
1	Joseph Kairu	County Government of Siaya
2	Winston Motanya	County Government of KISII
3	Nicholas Manyinsa	County Government of KISII
4	Cecilia Mutuku	County Government of MACHAKOS
5	Paul Busienei	County Government of NAKURU
6	David Kimera	Youth Agri-Preneur
7	Lawrence Swanya	County Government of MACHAKOS
8	Kenneth Kagai	County Government of TRANS-Nzoia
9	Benedict Khanyifu	County Government of TRANS-Nzoia
10	Mwalimu Menza	Kenya Agricultural and Livestock Research Organization
11	George Kamami	County Government of MAKUENI
12	Moses Munialo	County Government of BUGOMA
13	Agesa Eric	County Government of KAKAMEGA
14	Benard Mainga	County Government of KWALE
15	Jane M Kamamu	County Government of KILIFI
16	Teresia Ndungu	County Government of NYANDARUA
17	Wilbur Mutai	County Government of UASIN-GISHU
18	Stephen Odipo	Kenya Agricultural and Livestock Research Organization
19	Solomon Mbivya	PAPA FARMERS Limited
20	William Mwangi	County Government of MAKUENI
21	Doreen Kinoti	Micro-Enterprises Support Programme Trust
22	Serah Nzau	Micro-Enterprises Support Programme Trust
23	Margaret Kikuvi	Micro-Enterprises Support Programme Trust



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